# DISASTER PREPAREDNESS *for* HEALTHCARE FACILITIES

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This book is dedicated to the memory of Dr. David McCann
(Sept. 29, 1960–Aug. 8, 2011), visionary leader in disaster health preparedness,
Chief Medical Officer of the Florida One Disaster Medical Assistance Team,
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loving father & husband. He is sorely missed by many.


**Dr. David McCann Port-au-Prince,
Haiti, after the 2010 earthquake**

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# Foreword

You hold in your hands the first textbook on disaster preparedness conceived, designed, and written by first receivers and first responders to meet the needs of healthcare facilities. This book grew out of the concern held by those who will need to provide health care in disasters that our healthcare systems are not ready to cope with a major event.

It is a recurrent theme that the further away one is from the actual delivery of disaster care, the better prepared one perceives the system to be. At the extreme, recent correspondence from the Canadian Association of Emergency Physicians to the provincial health ministers across Canada voiced concern about the healthcare system's ability to respond to disaster. Uniformly, all health ministers in the provinces who responded (8 of 10) stated that their provinces were prepared.

Unfortunately, the reality at the front lines is not so rosy. Frontline providers have repeatedly expressed serious concerns about the ability of healthcare systems, and specifically healthcare facilities, to respond in a disaster.[1–4] Staff are inadequately trained despite the existence of competency lists and curricula.[4,5] US data show that there is a large amount of variability between regions and facilities.[6] Canadian data, while limited for reasons that will be expanded on further, also show that there are areas of strength and weakness and that there is both regional variability and variability in preparedness for specific types of events.

This discrepancy between high- and middle-level administration's perception of readiness and frontline caregivers' perception of a lack thereof stems from 3 key reasons. The first and simplest of these is the distance, both geographic and in terms of training and expertise, between the administrator and the individuals actually delivering the care in a disaster setting.

Second is the fact that, particularly in health care, disaster preparedness is an "orphan" entity. Healthcare professionals have extremely limited training in disaster preparedness,[5,7] disaster management experts have almost no expertise in health care, and there is no overarching authority that is able to bridge the gap between these two groups. This diffusion of responsibility exists at all levels, but in Canada reaches an extreme at the federal level. The Ministery of Public Safety has the expertise and the tools for disaster response and the Ministery of Health has significant expertise in healthcare issues, yet both of them are lacking in the expertise of the other.

The third reason is the absence of any formal assessment of healthcare facility disaster preparedness in Canada. This lack of formal, replicable, and evidence-based disaster preparedness assessment underpins all other problems in that if we do not measure our inabilities, we will not be able to remedy them.

One of the oft-quoted reasons for not having a disaster assessment tool is that disasters are so variable that it is impossible to design a uniform assessment tool for readiness. Although it is true that disasters may be variable, the *response* to disasters is far more uniform. Israeli hospitals, likely the world leaders in preparedness for dealing with disasters, have developed standard operating procedures that facilitate the management of mass casualty incidents. Not only do these procedures allow for an organized response to a disaster, they also allow for an ongoing process of quality improvement since there are standards against which to measure performance.[8]

Incidentally, the statement that there is a large variability in potential disasters leads one to question why hospitals do not routinely perform risk assessment to determine which disasters may befall them. Currently in Canada, there is no evidence that any formal risk assessment tool has been deployed across hospitals, despite the fact that such tools, specifically Canadian tools, do exist and are included in this textbook.

Another reason for the lack of formal assessment is the lack of a standard of care. This was alluded to earlier and stems from the misperception that each type of disaster requires its own unique plan and that a standard of care must be derived for each. The disaster literature has for years focused on an "all hazards" approach as opposed to individual plans. The "all hazards approach" requires a basic plan that is then adapted for specific events. This basic plan is the backbone of the hospital disaster response and should be measured against a standard of care.

The third reason for not performing formal readiness assessments is that, while the literature is replete with calls for the development of such a tool,[9,11] the perception is that nothing is available or what is available is not validated.[12–14] This perception is incorrect because tools, specifically Canadian tools, do exist for both risk and readiness assessment. With support from the Public Health Agency of Canada (PHAC), the Centre for Excellence in Emergency Preparedness (CEEP) has developed such tools and they too are included here.

The final reason that hospitals have not assessed their readiness is the most understandable. Faced with pressing and immediate issues such as hospital overcrowding and budget management, potential problems such as disasters are seen as deferrable concerns. This opinion exists despite the ability of disaster preparedness to help with overall efficiency. The irony is that, with our alternate level of care (ALC) statistics, our blocked emergency departments, and our overwhelmed pre-hospital services, the disaster is upon us already. We are blinded to it because it arrived with a whimper, not a bang.

Although the likelihood of a disaster occurring is small, the impact of a disaster can be extremely significant. First and foremost, there is a direct healthcare impact on the population, be it from mass trauma, an infectious

agent, a chemical release, weather patterns, or other causes. Disasters can also have an impact on the ability of the hospital to function. As the workload increases, the staff themselves may become ill and fear within the healthcare community may grow. Finally, the reputation of an organization that responds poorly to disasters is tarnished for an extremely long period of time. Tragedies such as the Indian Ocean tsunami in 2004 or Hurricane Katrina in 2005, shown on 24/7 news channels, provide our "global village" world an eyewitness account of disaster management (or lack thereof).[12] Any mention of the Federal [U.S.] Emergency Management Agency (FEMA) today immediately brings to mind the response to Hurricane Katrina while all good works that FEMA had performed in the past are forgotten. Thus, beyond the immediate impact on the population, the hospital staff, and the hospital's ability to function, the impact of a disaster on the public relations image of the hospital can be in and of itself disastrous and sustained for a very long time.

Standardizing approaches to surge management during disasters is the first step in quality improvement. Because disaster response is an organization-wide process, this improvement has an impact on the entire hospital. Processes that are discovered to be useful in expediting care in a disaster situation can easily find their way into the day-to-day function of the organization. If disaster is defined as an event that outstrips the organization's ability to deliver health care, preparedness is a method of "vaccination," raising the threshold not only in disaster periods but also in normal day-to-day function. Hospitals that function well before an event may have less need to invoke their disaster plan to begin with.

Preparing for disasters is a daunting task, not so much because of the depth of the issue but because of its breadth. It has been said that the way to eat an elephant is one bite at a time. The first two "bites" of this particular elephant are for hospitals to perform risk assessments and readiness assessments. Once these are done, it will be a far more manageable task to remedy the identified gaps. Until such time as these assessments are done, we are all at risk of being found unprepared when the disaster – whatever it may be – strikes. More so, it is incumbent on hospitals to take the initiative on this issue since it falls between the cracks of the health care and public safety systems, lacks clear ownership, and is often forgotten or deferred in the presence of more pressing issues such as hospital overcrowding and budget crunches. It is the sincere hope of the authors of this textbook that our contribution will help healthcare facilities in Canada and elsewhere face this challenge with success.

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Chapter 1

# Introduction to Disasters and Disaster Planning

By David G.C. McCann, BSc, MD, MPH, CCFP, FAASFP

# Preface

Disasters affect millions of people worldwide annually. From natural disasters such as tropical cyclones and earthquakes[1] to terrorist threats from biochemical weapons or improvised nuclear devices,[2] the world is becoming an ever more dangerous place to live in the twenty-first century. In fact, a major disaster occurs somewhere in the world almost every day, and a natural disaster requiring international assistance occurs approximately once a week.[3] The public health burden of disasters is particularly overwhelming in the developing world where the infrastructure is suboptimal at the best of times.[1] The 7.0 Haiti earthquake of January 12, 2010 that leveled much of Port-au-Prince is a perfect example of this problem. On the other hand, Hurricane Katrina demonstrated that North America is not immune to the devastation of nature's wrath.[4]

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# What Is a Disaster?

The word "disaster" is intuitively simple to understand yet the literature is replete with differing definitions. How then can one best define what constitutes a disaster? According to the United Nations Disaster Management Training Program[5]:

> A disaster is a catastrophic occurrence, a sudden or major misfortune that disrupts the basic fabric and normal functioning of a whole society or a community within it. It is an event or series of events which gives rise to casualties, damage to or loss of

> property, infrastructure, essential services, or means of livelihood on a scale which is beyond the normal capacity of the affected communities to cope with unaided.

From a healthcare standpoint, disasters usually cause numerous casualties—so-called "mass casualty incidents" or MCIs. An MCI may be defined as[6]:

> An incident that results in multiple casualties that overwhelm local resources and that may involve natural, biological, chemical, nuclear, or other agents.

Therefore, an MCI exists whenever the number of casualties exceeds the facility's ability to cope. So, if a school bus were to crash injuring 30 children, an MCI would exist for a rural hospital with a 6-bed Emergency Department. An MCI would not exist if the injured children were transported to the Emergency Department of a large tertiary care Children's Hospital. On the other hand, a major chlorine spill with 2000 inhalational casualties would represent an MCI even in Vancouver's world-class hospital system.

## An Overview of Disaster Planning Principles

It is important to understand some general principles about disaster planning because a poorly planned disaster response is often a major problem in itself. This was amply demonstrated in the aftermath of Hurricane Katrina. Some of the early, seminal work in the area of disaster planning was undertaken at the Disaster Research Center (DRC) of Ohio State University in the 1960s. Quarantelli's group at DRC has contributed a great deal to the literature in this area and they define disaster planning as "…an attempt, prior to the actual occurrence of a crisis, to facilitate recognition of emergency demands and to make more effective the community response."[7] They enumerated some important characteristics of disaster planning that should be kept in mind[7]:

1. Disaster planning is a continuous process—an unrevised, out-of-date plan is worse than no plan at all because it engenders a false sense of preparedness—the so-called "paper plan syndrome." In fact, well-prepared hospitals make it a policy to develop a disaster plan, exercise it until it breaks, re-design the plan to fix the inherent flaws, and then exercise it again (until it breaks…). The importance of this iterative approach to disaster planning cannot be overstated.
2. Planning seeks to reduce the unknowns in problem situations—one tries to anticipate problems that will crop up and provide solutions in advance that will mitigate the potential effects. Floods cannot be stopped but the damage to infrastructure and potential loss of life can be mitigated through careful planning.
3. Planning tries to foster appropriate, effective actions in a crisis—it may seem natural to rush right out after a calamity and start "doing something" but it is far more effective and efficient to first gather the necessary information. This so-called "rapid needs assessment" allows the disaster response to be tailored to actual needs on the ground in the disaster zone and avoids well meaning but ill-advised impulsivity. "Don't just do something, stand there" is the operative notion here.

4. Planning should be based on what is most likely to occur—designing a disaster plan based on idealistic, naive thinking is distinctly counterproductive. One must recognize and plan for what people are likely to do and not create elaborate plans that try to get the population to do things that do not "come naturally" when under duress.
5. Planning must be grounded in fact, not supposition and myth—there are numerous false assumptions about disasters which have been debunked in the literature but which are still prevalent in the minds of planning officials such as[8]:
   - People will panic (this is actually rare)—in fact, people often refuse to evacuate despite mandatory evacuation orders.
   - People will be immobilized by fear ("disaster stunned")—actually, the local community usually pulls together immediately and helps one another.
   - Local organizations will be paralyzed—local groups become the focus for community response.
   - Antisocial behavior will be common (looting, etc.)—this actually occurs in a minority of situations (New Orleans after Katrina notwithstanding).
   - Community morale will be low—often disasters cause dramatic "community mindedness" and laudably altruistic responses from local citizens.
6. Planning should focus on broad principles and not on minute details—the "all hazards" approach to disaster preparedness. Rather than developing detailed, specific plans for each possible disaster, instead basic principles of action should be the focus of attention. In fact, detailed tome-like disaster plans are often developed for accreditation but are uniformly ignored in practice because no one has read them and they are not practical to implement.
7. Planning is an educational activity—part of the purpose of planning is to engage stakeholders in a process that heightens awareness and fosters resilience in the face of a crisis. Such an educational approach to disaster planning empowers stakeholders with the "can do" attitude so important in crisis management.
8. Planning always faces resistance—especially when no calamity has occurred for many years, it is notoriously difficult to engage communities in expensive, time-consuming disaster planning and exercising.

## Phases of an Emergency

Traditionally, disasters have been conceptualized as having preimpact, impact, postimpact, and recovery phases.[9,10] The National Framework for Health Emergency Management similarly uses the terms pre-event, event, and postevent.[11] Pre-event activities include risk assessments, mitigation, and preparedness. The event may be either static—as a single point in time, such as an explosion or crash, or dynamic—evolving over time, such as a pandemic. Response and recovery occur during the postevent.

## Risk Assessment

Two approaches can be used when considering risk. The first is to use the "all-hazards" approach as previously mentioned in which a generic plan is devised that is most often designed to deal with a "worst case" scenario.[12] When an organization is in the early stages of developing its emergency response capacity, an "all-hazards" approach will ensure that at least a basic and consistent capability to respond exists. Advantages of the "all-hazards" approach include less time required for planning and being prepared for the unexpected. The "all-hazards" plan is a generic basis for most events that allow planners to add on components for unique emergencies such as chemical, biological, radiological, or nuclear events.

Once an organization, such as a hospital, has established a generic all-hazards plan, it can then enhance its capacity by developing hazard-specific plans. Note that these hazard-specific plans can be appendices for the basic "all-hazards" plan and should not be overly long as such tomes usually get ignored in a crisis. Such appended plans require that a hazard-vulnerability analysis (HVA—a specific type of risk assessment) be conducted to identify possible hazards, followed by a prioritizing exercise based on their probability and potential impact. High-priority hazards include those that are highly likely to occur, as well as those that are less likely to occur, but would have a devastating impact if they did. Risk assessments should be comprehensive and include both internal and external threats to individual wards or departments and to the facility as a whole. Participants in this process should include representatives from front-line staff, administration, and experts in emergency preparedness. Similar institutions, historical records, and individuals with knowledge of the institution's history should be consulted to learn from past events. Finally, assessment tools have also been developed to aid healthcare facilities in conducting their own risk assessments[13] (see Chapter 2).

The risk assessment process should not be conducted in isolation. Although healthcare facilities are essentially small communities unto themselves, it is important that they work with the larger community in which they reside.[14] Community emergency preparedness plans often stop at "patients are transported to hospital," whereas hospital plans begin with "patients arrive from disaster," without consideration of shared risks or integrated planning. External threats to healthcare facilities can have profound implications[15–17] that prevent the hospital from fulfilling its mandate, thereby jeopardizing the overall community response.[18] The recent severe acute respiratory syndrome (SARS) outbreak demonstrated that internal hospital events can have serious consequences for the surrounding community.[19] Hospital disaster planners should periodically meet with their counterparts in the community as well as with police, fire, and first responders to ensure that the disaster plans mesh well.

## Mitigation

After specific hazards have been identified, it may be possible to help mitigate the risk they pose to the healthcare facility. Mitigation can be through either structural adaptations, such as building improvements, or nonstructural measures, such as policy changes. This is the emergency preparedness equivalent to "preventative medicine." Building redundancy into the key systems of the

healthcare facility is one way in which mitigation can be achieved. Since not all risks can be mitigated, preparedness activities are required to manage an emergency should one occur.

The aviation industry is a common model that can be used when considering crisis management and response. Airplane crashes are highly visible disasters that share many commonalities with other types of emergencies. A review by the US National Aeronautics and Space Administration following a series of airplane crashes led to the development of the "cockpit resource management" system designed to help prevent future crashes by mitigating causative factors and improving the pilots' ability to respond effectively when problems do arise.[20] Cockpit resource management includes 4 key components: error identification and management, protocol driven crisis responses, human factors training, and simulator training. Many of these same principles can be applied to help healthcare facilities prepare for disasters and improve healthcare workers' capacity to respond. Furthermore, the cockpit resource management system may have a secondary benefit of reducing medical errors.[20–26]

## Disaster Preparedness

Disaster preparedness is more than simply disaster planning. It has multiple domains from a healthcare viewpoint[27]:

- Prevention of morbidity and mortality
- Provision of casualty care
- Ability to manage adverse climatic and environmental conditions
- Reestablishment of healthcare infrastructure
- Protection of staff, public health, and medical assets

For adequate disaster preparedness, multiple areas of concern must be addressed[27] including:

- Vulnerability assessment (e.g., HVA).
- Development of disaster planning.
- Training and education of first responders, civic leaders, and the citizenry.
- Development and deployment of early warning systems.
- Interoperable communications allowing response personnel to interact easily.
- Adequate information and resource databases and their ongoing management.
- Maintenance of adequate resource stockpiles.
- Regular disaster drills (drill till the plan breaks, fix the problem that caused the break, then drill again…).
- Adequate incident management system (and all personnel readily familiar with their roles in the system).

In a well-developed disaster plan, there are multiple components[27] including:

- The basic plan including policies, responsibilities, and a concept of operations (CONOPS) plan.
- Functional annex—containing the organization of tasks required to complete various critical functions.
- Hazard-specific appendices—based on the HVA for the hospital—what will be done for each specific hazard in a disaster.
- Standard operating procedures (SOPs) for responders—the rules of engagement as it were.

Most of the medical planning required for disasters revolves around core public health issues such as provision of clean water, safe food, adequate shelter, and sanitation. Other public health issues that should be addressed include vector control (e.g., mosquitoes and standing water), toxic (HAZMAT) exposures in a disaster, management of fatalities, management of animals affected by the disaster, and management of chronic illnesses in disaster-affected individuals. Too many disaster plans focus on "heroic" mass casualty care (mobile ORs and the like) while not paying adequate attention to public health basics that will have far more benefit on a population basis.

## Recovery

The transition from response to recovery is graded and in many cases both actions occur simultaneously. The speed with which an organization can return to normal functioning is an indicator of the organization's overall ability to manage an emergency. Given the importance of the healthcare system to the overall community, it is essential that the healthcare organization not only have a response plan but also an operational, or business, continuity plan. Just as the response plan identifies a team to deal with an event, it should also identify a team to coordinate the recovery. The Emergency Control Group, led by the CEO, oversees both the response and recovery activities. In many instances, the recovery activities will be shaped by the lessons learned from the disaster and thus lead full circle to mitigation actions to prevent a similar situation in the future.

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Chapter 2

# Risk and Hazard Vulnerability Analysis

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# Preface

This chapter provides a sample hazard risk assessment tool for medical facilities. Its purpose is to assist medical facilities in identifying and planning for hazards or potential vulnerabilities. It is intended as a guide to assist in prioritization within the construct of a comprehensive emergency management program.

The first step in any disaster plan is an assessment of the local and regional risks. It is impossible to prepare for all types of disasters, and limited resources make it important to focus on typical and high-impact disasters so that the plans are reflective of the likelihood of that significant event occurring. As such, the disaster hazard risk assessment tool becomes a critical document that disaster planners should perform, review, and reassess periodically.

The hazards faced by a small rural or community hospital in an agricultural area will be different from those of a teaching center in a national capital. Thus, no one disaster plan fits all facilities, and the staff of any facility is best suited to review its own risks.

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# Risk, Probability, and Impact

*Risk* is defined as the product of the *probability* of a hazard and its potential *impact*.

Risk = Probability × Impact

## Probability

Probability may be expressed as the likelihood of an event occurring within a given time period; for example, the probability of event *x* occurring at a given location in the next year is *y*. Table 2-1 quantifies probability for a given event to assist in calculating risk. Tables A–D list possible hazards.

Issues to consider for probability include, but are not limited to:

1. Known factors
2. Historical data
3. Statistics from industry, other geographical areas, and so on.

### Table 2-1: Assessment of Probability Rating

| Probability Rating | Description | Detail |
|---|---|---|
| A | Highly Likely | Nearly 100% probability in the next year |
| B | Likely | Between 10% and 100% probability in the next year, or at least one chance in 10 years |
| C | Possible | Between 1% and 10% probability in the next year, or at least one chance in next 100 years |
| D | Unlikely | <1% probability in the next 100 years |

## Impact

For the purpose of this hazard assessment, the *impact* is a score with 3 components, each ranked from 1 to 4.

1. *The human impact*
2. *The property impact*
3. *The business impact*

These 3 are the crucial components that, if disrupted, will interfere with the ability of the facility (and the individuals therein) to deliver care. Some of these are focused on the caregiver, but it is clear that some (particularly business impact) are focused on management and business continuity.

The rating given for *human impact* should consider whether the hazard is/will cause

1. unlikely to cause injury, illness, or death in staff or patients
2. low likelihood of injury, illness, or death in staff or patients
3. high likelihood of injury or illness in staff or patients; low probability of death
4. high likelihood of death in staff or patients

The rating given for *property impact* should consider whether the hazard is/will cause

1. unlikely to cause physical plant or equipment damage requiring any replacement costs or recovery time
2. minor physical plant or equipment damage requiring some replacement costs or recovery time
3. moderate physical plant or equipment damage requiring moderate replacement costs or recovery time
4. extensive physical plant or equipment damage with high replacement costs and recovery time

The rating given for *business impact* should consider whether the hazard is/will cause

1. unlikely to cause service interruption* or damage to public image of the institution
2. minor or limited service interruption or damage to public image
3. significant/widespread service interruption
4. unable to provide services

The *overall impact rating* provides a more accurate example of the effect a hazard will have on the facility and on the surrounding health care and broader community. For example, the hazard may directly impact the staff, clients, or the infrastructure that is critical for service delivery. In addition, the hazard may result in illness or injury in the community and increased patient loads; if healthcare facilities need to be evacuated, then the entire healthcare system will be impacted. An event such as a labor disruption or a power failure may directly limit a provider's ability to deliver services while not directly impacting the rest of the region. Most events will impact both the facility and the community or region to varying degrees. The overall impact rating evaluates the potential hazard's impacts on the ability of the facility to deliver services. It is calculated as the sum of the 3 impact factors for each hazard (see Table 2-2).

*Service interruption may include employees unable to work, staff unable to access or leave facility, interruption of supplies, lack of financial reserves/cash flow, and imposition of fines, penalties, or other legal measures.

## Table 2-2: The Overall Impact Rating Is the Sum of the 3 Impact Factors for Each Hazard

| | | |
|---|---|---|
| 3–4 | Marginal | Normal level of functioning or increased level of service required |
| 5–7 | Serious | Facility can provide a normal level of service with assistance from within region or local community, or facility can provide a reduced level of service with normal resources |
| 8–10 | Critical | Facility can provide a normal level of services with assistance from outside the local community or region, or facility can provide a minimal level of service with normal resources |
| 11–12 | Catastrophic | Facility cannot provide services without extensive assistance from provincial or federal resources |

*Note:* The minimum score is 3.

Combining the *impact rating* with the *probability rating* determines the *risk*, as outlined in Table 2-3.

## Table 2-3: Risk Rating

| Impact Rating / Probability Rating | A Highly Likely | B Likely | C Possible | D Unlikely |
|---|---|---|---|---|
| 11–12: Catastrophic | A11–A12 | B11–B12 | C11–C12 | D11–D12 |
| 8–10: Critical | A8–A10 | B8–B10 | C8–C10 | D8–D10 |
| 5–7: Serious | A5–A7 | B5–B7 | C5–C7 | D5–D7 |
| 3–4: Marginal | A3–4 | B3–4 | C3–4 | D3–4 |

High Moderate Low Very Low

*Source*: Adapted from: All-Hazard Assessment Model Version 3, Manitoba Health Disaster Management Services, June 2004.

Using Table 2-3, planning may proceed with those events prioritized at the highest risk.

## Table A: Medical Facility Hazard Risk Analysis Tool
## Naturally Occurring Events

| Event | Probability | Human Impact | Property Impact | Business Impact | Overall Impact Rating | Risk Rating |
|---|---|---|---|---|---|---|
| | A, B, C, or D (Table 1) | 1, 2, 3, or 4 | 1, 2, 3, or 4 | 1, 2, 3, or 4 | 4–12 (Table 2) | (Table 3) |
| Hurricane | | | | | | |
| Severe Thunderstorm | | | | | | |
| Tornado | | | | | | |
| Blizzard | | | | | | |
| Extreme Heat | | | | | | |
| Extreme Cold | | | | | | |
| Ice Storm | | | | | | |
| Earthquake | | | | | | |
| Tidal Wave | | | | | | |
| Drought | | | | | | |
| Fire—External | | | | | | |
| Flood—External | | | | | | |
| Landslide | | | | | | |
| Volcano | | | | | | |
| Epidemic (Pandemic) | | | | | | |

## Table B: Medical Facility Hazard Risk Analysis Tool Technological/Infrastructure Events (Internal/External)

| Event | Probability | Human Impact | Property Impact | Business Impact | Overall Impact Rating | Risk Rating |
|---|---|---|---|---|---|---|
| | A, B, C, or D (Table 1) | 1, 2, 3, or 4 | 1, 2, 3, or 4 | 1, 2, 3, or 4 | 4–12 (Table 2) | (Table 3) |
| Electrical Failure | | | | | | |
| Generator Failure | | | | | | |
| Transportation Emergency | | | | | | |
| Fuel Shortage | | | | | | |
| Water Emergency | | | | | | |
| Sewer Failure | | | | | | |
| Fire Alarm Failure | | | | | | |
| Communications Failure | | | | | | |
| Medical Gas Failure | | | | | | |
| Medical Vacuum Failure | | | | | | |
| HVAC Failure | | | | | | |
| Information Systems Failure | | | | | | |
| Fire—Internal | | | | | | |
| Flood—Internal | | | | | | |
| Supply Shortage | | | | | | |
| Structural Damage | | | | | | |
| HAZMAT Exposure—Internal | | | | | | |

## Table C: Medical Facility Hazard Risk Analysis Tool Human-Related Events

| Event | Probability | Human Impact | Property Impact | Business Impact | Overall Impact Rating | Risk Rating |
|---|---|---|---|---|---|---|
| | A, B, C, or D (Table 1) | 1, 2, 3, or 4 | 1, 2, 3, or 4 | 1, 2, 3, or 4 | 4–12 (Table 2) | (Table 3) |
| Mass Casualty Incident (Infectious) | | | | | | |
| Terrorism—Biological | | | | | | |
| VIP Situation | | | | | | |
| Infant Abduction | | | | | | |
| Hostage Situation | | | | | | |
| Civil Disturbance | | | | | | |
| Labor Action | | | | | | |
| Forensic Admission | | | | | | |
| Bomb Threat | | | | | | |

## Table D: Medical Facility Hazard Risk Analysis Tool Events Involving Hazardous Materials

| Event | Probability | Human Impact | Property Impact | Business Impact | Overall Impact Rating | Risk Rating |
|---|---|---|---|---|---|---|
| | A, B, C, or D (Table 1) | 1, 2, 3, or 4 | 1, 2, 3, or 4 | 1, 2, 3, or 4 | 4–12 (Table 2) | (Table 3) |
| Mass Casualty HAZMAT Incident | | | | | | |
| Small Casualty HAZMAT Incident | | | | | | |
| Chemical Exposure—External | | | | | | |
| Small- to Medium-Sized Internal Spill | | | | | | |
| Large Internal Spill | | | | | | |
| Terrorism—Chemical | | | | | | |
| Radiological Exposure—Internal | | | | | | |

## Table D: Medical Facility Hazard Risk Analysis Tool
## Events Involving Hazardous Materials *(continued)*

| Event | Probability | Human Impact | Property Impact | Business Impact | Overall Impact Rating | Risk Rating |
|---|---|---|---|---|---|---|
| | A, B, C, or D (Table 1) | 1, 2, 3, or 4 | 1, 2, 3, or 4 | 1, 2, 3, or 4 | 4–12 (Table 2) | (Table 3) |
| Radiological Exposure—External | | | | | | |
| Terrorism—Radiological | | | | | | |

**Source documents:**

1. Kaiser Permanente Medical Center Hazard and Vulnerability Analysis
2. All-Hazard Assessment Model—Manitoba Health Disaster Management
3. Integrated Hospital Emergency Management System—OCIPEP, 2001
4. CBRNE Plan checklist—A Template for Healthcare Facilities—2002

Chapter 3a

# Readiness and Mitigation*

## General Planning and Readiness Tool

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# Preface

For healthcare facilities, "disasters and emergencies include a variety of hazardous situations that may occur inside or outside the organization. These include, but are not limited to, fires, natural disasters, biochemical and bomb threats, chemical spills, radiation exposure, threats of personal violence and power failures" (*CCHSA Standard 5.0*). In addition, new and emerging infections and industrial accidents such as train derailments or explosions/fires at nuclear plants may be threats to healthcare providers.

Healthcare facilities play a vital role in the response to emergencies. Emergency preparedness for healthcare facilities includes elements of mitigation, preparedness, response, and recovery. Facility plans should take into account factors such as the appropriateness and adequacy of physical facilities, organizational structures, human resources, and communication systems and need a tool to assess their readiness.

The purpose of this chapter is to allow healthcare facilities to assess their readiness to deal with disasters. This is not a planning tool per se, but once the facility's plan is in place, it will provide a means to review the plan and identify gaps.

This checklist makes liberal use of various resources either freely available on the Internet or provided by coworkers. In particular, we have made use of the checklist provided by Denys J. Carrier, RN, Leader, Emergency Preparedness Program, Providence Health Care, BC, and that developed by Booz-Allen and associates for the Agency for Healthcare Research and Quality.

Every facility is different, and the nature of threats to specific facilities varies over time. For this reason, the chapter must, to some degree, remain general. Users must refer to their risk assessment process and the current standards of care. Risk assessment is covered in Chapter 2.

The term "Healthcare Facility" or "facility" is used throughout this chapter. The definition of facilities, clinics, rehabilitation or extended care facilities (ECF), retirement homes, long-term care home, and other healthcare institutions may vary from region to region, and it is the intention of the authors of this chapter to provide a reference tool that can be generalized across multiple platforms of healthcare delivery. The primary target audience is traditional facilities with inpatient units, particularly those that have an emergency department; as such, not all sections of this chapter are applicable to all facilities. An institution may choose not to address a specific issue when writing their disaster plan, because their risk analysis reveals a very low occurrence, a negative impact, or other considerations. Planners in each facility should decide which events they choose to prepare for and those they choose to assess using this tool.

## How to Use This Tool

The checklist is designed to provide facilities with questions that stimulate assessment and dialogue with key stakeholders within the facilities as well as at the local level and beyond. The checklist divides the assessment into sections; however, many of them overlap and may be grouped in differing manners according to the organization and operation of individual facilities. Although comprehensive, the facility assessment will undoubtedly identify new questions and considerations.

There are episodic redundancies in this questionnaire. These redundancies are intentional so as to provide for (1) internal validation and (2) sections of the tool to stand-alone and be given to separate individuals within the facility's organization. Redundant questions are cross-referenced in the chapter.

Assessment items should be answered as follows: Y = yes; N = no; N/A = not applicable; U = unsure (*for every* "U," *the facility must identify someone who will clarify the response*). In some cases, numerical information was felt to be more useful.

The majority of the questions are in the yes/no/not applicable (N/A) format. Although it is assumed that a "yes" answer means the issue raised by the question has been addressed, the converse is not true. A "No" or "N/A" answer may mean that the facility has a gap in its readiness, or it may be that the answer was a product of an active decision. This chapter is not meant to be proscriptive but rather one that is thought-provoking and generates discussion.

This chapter has 24 sections, each of which may be filled in by a different individual; however, one lead person should be designated to provide overall responsibility for ensuring that all information is complete. The completion of this form and the development and implementation of a full plan are a facility-wide activity, requiring cooperation from many areas or departments.

The term "Incident Command System" is used for referring to Incident Management Systems (IMS), Incident Command Systems (ICS), Hospital Emergency Incident Command System (HEICS), and other similar terms. Similarly, the term Incident Commander and Incident Manager are used interchangeably in this document. For more information, see References.

The process of developing this chapter was as follows:

1. Needs assessment/identifying the absence of a Canadian Healthcare Facility tool for readiness (2003)
2. Literature search (2004)
3. First draft (2004)
4. First draft reviewed and compilation of feedback (2004)
5. Second literature review and extraction of relevant documents (2005)
6. Panel review of literature search results and of edited initial tool (2006)
7. Compilation of panel's feedback and final draft (2006)
8. Final draft review by the panel (2006)*

The *National Framework for Health Emergency Management* (NFHEM) was prepared by F/P/T Network on Emergency Preparedness and Response with the support of the Centre for Emergency Preparedness and Response (Health Canada/Public Health Agency of Canada) in 2004. Its goal is "to set principles and elements of a comprehensive integrated framework that will provide a context for leadership and coordination through Federal/Provincial/Territorial emergency management systems in the health and social services sectors" (F/P/T Network 2004, p.3). This General Readiness Checklist is part of a larger strategy to develop emergency management tools and processes consistent with the NFHEM's principles and provides a means to achieving several of its elements.

# Definitions

**CBRNE:** A chemical, biological, radiological, nuclear, or explosive event.

**Dirty Bomb:** A mix of explosives, such as dynamite, with radioactive powder or pellets. When the dynamite or other explosives are set off, the blast carries radioactive material into the surrounding area (http:/www.bt.cdc.gov/radiation/dirtybombs.asp).

**Incident Command System or Incident Management System:** A command and control system used by military, fire fighters, and other agencies to manage critical incidents such as large fires or natural disasters.

**Hospital Emergency Incident Command System:** The ICS as adapted to hospitals. This is sometimes abbreviated as HEICS.

**Nuclear Incident:** An incident whereby individuals are exposed to or contaminated with nuclear material; also used to describe the detonation of a nuclear device.

**Radiological Incident:** An incident whereby individuals are exposed to ionizing radiation, not contaminated with nuclear material itself.

**Surge Capacity:** The ability to quickly and with little warning increase the capacity to respond to an incident; in the case of healthcare facilities, this refers to increase in capacity to care for patients.

**Internal Disaster:** An event occurring within a facility affecting the ability of the facility to provide care to its usual capacity.

**External Disaster:** An event occurring outside the facility that overwhelms the capacity of the facility to safely care for victims.

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## PLAN CHECKLIST

**A Template for Healthcare Facilities**

Name of Healthcare Facility: _____

Facility Address: _____

_____

Name and Title of Person(s) Responsible for Completing Form: _____

_____

_____

Contact Information:

Phone: ( ) _____ Pager: ( ) _____

Fax: ( ) _____ Email: _____

| Sections | Person(s) Responsible |
|---|---|
| Section 1: Determination of Bed Resource Capacity for an Internal or External Disaster | |
| Section 2: Foundational Considerations | |
| Section 3: Identification of Authorized Personnel | |
| Section 4: Activation of the Disaster Plan | |
| Section 5: Altering System | |
| Section 6: Response | |
| Section 7: Healthcare Incident Command | |
| Section 8: Security | |
| Section 9:Communications Systems | |
| Section 10: Internal Traffic Flow and Control | |
| Section 11: Internal/External Tracking | |
| Section 12: External Traffic Flow and Control | |
| Section 13: Visitor Management | |
| Section 14: Media | |
| Section 15: Reception of Casualties and Victims of Non-CBRNE Events | |
| Section 16: Relocation of Patients and Staff | |
| Section 17: Facility Evacuation (External) | |

*(continued)*

| Sections | Person(s) Responsible |
|---|---|
| Section 18: Facility Out of Communication or Cutoff From Resources | |
| Section 19: Equipment, Supplies, and Pharmaceuticals | |
| Section 20: Diagnostic Capabilities | |
| Section 21: Information Technology | |
| Section 22: Critical Incident Stress Management | |
| Section 23: Postdisaster Recovery | |
| Section 24: Education and Training | |

## Section 1: Determination of Bed Resource Capacity for an Internal or External Disaster

### GENERAL FACILITY INFORMATION

**1.1** What is your average daily inpatient census (averaged over most recent calendar year)?

_____

**1.2** Approximately how many people work at your facility?

_____

**1.3** What is your licensed, operational, and surge bed capacity? The chart on the next page is provided for your convenience.

_____

**1.4** How many times a month does your facility reach 100% of operational capacity (i.e., staffed beds)?

_____

**1.5** How many times a month does your facility exceed 100% capacity?

_____

**1.6** If your capacity exceeds 100% capacity more than once per month, what is the average duration of the excess capacity period?

_____

| **Facility Department** | **Total Physical Beds** (*Staffed and Unstaffed*) | **Staffed Beds** (*Operational Capacity*) | **Negative Pressure Rooms** (*Beds*) | **Location of Surge Patient Care Areas** | **Approximate Surge Capacity** (*Estimated Maximum Number of Additional Staffed Patient Care Areas Created in 6 & 12 Hours*) |
|---|---|---|---|---|---|
| Adult Medical & Surgical | | | | | |
| Pediatric Medical & Surgical | | | | | |
| Adult ICU (All Units Including CCU) | | | | | |
| Step-up/Step-down Units | | | | | |
| Operating Rooms | | | | | |
| Adult Intermediate Care Ward (Progressive Care Unit) | | | | | |
| Pediatric ICU (Including NICU) | | | | | |
| Pediatric Intermediate Care Ward (Progressive Care Unit) | | | | | |

*(continued)*

| **Facility Department** | **Total Physical Beds** (*Staffed and Unstaffed*) | **Staffed Beds** (*Operational Capacity*) | **Negative Pressure Rooms** (*Beds*) | **Location of Surge Patient Care Areas** | **Approximate Surge Capacity** (*Estimated Maximum Number of Additional Staffed Patient Care Areas Created in 6 & 12 Hours*) |
|---|---|---|---|---|---|
| Emergency Department Beds | | | | | |
| Decontamination Areas | | | | | |
| OB/GYN | | | | | |
| Psychiatry | | | | | |
| Substance Abuse | | | | | |
| Transitional Care (e.g., short-term care facility, rehabilitation) | | | | | |
| Other Departments | | | | | |
| | | | | | |
| | | | | | |

| Bed Types | Total Physical Beds | Staffed Beds | Surge Beds (Including Portable $O_2$/Suction) | Locations of Beds |
|---|---|---|---|---|
| Beds with oxygen only | | | | |
| Beds with suction only | | | | |
| Beds with both oxygen & suction | | | | |
| Monitored beds | | | | |
| Telemetry beds | | | | |

## Section 2: Foundational Considerations

*Person Responsible for Completing Section 2:* _____

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **2.1** Does the facility have a disaster plan? | | | | | | |
| **2.2** Is there an emergency planning/ disaster planning committee (DPC)? | | | | | | |
| **2.3** If the facility has a DPC, is it multidisciplinary and include administrative members? | | | | | | |
| **2.4** Does the plan detail actions to be taken for both internal and external disasters? | | | | | | |
| **2.5** Does the plan detail how it links with the local Emergency Response Agencies? | | | | | | |
| **2.6** Is the plan widely distributed and readily available throughout the healthcare facility? (Distribution should include both hard copies of the plan or an automated method that is readily available to all staff members) | | | | | | |
| **2.7** Has the facility implemented the Incident Command or Management System facility wide? (for more information, see Chapter 4) | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **2.8** Does your facility's emergency preparedness plan address requesting local, provincial, or federal resources for assistance? | | | | | | |
| **2.9** Does your facility's emergency preparedness plan address increasing operational bed capacity? | | | | | | |
| **2.10** Does your facility's emergency preparedness plan address processes to increase inpatient treatment capacity within your community? | | | | | | |
| **2.11** Does your facility's emergency preparedness plan address extending outpatient clinic hours beyond normal scheduled hours? | | | | | | |
| **2.12** Does your facility's emergency preparedness plan address processes to increase outpatient treatment capacity in your community? | | | | | | |
| **2.13** Does your facility's emergency preparedness plan address early inpatient discharge protocols to create additional beds? | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **2.14** Does your facility's emergency preparedness plan address canceling elective surgeries in order to make additional beds available for use in an emergency? | | | | | | |
| **2.15** Does your healthcare facility have policies concerning emergency department diversion? | | | | | | |
| **2.16** Is that plan recognized and accepted by the local EMS service and community hospitals? | | | | | | |
| **2.17** Can your healthcare facility track expenses incurred during an emergency disaster? | | | | | | |
| **2.18** Does the plan specify the number and location of isolation or protective environment rooms? | | | | | | |
| **2.19** Are these locations clearly identified in a document readily available to the disaster coordinator or command team? | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **2.20** Are isolation facilities monitored to ensure adequate airflow? | | | | | | |
| **2.21** Can your healthcare facility track human resource utilization during an emergency (including nonemployees: physician, students, volunteers)? | | | | | | |
| **2.22** Does your facility have an individual(s) responsible for tracking and incorporating information from Federal/Provincial/ Territorial and local plans? | | | | | | |

## Section 3: Identification of Authorized Personnel

*Person Responsible for Completing Section 3:* _____

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **3.1** Is there a process for designating an Incident Commander on a 24/7 basis? | | | | | | |
| **3.2** Has your healthcare facility designated a Medical Care Director who will be responsible for the facility's medical responses during the time the plan is activated? | | | | | | |
| **3.3** Have other key position holders who have a role in the Emergency Preparedness Plan been identified? (*See Section 7 Incident Command for a guide to an Incident Command Structure and References*) | | | | | | |
| **3.4** Is a notification system in place that can alert personnel to a potential disaster situation? | | | | | | |
| **3.5** Does the plan include lines of authority, role responsibilities, and provide for succession? | | | | | | |
| **3.6** Are those who are expected to implement and use the plan familiar with it? | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **3.7** Have job action sheets or role cards been developed for all personnel involved in disaster response? | | | | | | |
| **3.8** Does the plan designate how people will be identified within the healthcare facility (e.g., staff, outside supporting medical personnel, news media, clergy, and visitors)? | | | | | | |
| **3.9** Does your facility have an on-call nursing policy? | | | | | | |
| **3.10** Does your facility emergency preparedness plan address expanding staff availability? | | | | | | |
| **3.11** Can staff gain access to the healthcare facility when called back on duty? | | | | | | |
| **3.12** Does your healthcare facility participate in multiple facility credentialing procedures to permit rapid recognition of credentialed staff from other healthcare facilities? | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **3.13** Is there designation of assembly points to which all personnel report? | | | | | | |
| **3.14** Do these assembly points differ if staff are involved in patient care or have administrative responsibilities? | | | | | | |
| **3.15** Is there a back-up point if the disaster renders the primary assembly point unavailable? | | | | | | |

## Section 4: Activation of the Disaster Plan

*Person Responsible for Completing Section 4:* _____

| | | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|---|
| **4.1** | Does the plan specify the circumstances under which the plan must be activated? | | | | | | |
| **4.2** | Does the plan stipulate the position holder who has the mandate to *activate* the plan including nights, weekends, and holidays? | | | | | | |
| **4.3** | Does the plan stipulate the position holder who has the mandate to *deactivate* the plan including nights, weekends, and holidays? | | | | | | |
| **4.4** | Have activation stages been established and roles outlined with each stage? | | | | | | |
| Alert | Disaster situation possible: there is an increased level of preparedness | | | | | | |
| Level 1 | Disaster situation exists: can be managed by staff and resources currently at the site(s) | | | | | | |
| Level 2 | Disaster situation exists: facility overwhelmed by resources at the site(s) but can be handled by the staff and resources within or available to the organization | | | | | | |

*(continued)*

| | | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|---|
| Level 3 | Disaster situation exists: potential to overwhelm resources of one organization. Will need the coordination of staff and resources from more than one organization. How/who do you call for help? Is this established and verified periodically (to cover possibility of staff changes)? | | | | | | |

## Section 5: Alerting System

*Person Responsible for Completing Section 5:* _____

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **5.1** Does the plan provide for activation within 1 hour during normal as well as off hours including weekends and holidays? | | | | | | |
| **5.2** Does the plan specify how notification within the healthcare facility will be carried out? | | | | | | |
| **5.3** Does the plan specify the chain of command to notify internal staff and appropriate external personnel (including volunteers) indicating the status of the healthcare facility? | | | | | | |
| **5.4** Does the plan detail responsibility to initiate a system for calling staff rapidly back to duty? | | | | | | |
| **5.5** Does the plan provide for alternative systems of notification that considers people, equipment, and procedures? | | | | | | |
| **5.6** Does the plan provide mechanisms to ration staffing according to their skill levels and availability? | | | | | | |
| **5.7** Do staff understand their obligation to respond rapidly when the plan is activated? | | | | | | |

## Section 6: Response

*Person Responsible for Completing Section 6:* _____

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **6.1** Has the healthcare facility developed internal disaster plans for internal emergencies? | | | | | | |
| **6.2** Has the healthcare facility developed internal plans to respond to a disaster? | | | | | | |
| **6.3** Does this internal plan indicate how the healthcare facility will respond to an abnormally large (>20% of the total beds) influx of patients? | | | | | | |
| **6.4** Has the healthcare facility developed plans indicating how the facility will be able to supply resources in response to an external disaster? | | | | | | |
| **6.5** Has the healthcare facility developed plans indicating how the facility will be able to supply personnel in response to an external disaster? | | | | | | |
| **6.6** Has the healthcare facility identified what types of equipment may be required in a disaster based on risk assessment? | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **6.7** Is there an evaluation of current supply and equipment levels that are kept on hand during normal facility operation? | | | | | | |
| **6.8** Have provisions been made for activating an appropriately constituted team in response to an *internal* disaster? | | | | | | |
| **6.9** Have provisions been made for activating an appropriately constituted team in response to an *external* disaster? | | | | | | |
| **6.10** Is there a relief plan to replace staff on such a response team (internal and external)? | | | | | | |
| **6.11** Does your healthcare facility participate in multiple facility credentialing procedures to permit rapid recognition of credentialed staff from other healthcare facilities? | | | | | | |
| **6.12** Does your facility have agreements with appropriate unions for transfer of staff required in an emergency? | | | | | | |
| **6.13** Does the plan include procedures for assessing qualification of, incorporating, and managing volunteers? | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **6.14** Has risk management been involved to develop a process to provide insurance, liability, and safety for volunteers in an emergency? | | | | | | |
| **6.15** Is there a plan to ensure adequate supplies (*including food, linens, blankets, pillows, patient care items, cots*) are available from local or regional suppliers or that plans are in place to obtain them in a timely manner? | | | | | | |
| **6.16** Is there a plan to ensure adequate supplies (*as listed in 6.15*) for staff and volunteers as well? | | | | | | |
| **6.17** Has each department developed standard operating procedures to reflect how the department will provide services on a 24-hour basis? These services may include: | | | | | | |
| Administration | | | | | | |
| Communications | | | | | | |
| Emergency | | | | | | |
| Nursing | | | | | | |
| Radiology | | | | | | |
| Infection Control/ Epidemiology | | | | | | |
| Infectious Diseases | | | | | | |
| Occupational Health and Safety | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| Laboratory/ Transfusion Medicine | | | | | | |
| Pharmacy | | | | | | |
| Critical Care | | | | | | |
| Supplies | | | | | | |
| Plant Services | | | | | | |
| Biomedical Engineering | | | | | | |
| Respiratory Therapy | | | | | | |
| Security | | | | | | |
| Food and Nutrition | | | | | | |
| Housekeeping | | | | | | |
| Reprocessing of Instruments | | | | | | |
| Laundry | | | | | | |
| Waste Disposal Including Contaminated Waste | | | | | | |
| Social Services | | | | | | |
| CISM/Pastoral Care | | | | | | |
| Morgue | | | | | | |
| Physicians | | | | | | |
| Operating Room Services | | | | | | |
| **6.18** In the Emergency Department section of the plan, are the following detailed? | | | | | | |
| Is the necessary equipment readily available to the ED Staff? | | | | | | |
| Does the ED Staff all know where the equipment is and how to access it? | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| Have ED Staff been trained in disaster responsive skills and are they updated regularly? | | | | | | |
| Is there adequate backup power available in the event of a power failure? | | | | | | |
| Is there a mechanism for simultaneous communications with all persons in casualty receiving areas? | | | | | | |
| Is there a method of communication to allow all ED Staff to communicate rapidly? | | | | | | |
| Are there standard order sets developed for various defined high-risk events? | | | | | | |
| **6.19** Is there a procedure in place to collect and protect the evidence that may be required for criminal or other investigations? (e.g., maintaining chain of custody) | | | | | | |
| **6.20** Have roles and responsibilities of outside agencies been documented and communicated with ED Staff? (e.g., law enforcement) | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **6.21** Are there provisions for the proper examination, care, and disposition of deceased persons? | | | | | | |
| **6.22** Are there plans for the following? | | | | | | |
| Augmenting morgue facility and staff | | | | | | |
| Expanding morgue capacity | | | | | | |
| Procedures for decontamination/ isolation of human remains | | | | | | |
| Backup isolation procedures when morgue capacity is exceeded | | | | | | |
| Decontamination of the environment | | | | | | |
| Security of the morgue facility | | | | | | |
| Accommodating religions and cultural practices around death | | | | | | |
| Other—Specify | | | | | | |

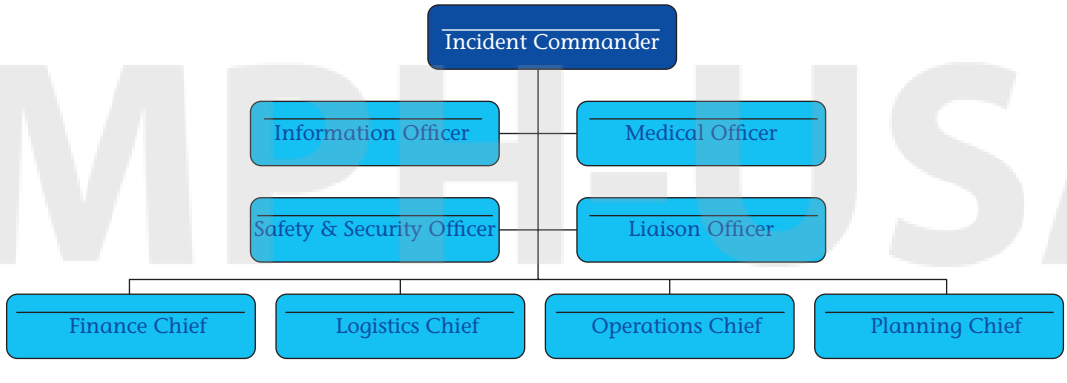
## Section 7: Healthcare Incident Command

(See References and Chapter 4)
*Person Responsible for Completing Section 7:* _____

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **7.1** Does the plan indicate the location of the healthcare facility Emergency Operations Center (EOC) with preference given to an area away from the Emergency Department? | | | | | | |
| **7.2** Has an alternate location been established? | | | | | | |
| **7.3** Have standard operating procedures been developed for the Emergency Operations Centre? | | | | | | |
| **7.4** Do the procedures for the EOC specify chain of command and communication channels for the key position holders within the EOC? Key position holders should be determined at the initiation of the disaster plan.*See Chapter 4 for additional help in determining roles.* | | | | | | |
| **7.5** Is there provision for alternative communication arrangements in the event the facility communication system fails or is overloaded? | | | | | | |
| **7.6** If the system is a battery driven system, are there back-up batteries available or the ability to recharge batteries? | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **7.7** Have special communication networks been established and tested that will maintain communication between the facility and local Emergency Response Agencies? | | | | | | |
| **7.8** Has an ICS structure been developed to include the following positions: | | | | | | |
| Incident Commander | | | | | | |
| Information Officer | | | | | | |
| Liaison Officer | | | | | | |
| Safety and Security Officer | | | | | | |
| Medical Officer | | | | | | |
| Logistics Chief | | | | | | |
| Planning Chief | | | | | | |
| Finance Chief | | | | | | |
| Operations Chief | | | | | | |
| **7.9** Has an individual(s) been assigned the task of collection of data to be used for feedback to local, provincial, and federal agencies and internal review in the recovery phase? | | | | | | |



## Section 8: Security

*Person Responsible for Completing Section 8:* _____

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **8.1** Does the facility have the ability to lock down so that entry and exit to all parts of the facility can be controlled? | | | | | | |
| **8.2** If established, has the facility tested their lock down procedure? | | | | | | |
| **8.3** Have steps been taken to minimize and control points of access and egress in buildings and areas without utilization of lock down procedures? | | | | | | |
| **8.4** Is there a plan to control access and egress of vehicular traffic? | | | | | | |
| **8.5** Is there a plan to control movement of people and information within the facility? | | | | | | |
| **8.6** Have arrangements been made to meet and escort responding emergency service personnel? | | | | | | |
| **8.7** Does the facility have the ability to communicate with individuals outside the facility in the event that a lock down is initiated? | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **8.8** Does the plan designate how people will be identified within the facility? (e.g., facility staff, outside supporting medical personnel, news media, clergy, visitors) | | | | | | |
| **8.9** Is there a plan for staff to gain access to the healthcare facility when called back on duty? | | | | | | |
| **8.10** Is there designation of assembly points to which all personnel report to? | | | | | | |
| **8.11** Is there a secondary assembly point(s) if the primary point(s) is/are compromised? | | | | | | |
| **8.12** Has an assessment been done to determine the security risks for the facility? (e.g., liquid/gas storage, fuel storage, labs with bio/radiological hazards) | | | | | | |
| **8.13** Does the facility have a system in place for augmentation of the security force? | | | | | | |

## Section 9: Communications Systems

*Person Responsible for Completing Section 9:* _____

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **9.1** Does the plan include provisions in the event that normal systems (e.g., telephone, facsimile, cellular phones, and paging) may be overloaded or rendered unserviceable during disasters? | | | | | | |
| **9.2** Is there provision for alternative communication arrangements in circumstances where the facility communication system fails/overloads (e.g., unlisted numbers, pay phones, walkie-talkie sets, 2-way radios, satellite phones)? | | | | | | |
| **9.3** Are these alternative methods of communications accessible to disaster responders and planners from outside the facility and do they know how to access them? | | | | | | |
| **9.4** Is there an organized runner or messenger system as backup for communication system and power failures, which can function both internally and externally? | | | | | | |
| **9.5** Are schematic area layout maps showing key areas for disaster operations readily available for use? | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **9.6** Has the healthcare facility established communication networks with the local Emergency Response Agencies? | | | | | | |
| **9.7** Has a communication plan, including social media if the hospital uses such systems for other public communication, been developed in advance for specific events that allow to communicate information to crucial stakeholders including: | | | | | | |
| Laboratories | | | | | | |
| Fire Services | | | | | | |
| Police Services | | | | | | |
| EMS | | | | | | |
| Media | | | | | | |
| Family Members | | | | | | |
| Other Local Healthcare Facilities | | | | | | |
| Public Health | | | | | | |
| Local Elected officials | | | | | | |
| **9.8** Is there a plan that allows staff to call out in an organized fashion (i.e. rolling call time schedule in wards for the first hours of an event), to allow staff to manage personal issues? | | | | | | |
| **9.9** Is there a dedicated method (i.e. phone, fax, computer) that can be used to ONLY RECEIVE disaster information regularly? | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **9.10** Is there a backup method for question 9.9? | | | | | | |
| **9.11** Is there capacity to respond to high volume of patient inquiries that can be used to provide patient information as required? | | | | | | |
| **9.12** Do you have a list of key internal/external personnel and their designates (to include 24-hour contact information)? *See list on next page.* | | | | | | |

| Sample list of key personnel (Table for 9.12) | Telephone # | Pager # | Cellular # |
|---|---|---|---|
| President/CEO | | | |
| Leader on-call | | | |
| Leader, Emergency Preparedness | | | |
| Leader, Security, Fire & Safety | | | |
| Emergency Department, Physician Leader | | | |
| Site Leader | | | |
| Chief of Professional Practice and Nursing | | | |
| Leader Plant Services | | | |
| Director of Infection Control/facility Epidemiologist | | | |
| Chief of Microbiology/ Laboratory Medical Director | | | |
| Chief of Medical Staff | | | |
| Risk Manager | | | |
| Department Chiefs | | | |
| Communications | | | |
| Information Services | | | |
| Security | | | |
| Director of Pharmacy | | | |
| Critical Incident Stress Management | | | |
| Social Services | | | |
| Ethics Officer | | | |
| Clergy | | | |
| Public Health | | | |
| Fire Services | | | |
| Ambulance and Pre-hospital Services | | | |
| Police Services | | | |

*(continued)*

| Sample list of key personnel (Table for 9.12) | Telephone # | Pager # | Cellular # |
|---|---|---|---|
| Provincial Laboratories | | | |
| Local Emergency management agency | | | |
| Other Local Healthcare Facilities | | | |
| Coroner's Services | | | |
| Funeral Homes | | | |
| Regional Health Authorities | | | |
| Provincial Health Authorities (MOH, etc.) | | | |
| Poison Control | | | |
| Ambulance Dispatch/ Communications Centre | | | |

## Section 10: Internal Traffic Flow and Control

*Person Responsible for Completing Section 10:* _____

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **10.1** Have provisions been made for internal traffic flow that allow for *staff* movement: | | | | | | |
| to/from ICU | | | | | | |
| to/from OR | | | | | | |
| to/from Diagnostics | | | | | | |
| to/from wards | | | | | | |
| to/from patient discharge/pickup areas | | | | | | |
| to/from exits | | | | | | |
| **10.2** Have provisions been made for internal traffic flow that provide direction and allow for *ambulatory* patient movement: | | | | | | |
| to/from ICU | | | | | | |
| to/from OR | | | | | | |
| to/from Diagnostics | | | | | | |
| to/from wards | | | | | | |
| to/from patient discharge/pickup areas | | | | | | |
| to/from exits | | | | | | |
| **10.3** Have provisions been made for internal traffic flow that allow for *non-ambulatory* patient movement: | | | | | | |
| to/from ICU | | | | | | |
| to/from OR | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| to/from Diagnostics | | | | | | |
| to/from wards | | | | | | |
| to/from exits | | | | | | |
| **10.4** Have provisions been made for internal traffic flow that provide direction and allow for *external responder* movement: | | | | | | |
| to/from ICU | | | | | | |
| to/from OR | | | | | | |
| to/from Diagnostics | | | | | | |
| to/from wards | | | | | | |
| to/from patient discharge/pickup areas | | | | | | |
| to/from exits | | | | | | |
| **10.5** Have provisions been made for internal traffic flow that provide direction and allow for *visitor* movement: | | | | | | |
| to/from ICU | | | | | | |
| to/from OR | | | | | | |
| to/from Diagnostics | | | | | | |
| to/from wards | | | | | | |
| to/from patient discharge/pickup areas | | | | | | |
| to/from exits | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **10.6** Is there proper charting/signage that will direct traffic flow? | | | | | | |
| **10.7** Is there proper signage to indicate traffic routes? | | | | | | |
| **10.8** Is there enough signage available for deployment throughout the entire healthcare facility? | | | | | | |

## Section 11: Internal/External Tracking

*Person Responsible for Completing Section 11:* _____

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **11.1** Is there a process to track movement of *patients* through the facility via one of: | | | | | | |
| Paper tracking with tags | | | | | | |
| Bar coding | | | | | | |
| Radio frequency identification | | | | | | |
| Escorts | | | | | | |
| Other | | | | | | |
| **11.2** Is there a process to track movement of *staff* through the facility via one of: | | | | | | |
| Paper tracking with tags | | | | | | |
| Bar coding | | | | | | |
| Radio frequency identification | | | | | | |
| Escorts | | | | | | |
| Other | | | | | | |
| **11.3** Is there a process to track movement of *visitors* through the facility via one of: | | | | | | |
| Paper tracking with tags | | | | | | |
| Bar coding | | | | | | |
| Radio frequency identification | | | | | | |
| Escorts | | | | | | |
| Other | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **11.4** Is there a process to track movement of *volunteers* through the facility via one of: | | | | | | |
| Paper tracking with tags | | | | | | |
| Bar coding | | | | | | |
| Radio frequency identification | | | | | | |
| Escorts | | | | | | |
| Other | | | | | | |
| **11.5** Is there a process to track movement of *VIPs* through the facility via one of: | | | | | | |
| Paper tracking with tags | | | | | | |
| Bar coding | | | | | | |
| Radio frequency identification | | | | | | |
| Escorts | | | | | | |
| Other | | | | | | |
| **11.6** Is there a process to track movement of VIP"s *Security escort* through the facility via one of: | | | | | | |
| Paper tracking with tags | | | | | | |
| Bar coding | | | | | | |
| Radio frequency identification | | | | | | |
| Escorts | | | | | | |
| Other | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **11.7** Is there a process to track movement of *Media* through the facility via one of: | | | | | | |
| Paper tracking with tags | | | | | | |
| Bar coding | | | | | | |
| Radio frequency identification | | | | | | |
| Escorts | | | | | | |
| Other | | | | | | |
| **11.8** Is there a process to track movement of *external maintenance personnel* through the facility via one of: | | | | | | |
| Paper tracking with tags | | | | | | |
| Bar coding | | | | | | |
| Radio frequency identification | | | | | | |
| Escorts | | | | | | |
| Other | | | | | | |
| **11.9** Is there a process to track patient movement between facilities? | | | | | | |
| **11.10** Is there a process to track patient movement during evacuation? | | | | | | |

## Section 12: External Traffic Flow and Control

*Person Responsible for Completing Section 12:* _____

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **12.1** Have arrangements been made for vehicular entrance to and from the facilities entrances/exits? | | | | | | |
| **12.2** Is there a shuttle system in place to move staff/visitors/and other personnel to and from entrance/exits? | | | | | | |
| **12.3** Is there an external checkpoint to control all traffic? | | | | | | |
| **12.4** Have ingress routes been established for the following: | | | | | | |
| Emergency vehicles | | | | | | |
| Non-emergency essential vehicles | | | | | | |
| Preliminary triage stations | | | | | | |
| Non-ambulatory patients | | | | | | |
| Ambulatory patients requiring treatment | | | | | | |
| Individuals not requiring medical intervention | | | | | | |
| Family/visitors | | | | | | |
| Media | | | | | | |
| Onlookers | | | | | | |
| Volunteers | | | | | | |
| All staff/clinical personnel | | | | | | |
| Other | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **12.5** Is there a capacity to divert non-emergency vehicles to alternate distant parking area(s)? | | | | | | |
| **12.6** Has the facility established how to handle uninterrupted flow of ambulances and other vehicles to casualty sorting areas or emergency room entrances? | | | | | | |
| **12.7** Is there a process to handle access and egress control of authorized vehicles carrying supplies and equipment to a dock or other appropriate area? | | | | | | |
| **12.8** Is there a process to handle authorized vehicle parking? | | | | | | |
| **12.9** Is there a process to provide direction for authorized personnel and visitors to proper entrances? | | | | | | |
| **12.10** Is there a process to track patient movement out of the facility (e.g., evacuation, transfer to another facility)? | | | | | | |

## Section 13: Visitor Management

*Person Responsible for Completing Section 13:* _____

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **13.1** Is there a policy to limit visitors to the hospital during a disaster? | | | | | | |
| **13.2** Does the facility have a plan to deal with anticipated increases in visitors and curious onlookers seeking to gain entrance during disasters? | | | | | | |
| **13.3** Does the facility have a plan to include a visitor reception centre (away from the Emergency Department)? | | | | | | |
| **13.4** Have the following services been established for patient families/visitors? | | | | | | |
| Supportive counseling | | | | | | |
| Chaplaincy | | | | | | |
| Social services | | | | | | |
| Ability to locate patients within the institution | | | | | | |
| Ability to locate patients outside the institution | | | | | | |
| Security | | | | | | |
| Medical care | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **13.5** Is there a policy in place regarding disclosure of patient status? | | | | | | |
| **13.6** Is there a procedure in place to properly identify visitors upon arrival and provide them with "right to know"? | | | | | | |
| **13.7** Has a level of patient disclosure been established to provide to family/visitors? | | | | | | |
| **13.8** Has the facility established a designated spokesperson with responsibility for relaying disclosable information? | | | | | | |
| **13.9** Has the facility established: | | | | | | |
| Designated grieving areas | | | | | | |
| Designated smoking areas | | | | | | |
| Designated family briefing area | | | | | | |

## Section 14: Media

*Person Responsible for Completing Section 14:* _____

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **14.1** Does the facility's plan include a media reception centre geographically distant from patients, visitors and EOC? | | | | | | |
| **14.2** Is there a designated responsible person for the deployment and maintenance of this area? | | | | | | |
| **14.3** Does the plan include external communication capability for media personnel (cell phone compatible)? | | | | | | |
| **14.4** Does the plan include the following for media personnel? | | | | | | |
| Security | | | | | | |
| Food | | | | | | |
| Hygiene | | | | | | |
| Seating | | | | | | |
| **14.5** Does the facility have a plan to designate a separate location identified specifically for press briefings? | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **14.6** Has the facility established a designated spokesperson and alternates for information dissemination in the event of a disaster? | | | | | | |
| **14.7** Does the facility have an information release policy, including regulating the use of social media? | | | | | | |
| **14.8** Will the facility have a briefing cycle plan based on IMS? | | | | | | |
| **14.9** Have all staff been briefed on the information release policy? | | | | | | |
| **14.10** Has a coordinated network of spokespeople from responding agencies been established? | | | | | | |
| **14.11** Has a procedure been established for streaming questions to appropriate spokespeople? | | | | | | |

## Section 15: Reception of Casualties and Victims of Non-CBRNE Events

*(For CBRNE Events, See Chapter 3, Part 2: CBRNE Plan Checklist)*
*Person Responsible for Completing Section 15:* _____

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **15.1** Is there a precise plan of immediate action whereby multiple casualties can be: | | | | | | |
| Received | | | | | | |
| Identified | | | | | | |
| Triaged | | | | | | |
| Added to patient tracking system/ identification system | | | | | | |
| Treated in designated treatment areas (emergent, acute, ambulatory, palliative/ near-deceased, deceased) admitted or transferred | | | | | | |
| Transported as needed | | | | | | |
| Released conditionally with follow-up protocol | | | | | | |
| **15.2** Is there a clearly defined mechanism for notification from the scene of the event? | | | | | | |
| **15.3** Does that system have a backup in case of communications failure? | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **15.4** Is there a clearly defined mechanism for the notification to be stood down? | | | | | | |
| **15.5** Is there a clearly defined mechanism for the facility to receive regular updates from the scene of the event regarding further casualties and/or the state of the event? | | | | | | |
| **15.6** Does the disaster plan provide for: | | | | | | |
| Clearance of all non-emergency patients and visitors from the Emergency Department | | | | | | |
| Cancellation of elective admissions and elective surgeries | | | | | | |
| Determination of rapidly available or open beds | | | | | | |
| Determination of space that can be converted to patient care areas | | | | | | |
| **15.7** Do the newly deployed patient care areas have: | | | | | | |
| Beds | | | | | | |
| Medical gases | | | | | | |
| Suction | | | | | | |
| Dedicated staff | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **15.8** Does each patient location in the converted areas have a pre-defined unique identifier, which includes: | | | | | | |
| Signage | | | | | | |
| Patient transport | | | | | | |
| Specimen transport | | | | | | |
| Medication and supply transport | | | | | | |
| Communications plan for the area | | | | | | |
| Hygiene facilities | | | | | | |
| Monitoring units | | | | | | |
| Computer access | | | | | | |
| Running water | | | | | | |
| Baths/showers | | | | | | |
| Toilets | | | | | | |
| Food and drink | | | | | | |
| Telephone access | | | | | | |
| Hand washing | | | | | | |
| Waste removal | | | | | | |
| Patient privacy | | | | | | |
| **15.9** Does the plan include determination of patients who can be transferred or discharged early? | | | | | | |
| **15.10** Does the plan include immediate communication networking with: | | | | | | |
| Other healthcare facilities | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| Public health | | | | | | |
| Home care | | | | | | |
| Extended care facilities | | | | | | |
| **15.11** Is the receiving and sorting area accessible and in close proximity to the areas of the facility in which definitive care will be given? | | | | | | |
| **15.12** Is the reception area equipped with portable auxiliary power for illumination/ other electrical equipment, or can power be supplied from facility emergency power circuits? | | | | | | |
| **15.13** Does the reception area allow for retention, segregation, isolation, processing and release of incoming casualties? | | | | | | |
| **15.14** Are sufficient equipment, supplies, and apparatus available, in an organized manner, to permit prompt and efficient casualty movement? | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **15.15** Has provision been made for a large influx of casualties to include such factors as: | | | | | | |
| Bed arrangements | | | | | | |
| Patient privacy (e.g., curtains) | | | | | | |
| Personnel requirements | | | | | | |
| Extra resources (such as interpretive services, linen, pharmaceutical needs, dressings) | | | | | | |
| Access to supplemental oxygen | | | | | | |
| Access to suction | | | | | | |
| Access to monitoring units | | | | | | |
| Computer access | | | | | | |
| Running water | | | | | | |
| Baths/showers | | | | | | |
| Toilets | | | | | | |
| Food and drink | | | | | | |
| Telephone access | | | | | | |
| Hand washing/ hygiene areas | | | | | | |
| Waste removal | | | | | | |
| **15.16** Is the Health Records department organized to handle an influx of casualties? | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **15.17** Is the Admission department organized to handle an influx of casualties? | | | | | | |
| **15.18** Can your facility's computer process orders for patients not residing in traditional patient care areas? | | | | | | |
| **15.19** Is there a system for retention and safe-keeping of personal items removed from casualties? | | | | | | |
| **15.20** Is there a system for chain of custody for all personal belongings? | | | | | | |
| **15.21** Is there a system for chain of custody for forensic samples? | | | | | | |
| **15.22** Is there a system for containment/ disposal of personal items removed from casualties, if required? | | | | | | |
| **15.23** Does your facility have a memorandum of agreement (MOA) with nearby extended care facilities (ECF) or rehabilitation facilities to accept patients during a declared disaster that can be discharged early from the affected facility, but still require nursing care? | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **15.24** Does your facility have a memorandum of agreement (MOA) with outlying healthcare facilities to accept inpatients during a declared disaster? | | | | | | |
| **15.25** Are procedures established for the orderly disposition of patients to their homes, if applicable? | | | | | | |
| **15.26** Does your facility have an agreement with an Ambulance Service or medical transfer service which can transfer patients noted above out of the facility in a safe manner? | | | | | | |
| **15.27** If yes, has the agreement been verified to not include "cross committed" resources (resources allocated to other facilities simultaneously)? | | | | | | |

## Section 16: Relocation of Patients and Staff

*Person Responsible for Completing Section 16:* _____

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **16.1** Have satellite locations been pre-determined and confirmed for *patients*? | | | | | | |
| **16.2** Have satellite locations been pre-determined and confirmed for *staff*? | | | | | | |
| **16.3** Have evacuation routes been pre-determined for *patients*? | | | | | | |
| **16.4** Have evacuation routes been pre-determined for *staff*? | | | | | | |
| **16.5** Have transportation requirements been pre-designated for the movement of people? Has it been confirmed that these resources will not have another allocation during a disaster? | | | | | | |
| **16.6** Have transportation resources been identified for patients that must be moved in facility beds, on ventilators, and connected to specialized equipment? Has it been confirmed that these resources will not have another allocation during a disaster? | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **16.7** Have provision been made for the movement of patient's records and documents? | | | | | | |
| **16.8** Is there a sequence built into the plan designating priority of patients, and associated personnel (including Professional Staff), when moving to specific locations? | | | | | | |
| **16.9** In relation to question 16.8, do you have a means to communicate these plans with patients and staff? | | | | | | |
| **16.10** Has provision been made for immediate refuge, care, and comfort for the patients and staff on or near the facility grounds during inclement and winter weather? | | | | | | |

## Section 17: Facility Evacuation (External)

*Person Responsible for Completing Section 17:* _____

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **17.1** Is there an organized discharge routine to handle large numbers of patients upon short notice? | | | | | | |
| **17.2** Is there a process to manage the medical record of evacuated patients? | | | | | | |
| **17.3** Is there an individual (or position) identified to be responsible for the flow and control of patient records and documents for evacuated patients? | | | | | | |
| **17.4** Have agreements been made with other healthcare facilities for the relocation of patients should the facility be unable to support patient care? | | | | | | |
| **17.5** Have agreements been made with Ambulance Services and/or medical transfer services for the safe transfer of these patients? | | | | | | |

*(continued)*

| | | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|---|
| **17.6** | In the absence of nearby health care facilities: | | | | | | |
| **17.6.1** | Have arrangements been made with other organizations or facilities that can serve as temporary hospitals? | | | | | | |
| **17.6.2** | Are dedicated supplies and equipment available and identified for transport to a non-medical facility in order to provide interim medical care off site? | | | | | | |
| **17.6.3** | If offsite location, supplies, and equipment *are* available, is there a deployment plan to establish the off-site facility? | | | | | | |

## Section 18: Facility Out of Communication or Cutoff From Resources

*Person Responsible for Completing Section 18:* _____

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **18.1** In the event the healthcare facility is completely out of communication or cutoff from resources, has the plan assigned position holders responsible for the following: | | | | | | |
| Auxiliary power | | | | | | |
| Management of food and water | | | | | | |
| Waste and garbage disposal | | | | | | |
| Rest and rotation of staff | | | | | | |
| Management of medication and supplies | | | | | | |
| Laundry | | | | | | |
| Staff and patient support/ counseling | | | | | | |
| **18.2** Has consideration been given to utilization of patients and visitors to assist staff with duties? | | | | | | |
| **18.3** Does the facility have a plan for the deployment of volunteers (including patients/visitors)? | | | | | | |

## Section 19: Equipment, Supplies, and Pharmaceuticals

*Person Responsible for Completing Section 19:* _____

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **19.1** Does the facility have a means of real-time inventory and tracking of the following: | | | | | | |
| Ventilators (adult) | | | | | | |
| Ventilators (pediatric) | | | | | | |
| Ventilators (neonate) | | | | | | |
| IV pumps | | | | | | |
| IV poles | | | | | | |
| Suction machines | | | | | | |
| Beds | | | | | | |
| Stretchers | | | | | | |
| Wheelchairs | | | | | | |
| Body bags | | | | | | |
| **19.2** What quantity (in days) of critical supplies are kept on-hand in the facility, including: | | | | | | |
| Medications: | | | | | | |
| Antibimicrobial Agents | | | | | | |
| Cardiac Medications | | | | | | |
| Insulin | | | | | | |
| Anti-hypertensive Agents | | | | | | |
| IV fluids | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| Medical–surgical administration supplies | | | | | | |
| Linen | | | | | | |
| Food (patients/ staff) | | | | | | |
| Hand hygiene measures/ gloves | | | | | | |
| Physical plant supplies (including oil, gas, water) | | | | | | |
| Medical gases | | | | | | |
| **19.3** Are local suppliers of medications identified (including location of pharmacies)? | | | | | | |
| **19.4** Are there 24-hour contact numbers for these supplies? (*you may use table on page 90 to list supplies and suppliers*) | | | | | | |
| **19.5** Is there a plan to access additional ventilators, including: | | | | | | |
| Mobilizing ventilators from long-term care facilities/rehab clinics | | | | | | |
| Other acute care facilities regionally | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **19.6** Is there a plan to access additional supplies of pharmaceuticals, including a regional plan? | | | | | | |
| **19.7** Has consideration been given to the allocation of scarce resources in the event that demand outstrips supply? (see References) | | | | | | |
| **19.8** Does your facility have a policy in place for decision-making around allocation of scarce resources including who will be involved in the decision-making? | | | | | | |
| **19.9** Does the facility have policies or procedures in place to ensure the following *housekeeping* issues are being maintained during a disaster? | | | | | | |
| Proper stocking of food | | | | | | |
| Proper stocking of hygiene items and tissues | | | | | | |
| Proper stocking of pillows/ mattresses/ blankets | | | | | | |

| Table for 19.4 | Company Name | Emergency Phone # | Routine Phone # |
|---|---|---|---|
| Pharmaceutical supplies | | | |
| Antibimicrobial agents | | | |
| Cardiac medications | | | |
| Insulin | | | |
| Anti-hypertensive agents | | | |
| IV Fluids | | | |
| Medical–surgical administration supplies | | | |
| Linen | | | |
| Food (patients/ staff) | | | |
| Hand hygiene measures/gloves | | | |
| Physical plant supplies (including oil, gas, water) | | | |
| Medical gases | | | |

## Section 20: Diagnostic Capabilities

*Person Responsible for Completing Section 20:* _____

| | Yes (If Yes, Please Include %) | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **20.1** Do you know what percent of laboratory specimens are analyzed in-house? | | | | | | |
| **20.2** Do you know what percent of laboratory specimens are sent for analysis to public health facilities? | | | | | | |
| **20.3** Do you know what percent of laboratory specimens are analyzed by private contracted laboratories? | | | | | | |
| **20.4** Has your facility identified alternative laboratories in the event your internal laboratories are contaminated/ inundated? | | | | | | |
| **20.5** Has your facility identified alternative laboratories in the event your external laboratories are contaminated/ inundated? | | | | | | |

*(continued)*

| | Yes (If Yes, Please Include %) | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **20.6** Does your facility have procedures/ protocols in place for handling unusually high volumes of lab specimens including: | | | | | | |
| Acquisition of suspect lab specimens? | | | | | | |
| Handling and tracking of suspect lab specimens? | | | | | | |
| Transportation of suspect lab specimens? | | | | | | |
| **20.7** Are the telephone numbers for Public Health posted in your Laboratories? | | | | | | |
| **20.8** Are the telephone numbers for Public Health posted in your Emergency Department? | | | | | | |

## Section 21: Information Technology

*Person Responsible for Completing Section 21:* _____

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **21.1** Do you have information management systems that can rapidly provide the following: | | | | | | |
| Inpatient staffing levels | | | | | | |
| Facility bed availability | | | | | | |
| Diversion status of other healthcare facilities in the area or region | | | | | | |
| Bed availability of other facilities in the area or region | | | | | | |
| **21.2** Are there systems readily adaptable to function in a mass casualty situation? | | | | | | |
| **21.3** Are there effective downtime procedures in place for all patient care systems? | | | | | | |

## Section 22: Critical Incident Stress Management

*Person Responsible for Completing Section 22:* _____

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **22.1** Does your facility's training program include preparation for the emotional and mental health impacts for the following categories of individuals: | | | | | | |
| Staff/Volunteers/ Physicians | | | | | | |
| Patients/Residents | | | | | | |
| Family Members | | | | | | |
| **22.2** Does your facility have an internal messaging/"rumour control" procedure to ensure timely communication of information to internal stakeholders (e.g., patients, staff)? Does the procedure take social media into account? | | | | | | |
| **22.3** Does your facility have a Critical Incident Stress Management (CISM) Team or access to CISM capability? | | | | | | |
| **22.4** Does your facility's emergency preparedness plan address provision of the following services if staff had to return to work during a community disaster? | | | | | | |
| Day (night) care for their children | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| Day (night) care for their dependent adults | | | | | | |
| Day (night) care for their pets | | | | | | |
| Sleeping quarters | | | | | | |
| Accommodations for staff on quarantine | | | | | | |
| Nourishment | | | | | | |
| Distribution of medications/ prophylaxis | | | | | | |

## Section 23: Postdisaster Recovery

*Person Responsible for Completing Section 23:* _____

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **23.1** Does the plan designate who will be in charge of recovery operations? | | | | | | |
| **23.2** Does the plan include a declaration of initiation and termination of recovery efforts? | | | | | | |
| **23.3** Does the plan make provision for the following during recovery? | | | | | | |
| Documentation | | | | | | |
| Financial matters | | | | | | |
| Inventory and re-supply | | | | | | |
| Record preservation | | | | | | |
| Cleanup | | | | | | |
| Hazard removal and cleanup | | | | | | |
| Salvage | | | | | | |
| Garbage and waste disposal | | | | | | |
| Utility and equipment servicing | | | | | | |
| Physical plant restoration and renovation | | | | | | |
| **23.4** Does the plan address the following programs? | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| Critical Incident Stress Management (CISM) Program | | | | | | |
| Employee Assistance Program | | | | | | |
| Group/ Individual Counseling services | | | | | | |
| Family Support Program | | | | | | |
| Leaves of Absence | | | | | | |

## Section 24: Education and Training

*Person Responsible for Completing Section 24:* _____

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **24.1** Does the plan specify who is responsible for the training program? | | | | | | |
| **24.2** Does the plan include methods for initial and ongoing training for new and altered roles? | | | | | | |
| **24.3** Do the facility's departments have department-specific mandatory disaster training programs? | | | | | | |
| **24.4** Has the facility considered adapting disaster procedures for application when dealing with routine procedures so personnel can become familiar with them? | | | | | | |
| **24.5** Does the program provide disaster education material at staff orientation to facilitate staff awareness? | | | | | | |
| **24.6** Does the program provide ongoing disaster education to facilitate staff awareness and currency of procedures? | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| **24.7** Does the program have joint training sessions with external organizations that deal with common aspects of disaster response? | | | | | | |
| **24.8** Does the plan include cooperative training with the local EMS system regarding patient transfer from the pre-hospital to in-hospital setting? | | | | | | |
| **24.9** Does the facility's safety program conduct a regularly scheduled annual exercise as part of their ongoing disaster management program? | | | | | | |
| **24.10** If answer to question 24.8 is Yes, is this exercise a (*circle answer*): | | | | | | |
| Paper drill | | | | | | |
| Table top exercise | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action(s) | Person(s) Responsible |
|---|---|---|---|---|---|---|
| Facility-wide exercise with simulated patients | | | | | | |
| Community-wide exercise | | | | | | |
| **24.11** Does the exercise ensure all key participants are familiar with the contents of the plan? | | | | | | |
| **24.12** Are specific aspects of the plan tested? | | | | | | |
| **24.13** Is a formal critique performed with results distributed to all key individuals and participating groups? | | | | | | |

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Chapter 3b

# Readiness and Mitigation

## Chemical, Biological, Radiological, Nuclear, and Explosive Plan Checklist

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*Chemical, Biological, Radiological, Nuclear and Explosive (CBRNE) disaster plans can only function within the context of a general disaster plan. As such, this checklist is an appendix to the General Readiness Checklist and should only be used in conjunction with that document.*

# Preface

Directions for the use of this tool are the same as outlined in Chapter 3a, "Readiness and Mitigation Part One: General Planning and Readiness Tool."

Assessment items should be answered as follows: Y = yes; N = no; N/A = not applicable; U = unsure (for every "U," the facility must identify someone who will clarify the response) In some cases, numerical information was felt to be more useful.

The majority of the questions are in the yes/no/not applicable format. Although it is assumed that a "yes" answer means that the issue raised by the question has been addressed, the converse is not true. A "no" or "N/A" answer may mean that the facility has a gap in its readiness or it may be that the answer was a product of an active decision. This chapter is not meant to be proscriptive but rather one that is thought-provoking and generates discussion.

In making CBRNE preparations, facilities must consider key assumptions regarding communication, resources, and victims. When developing plans, facilities should anticipate the following:

- Victims will arrive with little or no warning to the facility.
- Information regarding the hazardous agent(s) will not be available immediately.
- A large number of victims will be self-referred (as many as 80% of the total number of victims).
- Victims will not necessarily have been decontaminated before arriving at the facility.
- A high percentage of people arriving at the facility may have little or no actual exposure and this eventuality should be considered in decontamination plans.
- Most victims will go to the healthcare facility closest to the site where the emergency occurred.
- Victims will attempt to use other entrances in addition to the emergency department (ED).

This checklist is a tool that does not stand alone but should be used in conjunction with the "General Planning and Readiness Tool" as well as Chapter 12 in this book, dealing with contaminated disasters.

## Definitions

**CBRNE:** A chemical, biological, radiological, nuclear, or explosive event.

**Dirty Bomb:** A mix of explosives, such as dynamite, with radioactive powder or pellets. When the dynamite or other explosives are set off, the blast carries the radioactive material into the surrounding area. (http:/www.bt.cdc.gov/radiation/dirtybombs.asp)

**Incident Command System (ICS) or Incident Management System (IMS):** A command and control system used by the military, fire fighters, and other agencies to manage critical incidents such as large fires or natural disasters.

**Hospital Emergency Incident Command System:** The ICS as adapted to hospitals. This is sometimes abbreviated HEICS.

**Nuclear Incident:** An incident whereby individuals are exposed to or contaminated with nuclear material. It is also used to describe the detonation of a nuclear device.

**Radiological Incident:** An incident whereby individuals are exposed to ionizing radiation, not exposed to or contaminated with nuclear material itself.

**Surge Capacity:** The ability to quickly, and with little warning, increase the capacity to respond to an incident; in the case of healthcare facilities, this refers to increase in capacity to care for patients.

**Internal Disaster:** An event occurring within a facility affecting the ability of the facility to provide care to its usual capacity.

**External Disaster:** An event occurring outside the facility, which overwhelms the capacity of the facility to safely care for victims.

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## CBRNE PLAN CHECKLIST

### A Template for Healthcare Facilities

Name of Healthcare Facility:_____

Facility Address:_____

_____

Name and Title of Person(s) Completing Form: _____

_____

_____

Contact Information:

Phone: ( )_____ Pager: ( )_____

Fax: ( )_____ Email:_____

| Sections | Person(s) Responsible |
|---|---|
| Section 1: Foundational Considerations | |
| Section 2: Planning | |
| Section 3: Training and Awareness | |
| Section 4: Procedures | |
| Section 5: Module for Preparing for a Biological Incident | |
| Section 6: Module for Preparing for a Chemical Incident | |
| Section 7: Module for a Radiological or Nuclear Incident | |

## Section 1: Foundational Considerations

(See also Chapter 3—Readiness and Mitigation Part 1: General Planning and Readiness Tool)

*Person Responsible for Completing Section Section 1:* _____

| | Yes | No | N/A | U | Required Action (s) | Person Responsible |
|---|---|---|---|---|---|---|
| **1.1** Has a risk assessment been performed that specifically considers CBRNE incidents? | | | | | | |
| **1.2** Does the facility disaster plan include specific consideration of CBRNE incidents? | | | | | | |
| **1.3** Is there a CBRNE planning committee? | | | | | | |
| **1.4** Is there currently a collaborative relationship with the local Emergency Response Agencies and Public Health regarding CBRNE incidents? | | | | | | |
| **1.5** Does the plan detail actions to be taken for both internal and external disasters? | | | | | | |
| **1.6** Does the CBRNE plan detail how it links with local Emergency Response Agencies? | | | | | | |
| **1.7** Is the plan widely distributed and readily available throughout the hospital/healthcare facility? (Distribution should include hard copies of the plan and an automated method that is readily available to all staff members) | | | | | | |

*(continued)*

| | | Yes | No | N/A | U | Required Action (s) | Person Responsible |
|---|---|---|---|---|---|---|---|
| 1.9 | Does your hospital's CBRNE preparedness plan address requesting appropriate local, provincial, or federal resources for assistance? | | | | | | |
| 1.9 | Does the plan specify the number and location of isolation or protective environment rooms? | | | | | | |
| 1.9.1 | Are these locations clearly identified in a document readily available to the disaster coordinator or command team? | | | | | | |
| 1.9.2 | Are isolation facilities monitored to ensure adequate airflow? | | | | | | |

## Section 2: Planning

*Person Responsible for Completing Section 2:*_____

| | Yes | No | N/A | U | Required Action (s) | Person Responsible |
|---|---|---|---|---|---|---|
| **2.1** Does your facility have a coordinator designated to oversee all CBRNE preparedness efforts? | | | | | | |
| **2.2** Does your facility have a medical director who oversees all training and preparedness efforts as it relates to your facility's CBRNE preparedness efforts? | | | | | | |

## Section 3: Training and Awareness

*Person Responsible for Completing Section 3:*_____

| | Yes | No | N/A | U | Required Action (s) | Person Responsible |
|---|---|---|---|---|---|---|
| **3.1** Does every person working in your facility know how to identify signs and symptoms of exposure to CBRNE agents? | | | | | | |
| **3.2** Does every person working in the facility know whom to contact internally upon identification of exposure/ symptoms related to CBRNE agents? | | | | | | |
| **3.3** Is there specific ongoing training for personnel assigned to the facility's CBRNE response? | | | | | | |
| **3.4** Does your facility plan include identification of roles and responsibilities specific to a CBRN event, to include: | | | | | | |
| Security | | | | | | |
| Identification, chain of custody, and storage of contaminated items | | | | | | |
| Analysis of contaminated specimens | | | | | | |
| Transport of contaminated items | | | | | | |
| Transport of contaminated deceased persons | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action (s) | Person Responsible |
|---|---|---|---|---|---|---|
| Triage personnel | | | | | | |
| Decontamination team | | | | | | |
| Patient care teams | | | | | | |
| **3.5** Does your facility's plan identify positions/ individuals to fill roles/responsibilities required for CBRNE response? | | | | | | |
| **3.6** Does every person who is part of the CBRNE response team know where the equipment is / how to access it? | | | | | | |
| **3.7** Have all members of the CBRNE response team including Emergency Department (ED) personnel been trained in CBRNE Preparedness? | | | | | | |

## Section 4: Procedures

*Person Responsible for Completing Section 4:*_____

| | Yes | No | N/A | U | Required Action (s) | Person Responsible |
|---|---|---|---|---|---|---|
| **4.1** Has a method of communication been developed which allows staff to communicate easily with each other with and without PPE? | | | | | | |
| **4.2** Has a method of communication been developed that will allow staff to communicate while wearing PPE with a large number of people simultaneously? | | | | | | |
| **4.3** Does the facility currently have a baseline established for numbers of patients seen in the facility Emergency Department, outpatient clinics, or via direct admission, stratified according to clinical symptoms? | | | | | | |
| **4.4** Is there a process available to gather and evaluate clinical information when conducting surveillance for a disease secondary to a CBRNE emergency? | | | | | | |
| **4.5** Does your agency have an internal 24/7 Point of Contact (POC) for *CBRNE* incidents? | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action (s) | Person Responsible |
|---|---|---|---|---|---|---|
| **4.6** If the *CBRNE* event was *criminal*, is there a procedure in place to collect and protect evidence? | | | | | | |
| **4.7** Does your agency have procedures to receive patients who are exposed to CBRNE agents and require medical care? | | | | | | |
| **4.8** Is there a plan to segregate/isolate disaster victims from the rest of the hospital if those victims are contaminated? (e.g., hazardous materials) | | | | | | |
| **4.9** Is there a separate entry to the Emergency Department for contaminated patients, if necessary? | | | | | | |
| **4.10** Is there a dedicated facility, area, or portable device for decontamination, if necessary? | | | | | | |
| **4.11** Has staff assigned to prepare the facility/portable device for use been trained on how to do this? | | | | | | |
| **4.12** Does the dedicated decontamination area have a "hot" and "cold" zone? | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action (s) | Person Responsible |
|---|---|---|---|---|---|---|
| **4.13** Is there a hot and cold water supply to the decontamination area? | | | | | | |
| **4.14** Is the decontamination area separate (i.e., outside) from the Emergency Department? | | | | | | |
| **4.15** Can water run-off from the decontamination area be contained? | | | | | | |
| **4.16** Is the necessary equipment readily available to the ED staff? | | | | | | |
| **4.17** Can the ventilation system in the ED be isolated from the rest of the facility, if necessary? | | | | | | |
| **4.18** Does the facility have the ability to shut down air intakes? | | | | | | |
| **4.19** Have arrangements been made for police or other appropriate support in maintaining order in the vicinity of the facility, including control of vehicular and pedestrian traffic adjacent to the decontamination site? | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action (s) | Person Responsible |
|---|---|---|---|---|---|---|
| **4.20** Are there standard orders developed for various defined CBRNE events? | | | | | | |
| **4.21** Does your agency have access to dosage requirements for antidotes and therapies for patients (adults and pediatric) who are exposed to CBRNE agents? | | | | | | |
| **4.22** Is the necessary drug administering equipment available for the on-hand quantities of antidotes and therapies? | | | | | | |
| **4.23** Does your agency have a staff member designated to accept deliveries from the National Pharmaceutical Stockpile in the event of a CBRNE event? | | | | | | |
| **4.24** Has your facility ascertained the regulatory requirements for PPE for employees in the workplace in this type of incident? | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action (s) | Person Responsible |
|---|---|---|---|---|---|---|
| **4.25** Have PPE requirements been identified for each group below? | | | | | | |
| Decontamination team | | | | | | |
| Triage | | | | | | |
| Caregivers (MD, RN, RT, etc.) | | | | | | |
| Support staff/ Maintenance | | | | | | |
| Administration | | | | | | |
| Suppliers | | | | | | |
| Patients/visitors | | | | | | |

## Section 5: Module for Preparing for a Biological Incident

*Person Responsible for Completing Section 5:*_____

| | Yes | No | N/A | U | Required Action (s) | Person Responsible |
|---|---|---|---|---|---|---|
| **5.1** In addition to Class A agents (see Appendix A), the range of significant, reportable infections varies with time. It is important to maintain current knowledge of relevant infections. For all Class A agents, as a minimum, does your hospital have policies and procedures for: | | | | | | |
| Clinical presentation | | | | | | |
| Laboratory diagnosis | | | | | | |
| Infection control procedures | | | | | | |
| Treatment | | | | | | |
| Prophylaxis | | | | | | |
| Vaccination, and | | | | | | |
| Public health requirements | | | | | | |
| **5.2** Do you train staff in these policies and procedures? | | | | | | |
| **5.3** Have all clinical staff and physicians been trained to recognize the signs and symptoms of Class A agents? | | | | | | |
| **5.4** In the event of a Class A agent being identified, is there a process to advise Public Health Authorities? | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action (s) | Person Responsible |
|---|---|---|---|---|---|---|
| **5.5** Are the facility's policies and procedures congruent with the local Public Health Unit and mutually supportive? | | | | | | |
| **5.6** Is there a process to rapidly follow up on all abnormal or unusual laboratory results from samples collected in your facility? | | | | | | |
| **5.7** Is there a process for timely notification of infection control? | | | | | | |
| **5.8** Does your facility's emergency preparedness plan address stockpiling medications necessary for response to biologic incidents? | | | | | | |
| **5.9** Does your facility's emergency preparedness plan address stockpiling supplies? | | | | | | |
| **5.10** Does your healthcare facility currently maintain a separate stockpile of medications to treat or prophylaxes facility staff in the event of a biological incident? | | | | | | |
| **5.11** Does your facility have a plan to access the following government stockpiles if required? | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action (s) | Person Responsible |
|---|---|---|---|---|---|---|
| Municipal | | | | | | |
| Regional | | | | | | |
| Provincial/ National | | | | | | |
| **5.12** Which of the following medications are stockpiled in the facility? | | | | | | |
| Doxycycline | | | | | | |
| Tetracycline | | | | | | |
| Ciprofloxacin | | | | | | |
| Levofloxacin | | | | | | |
| Oseltamivir | | | | | | |
| Zanamivir | | | | | | |
| Penicillin | | | | | | |
| **5.13** Does your facility have a plan to access *C. botulinum* antitoxin? | | | | | | |
| **5.14** Does your healthcare facility vaccinate staff/ physicians annually against influenza? | | | | | | |
| **5.15** Does your facility have a plan for mass vaccination of staff and physicians if required after a biologic incident? | | | | | | |
| **5.16** Does your facility have a plan for mass prophylaxis of staff and physicians if required after a biologic incident? | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action (s) | Person Responsible |
|---|---|---|---|---|---|---|
| **5.17** Does your facility have an internal surveillance system in place that identifies abnormal patterns of specific syndromes, including: | | | | | | |
| Gastrointestinal Illness | | | | | | |
| Influenza-Like Illness Monitoring | | | | | | |
| Febrile respiratory Illness | | | | | | |
| Increased Use of Specific Antibiotics | | | | | | |
| **5.18** Can your Emergency Department identify trends and changes in frequency of specific discharge diagnoses? | | | | | | |
| **5.19** Is there a policy that identifies when the Emergency Department should notify any/all of the following in the event of unusual clusters of illnesses or unusual presentations? | | | | | | |
| Hospital infection control personnel | | | | | | |
| Other designated in-house personnel | | | | | | |
| Local Public Health Authority | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action (s) | Person Responsible |
|---|---|---|---|---|---|---|
| Provincial Health Agency | | | | | | |
| **5.20** Does your facility have a plan to test for biologic agents 24 hours a day/7 days per week if needed? | | | | | | |
| **5.21** Does your laboratory have the ability to process, or appropriately refer specimens from patients suspected to have any of the following: | | | | | | |
| Anthrax | | | | | | |
| Plague | | | | | | |
| Smallpox | | | | | | |
| Brucellosis | | | | | | |
| Botulism | | | | | | |
| Ricin toxicity | | | | | | |
| Tularemia | | | | | | |
| SARS | | | | | | |
| Viral Hemorrhagic fever | | | | | | |
| Unknown agent | | | | | | |
| **5.22** The highest Biosafety Level capacity of your in-patient laboratory is (*Yes or No*): | | | | | | |
| BSL 1 | | | | | | |
| BSL 2 | | | | | | |
| BLS 3 | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action (s) | Person Responsible |
|---|---|---|---|---|---|---|
| **5.23** Does your facility have protocols and procedures for processing potentially highly infectious specimens, which address the following: | | | | | | |
| Collection | | | | | | |
| Labelling | | | | | | |
| Chain of custody | | | | | | |
| Secure Storage | | | | | | |
| Processing | | | | | | |
| Transportation to a secondary laboratory | | | | | | |
| Referral to Public Health Laboratory | | | | | | |
| Use of Personal Protective Clothing | | | | | | |
| Contacting local law enforcement | | | | | | |
| Decontamination of biohazardous waste | | | | | | |
| Safe disposal of waste | | | | | | |
| **5.24** Does your healthcare facility's emergency preparedness plan address mass casualty incidents involving biological agents? | | | | | | |
| **5.25** Does your facility have a plan to provide pharmacy services 24 hours a day/7 days per week if needed? | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action (s) | Person Responsible |
|---|---|---|---|---|---|---|
| **5.26** Does your pharmacy have a protocol to identify increased consumption of: | | | | | | |
| Antidiarrheals | | | | | | |
| Antibiotics | | | | | | |
| Antivirals | | | | | | |
| **5.27** Does your pharmacy have a protocol to report increased consumption of: | | | | | | |
| Antidiarrheals | | | | | | |
| Antibiotics | | | | | | |
| Antivirals | | | | | | |
| **5.28** Does your facility have an ongoing fit testing program for those staff that require respiratory protection? | | | | | | |
| **5.29** Does your facility have a supply of PPE on-site and available (*as per the guidelines of your local Health Authority*) including: | | | | | | |
| Head covering | | | | | | |
| Gowns | | | | | | |
| Aprons | | | | | | |
| Gloves | | | | | | |
| Eye protection (goggles, face shields) | | | | | | |
| Respiratory protection (Masks, Respirators [N95 or equivalent]) | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action (s) | Person Responsible |
|---|---|---|---|---|---|---|
| **5.30** Does your facility have a plan to obtain additional PPE if required (*as per the guidelines of your local Health Authority*) including: | | | | | | |
| Head covering | | | | | | |
| Gowns | | | | | | |
| Aprons | | | | | | |
| Gloves | | | | | | |
| Eye protection (goggles, face shields) | | | | | | |
| Respiratory protection (Masks, Respirators [N95 or equivalent]) | | | | | | |
| **5.31** Does the facility have a policy & procedure for managing deceased persons who have died from biologic agents? | | | | | | |

## Section 6: Module for Preparing for a Chemical Incident

*Person Responsible for Completing Section 6:* _____

| | Yes | No | N/A | U | Required Action (s) | Person Responsible |
|---|---|---|---|---|---|---|
| **6.1** Does your hospital have policies and procedures that address the Clinical Presentation, Laboratory Diagnosis, Infection Control Procedures, Treatment, Prophylaxis, Vaccination, and Public Health Requirements for each of the following agents? | | | | | | |
| Nerve gases (e.g., Sarin, Tabun, Soman, VX) | | | | | | |
| Pesticides | | | | | | |
| Blood agent (e.g., Cyanides) | | | | | | |
| Vesicants (e.g., Sulfur Mustard, Lewisite, Phosgene) | | | | | | |
| Pulmonary agents (e.g., chlorine, phosgene, diphosgene, ammonia) | | | | | | |
| Riot control agents (e.g., tear gas, vomiting gas, pepper spray) | | | | | | |
| **6.2** Does your facility have immediate access to the following antidotes/ prophylactics as required in the context of the hazard assessment? | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action (s) | Person Responsible |
|---|---|---|---|---|---|---|
| Atropine | | | | | | |
| Pralidoxime (2 PAM) or equivalent | | | | | | |
| Diazepam | | | | | | |
| Tropicamide (Mydriacyl) | | | | | | |
| Pyridostigmine (for pre-treatment) | | | | | | |
| Cyanide antidote kit (including amyl nitrite, sodium nitrite, and sodium thiosulfate) | | | | | | |
| Dimercaprol (antidote to Lewisite) | | | | | | |
| Acetylcysteine aerosol (antidote against phosgene; effective in animal studies) | | | | | | |
| Other—Please specify | | | | | | |
| **6.3** Does your facility have access to a stockpile of the following antidotes/ prophylactics as required in the context of the hazard assessment? | | | | | | |
| Atropine | | | | | | |
| Pralidoxime (2 PAM) or equivalent | | | | | | |
| Diazepam | | | | | | |
| Tropicamide (Mydriacyl) | | | | | | |
| Pyridostigmine (for pre-treatment) | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action (s) | Person Responsible |
|---|---|---|---|---|---|---|
| Cyanide antidote kit (including amyl nitrite, sodium nitrite, and sodium thiosulfate) | | | | | | |
| Dimercaprol (antidote to Lewisite) | | | | | | |
| Acetylcysteine aerosol (antidote against phosgene; effective in animal studies) | | | | | | |
| Other—Please specify | | | | | | |
| **6.4** Is there a defined mechanism for rapid access to the stockpile? | | | | | | |
| **6.5** Is there provision for tracking antidote inventories? | | | | | | |
| **6.6** Is there provision for maintaining antidote inventories? | | | | | | |
| **6.7** Is there a plan for containment and remediation in the event of contamination reaching designated clean areas? | | | | | | |
| **6.8** Does the facility have equipment for monitoring chemical contamination? | | | | | | |
| **6.9** Is there a specific policy that addresses the issue of decontaminating pregnant patients? | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action (s) | Person Responsible |
|---|---|---|---|---|---|---|
| **6.10** Are there sufficient chemically resistant/vapour-tight plastic bags and containers for waste? | | | | | | |
| **6.11** Does the facility have the appropriate respirators on site subject to regulatory requirements, including: | | | | | | |
| Supplied air respirators (full mask and airline from hospital air system) | | | | | | |
| Powered air chemical cartridge air purifying respirators | | | | | | |
| Native pressure chemical cartridge air purifying respirators | | | | | | |
| **6.12** Does the facility have the appropriate protective clothing on site based on risk assessment and regulatory requirements? | | | | | | |
| **6.13** Has staff been trained in the use of this equipment? | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action (s) | Person Responsible |
|---|---|---|---|---|---|---|
| **6.14** Does the facility have a plan to respond to an internal chemical release? | | | | | | |
| **6.15** Does the plan involve an internal response team? | | | | | | |
| **6.16** Does the facility have a procedure for accessing assistance from trained responders, e.g., hazmat team with higher level PPE, if an internal event occurs? | | | | | | |
| **6.17** Is there a respiratory protection program in place? | | | | | | |
| **6.18** Does this program include regular respirator fit testing if required? | | | | | | |
| **6.19** Is there provision for tracking PPE inventories? | | | | | | |
| **6.20** Is required size distribution regularly updated based on personnel requirements? | | | | | | |
| **6.21** Does the facility have a procedure for handling chemically contaminated deceased persons? | | | | | | |

## Section 7: Module for a Radiological or Nuclear Incident

*Person Responsible for Completing Section 7:*_____

| | Yes | No | N/A | U | Required Action (s) | Person Responsible |
|---|---|---|---|---|---|---|
| **7.1** Does the facility have a Radiation Safety officer? | | | | | | |
| **7.2** Does the facility have a plan for an Internal Radiation incident? | | | | | | |
| **7.3** Does the facility have a plan to manage victims from a radiological event? | | | | | | |
| **7.4** Does your plan include identification of irradiated victims vs. patients contaminated with a radioactive material? | | | | | | |
| **7.5** Does your facility have a process to provide emergency resuscitative care to potentially radiologically contaminated patients? | | | | | | |
| **7.6** Is there an acute care evaluation and treatment protocol for radiation victims? | | | | | | |
| **7.7** Is there a specific policy that excludes pregnant women from decontaminating/ treating potentially radiologically contaminated patients? | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action (s) | Person Responsible |
|---|---|---|---|---|---|---|
| **7.8** Does the facility have a radiation detection instrumentation to measure radioactive contamination on a patient? | | | | | | |
| **7.9** Do a sufficient number of staff know how to use the instruments and interpret the data? | | | | | | |
| **7.10** Is there a plan to document the radiation monitoring results for patients? | | | | | | |
| **7.11** Are there sufficient dosimeters on site for those staff responsible for decontaminating patients and caring for patients who may have ingested or inhaled radioactive materials? | | | | | | |
| **7.12** Is there a program for monitoring the dosimeters? | | | | | | |
| **7.13** Is there a contact list for all facility radiation experts, including Radiation Safety Officer, Nuclear Medicine Specialist, and Radiation Oncology Staff, and Radiologists? | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action (s) | Person Responsible |
|---|---|---|---|---|---|---|
| **7.14** Is there a contact list for radiation experts external to the facility? Including but not limited to: | | | | | | |
| Regional nuclear facility | | | | | | |
| Regional designated radiation treatment facilities | | | | | | |
| Relevant government organizations | | | | | | |
| Local universities | | | | | | |
| Other – Please specify | | | | | | |
| **7.15** Are these contact lists readily available to the front-line receivers? | | | | | | |
| **7.16** Does the facility have the appropriate protective clothing on site based on risk assessment and regulatory requirements? For example: | | | | | | |
| Tyvek suits | | | | | | |
| Head covering | | | | | | |
| Respiratory protection | | | | | | |
| Eye protections | | | | | | |
| Boots/shoe covers | | | | | | |
| Plastic gloves | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action (s) | Person Responsible |
|---|---|---|---|---|---|---|
| **7.17** Are there sufficient anti-emetics available (based on risk assessment?) including: | | | | | | |
| Ondansetron | | | | | | |
| Granisetron | | | | | | |
| Other 5HT3 Receptor Antagonists | | | | | | |
| **7.18** Are there sufficient anti-diarrheal agents available (based on risk assessment?) including: | | | | | | |
| Loperamide HCI | | | | | | |
| Diphenoxylate/ atropine | | | | | | |
| **7.19** Is there sufficient Potassium iodide (KI) available for immediate administration to large numbers of individuals? | | | | | | |
| **7.20** Are there sufficient supplies to maintain fluid and electrolyte balance for severely affected victims? | | | | | | |
| **7.21** Are there sufficient plastic bags and containers for waste? | | | | | | |
| **7.22** Is there an area/ room that is lead lined or concrete that could be used for storing contaminated clothing and waste? | | | | | | |

*(continued)*

| | Yes | No | N/A | U | Required Action (s) | Person Responsible |
|---|---|---|---|---|---|---|
| **7.23** Are there sufficient urine containers to collect 24-hour urine for measurement of radioactivity? | | | | | | |
| **7.24** Are there sufficient containers to collect feces for measurement of radioactivity? | | | | | | |
| **7.25** Has arrangement been made for safe transportation of potentially contaminated specimens within the facility? | | | | | | |
| **7.26** Is there an arrangement with appropriate laboratory facilities for specimen analysis? | | | | | | |
| **7.27** Has a method of communication been developed which allows staff to communicate easily with each other with and without PPE? | | | | | | |
| **7.28** Is there a provision for mitigation, in the event of a breach in the decontamination process? | | | | | | |

# Appendix A – Categories of Biological Agents

**Categories of Biological Agents as designated by the US CDC and the Public Health Agency of Canada:**

## 1. Category A Diseases/Agents

The public health system and primary healthcare providers must be prepared to address various biological agents, including pathogens that are rarely seen in North America. High-priority agents include organisms that pose a risk to national security because they

- can be easily disseminated or transmitted from person to person;
- result in high mortality rates and have the potential for major public health impact;
- might cause public panic and social disruption; and
- require special action for public health preparedness.

### Category A agents include:

- Anthrax
- Plague
- Smallpox
- Botulism
- Viral hemorrhagic fevers (filoviruses [e.g., Ebola, Marburg] and arenaviruses [e.g., Lassa, Machupo])
- Tularemia

## 2. Category B Diseases/Agents

Second highest priority agents include those that

- are moderately easy to disseminate;
- result in moderate morbidity rates and low mortality rates; and
- require specific enhancements of CDC's diagnostic capacity and enhanced disease surveillance.

### Category B agents include:

- Brucellosis (Brucella species)
- Epsilon toxin of *Clostridium perfringens*
- **Food safety threat** (e.g., Salmonella species, Escherichia coli O157:H7, Shigella)

- Glanders (*Burkholderia mallei*)
- Melioidosis (*Burkholderia pseudomallei*)
- Psittacosis (*Chlamydia psittaci*)
- *Q fever* (*Coxiella burnetii*)
- *Ricin toxin from Ricinus communis* (castor beans)
- Staphylococcal enterotoxin B
- Typhus fever (*Rickettsia prowazekii*)
- Viral encephalitis (alphaviruses [e.g., Venezuelan equine encephalitis, eastern equine encephalitis, western equine encephalitis])
- Water safety threats (e.g., *Vibrio cholerae, Cryptosporidium parvum*)

### 3. Category C Diseases/Agents

Third highest priority agents include emerging pathogens that could be engineered for mass dissemination in the future because of

- availability;
- ease of production and dissemination; and
- potential for high morbidity and mortality rates and major health impact.

These include:

- Emerging infectious diseases such as Nipah virus and hantavirus.

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Chapter 4

# IMS and Communications*

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# Preface

The most critical aspect of any disaster is the coordination of resources and of responders. Because of the involvement of multiple agencies and because disasters have no limitation of jurisdiction, it is important that the response command and control structure be standardized. The gold standard for this response is the Incident Management System (IMS) that has become the de facto standard for disaster response in North America and in many other places across the globe. This chapter outlines the rationale and history behind IMS and the IMS response structure.

Of note to European readers, the British "Major Incident Medical Management & Support" (published by the Bay Group) is a UK course that, while covering some similar content, is focused primarily on prehospital and first receivers. IMS, as outlined in this chapter, is focused on healthcare facilities.

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# Incident Management System

Organized command and control is critical in responding to any emergency. Incident Management System (IMS), also known as Incident Command System, is a method of organizing a disaster response. In November 2004, the National Framework for Health Emergency Management concluded that the adoption of IMS by hospitals to structure their response was a significant priority.[1] IMS has been widely adopted by many North American emergency and disaster response agencies,[2,3] including most Canadian police, fire and emergency medical services (EMS) first responders. However, although most communities have successfully implemented IMS in their emergency services sector, many have difficulty integrating it into their healthcare systems.

IMS was developed to address the difficulties managing California wildfires during the 1970s.[4] Prior to IMS, multiagency responses were plagued by interagency communication breakdowns, disparate terminology, uncoordinated efforts, lack of response scalability, and ill-defined command structures.

The key attributes of IMS are described below[3] and the basic structure is outlined in Figure 4-1.

- *Common terminology*: This allows parties from multiple organizations to work together and understand each other. It is worth noting that no common terminology exists for either the healthcare or public health sectors to deal with disasters.
- *Modular organization*: Four separate sections (operations, planning, logistics, and administration/finance), along with possible subsections, are deployed as needed.
- *Scalable responses*: This system allows the response to easily be scaled to deal with any size of crisis while maintaining the same basic organizational structure. Figures 4-2a, 4-2b, and 4-2c provide an example of the scalability of IMS during an event. Each figure has an explanation of the scenario and the responses.
- *Unity of command*: A clear chain of command is established whereby each individual within an organization reports to only 1 designated person. Although this chain of command is key to IMS, this "top down" structure is foreign to healthcare culture and can present a roadblock to implementing this system.
- *Unified command structure*: Each incident must be coordinated by a sole incident commander (IC) regardless of the number of agencies involved in the response. Several agencies or departments can still be represented at the command post and work together to coordinate the response.

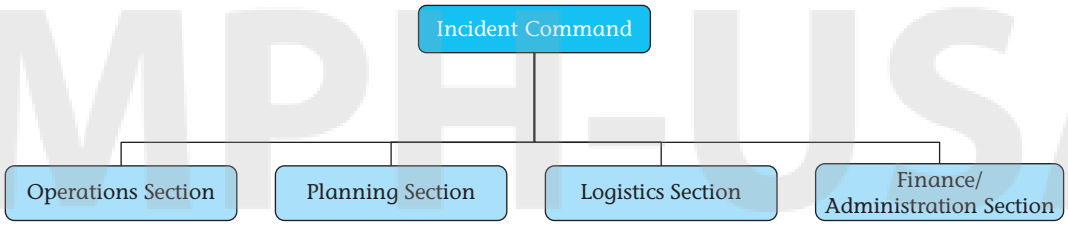



**Figure 4-1: Basic IMS structure.**

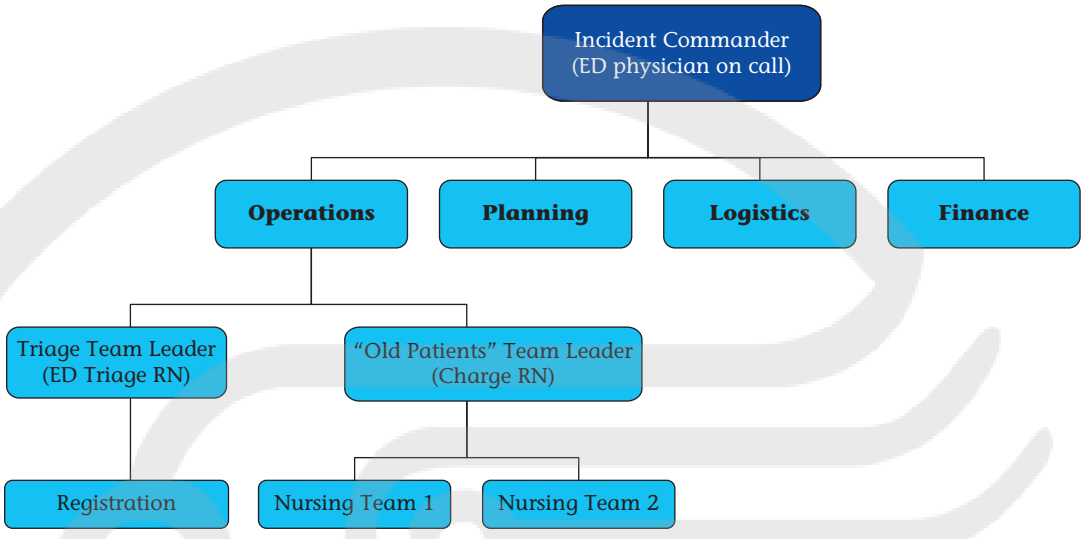



**Figure 4-2a: Example of deployment of an IMS-based response: Beginning of the incident and activation of IMS. ED = Emergency Department; RN = Registered Nurse.**

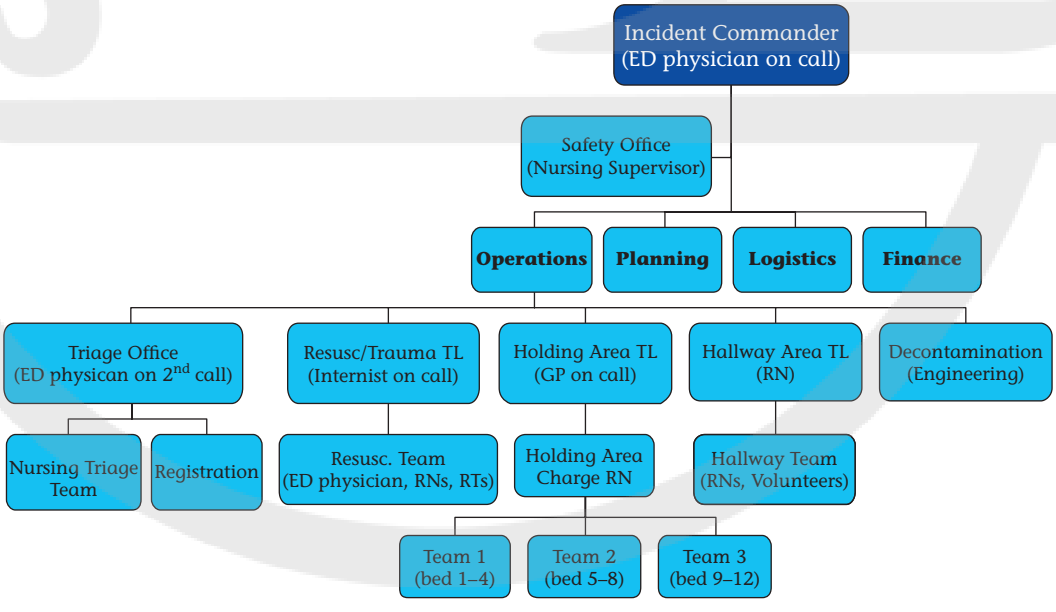



**Figure 4-2b: Example of deployment of an IMS-based response: Emergency Operations Center (EOC) opens. Resusc. = Resuscitation; GP = General Practitioner; TL = Team Leader; RTs = Respiratory therapists.**

- *Consolidated Incident Action Plans (IAPs)*: IAPs are brief written plans, developed by the Incident Commander (IC) or planning chief, defining the response goals, operational objectives, and support activities for a specified time period of 8–24 hours. This allows documentation of the decision-making process and facilitates sign over when there is a change of command. A sample IAP is in Appendix A.
- *Job action sheets*: These are brief job descriptions that are distributed when a response is initiated. They outline immediate and short-term actions created

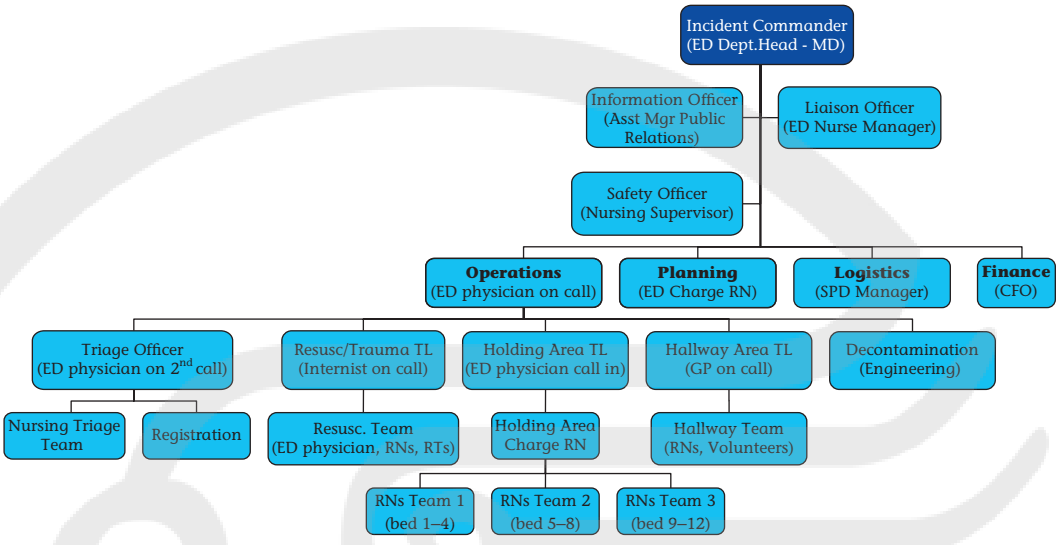



**Figure 4-2c: Example of deployment of an IMS-based response: EOC; phase 2.**

in advance for the common roles in most responses allowing anyone to fill a position. This offers significant flexibility and redundancy should the primary responders, who would typically fill a role, be unavailable for any reason. Sample job action sheets can be found in Appendix C.

- *Operating cycle*: The time period between the meetings of the Emergency Operations Center (EOC). This will determine the duration of plans, briefing cycle of staff, and so on. Initially the cycles tend to be shorter and, as the situation stabilizes, the meetings are spaced further apart.
- *Manageable span of control*: This defines the number of people who can be effectively managed by 1 person during a crisis and typically ranges between 3–7 people, with the ideal being 5.
- *Comprehensive resource management*: IMS prescribes the manner in which resources are used in an attempt to ensure their use is maximized, the communication load is minimized, accountability is ensured, freelancing is reduced, and the safety of the personnel involved is ensured. On the basis of the operational goals, response teams are developed, often involving people from different fields working together outside of their traditional organizational structure on a common task.

"Walking wounded" patients have just begun to arrive from a chemical explosion. Six patients have arrived at the emergency department (ED) and tell of a major explosion with building collapse.

The ED activates its incident command system (IMS) with the ED physicians on call initially assuming the lead. He/she/they also manage the operations/planning/logistic roles until support arrives:

- The triage nurse starts to triage patients
- The ED charge nurse begins to identify patients who may be suitable for discharge

- The ED physician on call asks that both the hospital's chemical response plan be initiated and a Code Orange* (disaster) be declared

Extra support will soon arrive from other staff currently in the hospital and those subsequently being called in. The charge nurse will start to identify patients whose visit is not related to the explosion and who may be ready for discharge. (*Note:* This is an example of how a hospital might respond to an external disaster. Although the structure remains the same, who and how various IMS roles are fulfilled will vary from event to event and from hospital to hospital.)

With the declaration of a Code Orange, the administrators open the EOC to provide support for the IC and deal with other operations at the hospital as follows:

- The Executive Emergency Control Group (EECG) arrive in the EOC. The EECG not only provide support to the IC but also consider issues related to the ongoing function of the entire hospital (operational continuity)
- The EOC begins to lay out its operating cycle
- As more staff arrive, key roles are filled and resources (i.e., staff) are redeployed to areas as needed
- The IC continues to oversee operations, planning, and logistics for the present time
- All other areas (i.e., laboratory, radiology, operating rooms, and intensive care unit) activate their emergency protocols and their own IMS as needed
- The surgeon and anaesthetist on call will participate in the trauma team but not lead, because they have to be free to take patients to the operating room
- Upon the arrival of the head of the ED, the ED physician on call takes over operations after briefing the ED department head.
- As other personnel arrive, the positions of information officer, liaison officer, planning, and logistics are staffed.

The staff are doing well with large volumes of patients, and there is a clear chain of command with a good flow of communication. The holding area, with fully monitored beds, is acting as an overflow for seriously injured patients, until they can be transported to the operating room or intensive care unit or transferred to other hospitals.

As the incident enters the recovery phase, the structure will begin to contract.

Without IMS implementation, disaster response inevitably become chaotic and inefficient, potentially contributing to more loss of life and property damage. Specifically, IMS corrects the following problems inherent in disaster response:

- Lack of accountability—particularly an unclear chain of command (To whom do I report?)

*A variety of hospital codes have been defined, each with a formalized response and each with its own colour. "Code Orange" is a disaster code.

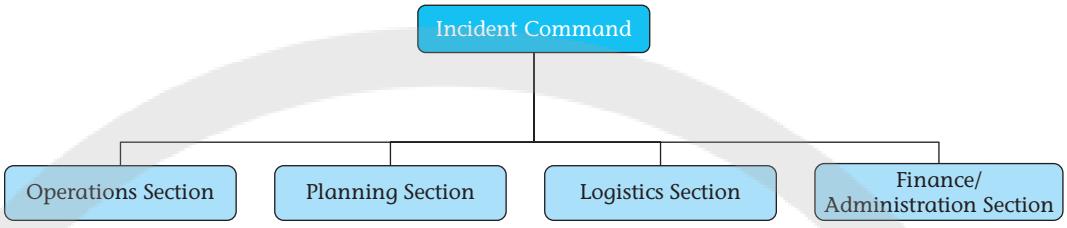
- Poor communication—especially conflicting terminology and slang among various responders (What does "10-7" mean?) and inefficient use of communications systems (Who is talking to whom?)
- Lack of an effective, integrated planning process
- Lack of a common, scalable management system that permits commanders to delegate various tasks, allowing manageable workloads for each responder (and the commander)
- Lack of a methodology for integrating multiple agencies and jurisdictions into an efficient, accepted management structure

The advantages of the IMS are its flexibility, scalability, and the fact that IMS is objective oriented. Because individual action sheets are based upon operational objectives, it allows the response to be dynamic and will still allow an organized response even when no preexisting plan exists or for problems that were never anticipated. The IMS works well both for small, circumscribed emergencies as well as large, multijurisdictional complex disasters. The first responder arriving on scene becomes the IC until such time as someone more experienced arrives. For a small emergency situation, the IC may be the only element of the IMS activated. That 1 person would be able to manage the situation on his own. However, as the emergency becomes larger and more complex, the IC will inevitably need assistance to manage the response. Major incidents should prompt the deployment of an EOC (see below) where the EECG, led by the Chief Executive Officer (CEO), will support the IC, coordinate responses if multiple incidents are involved, and maintain all other operations of the organization that are not directly related to the incident. Each incident should be defined by a single geographic location or other characteristic and should have its own commander.

## Management Positions

IMS contains multiple sections that can be activated if necessary. As mentioned earlier, the 5 major management positions of the IMS are[5] (see Figure 4-1):

- *Incident Command*: The person who determines the incident objectives, strategies, and priorities and has overall responsibility for the scene. This is the only position in IMS that is always filled.
- *Operations* (the "Doers"): The person who conducts tactical operations to reach the incident objectives. He or she chooses tactics and controls all operational resources.
- *Planning* (the "Thinkers"): The person who supports the incident action planning process by tracking resources, collecting/analyzing information, and maintaining documentation.
- *Logistics* (the "Getters"): The person in charge of providing resources and needed services to support the achievement of the incident objectives.
- *Finance/Administration* (the "Payers"): The person in charge of monitoring costs related to the incident. He or she provides accounting, procurement, time recording, and cost analyses.




## Command Staff

The IC may appoint a *Command Staff* who report to him/her (in addition to the Section Chiefs).The Command Staff includes a Safety Officer, a Public Information Officer (PIO), and a Liaison Officer (Figure 4-3). The job descriptions for these individuals are as follows[5]:

- *PIO*: The person who serves as the spokesperson to relay factual information to internal and external stakeholders, including the media or other organizations seeking information directly from the incident.
- *Safety Officer*: The person who monitors safety conditions and develops measures for assuring the safety of all incident-related personnel. The Safety Officer is the only person who can overrule the IC at the scene in the case of an unsafe situation.
- *Liaison Officer*: The person who serves as the primary contact for supporting agencies assisting at an incident.

The expanded IMS line diagram including Section Chiefs and Command Staff is shown in Figure 4-3.[5]

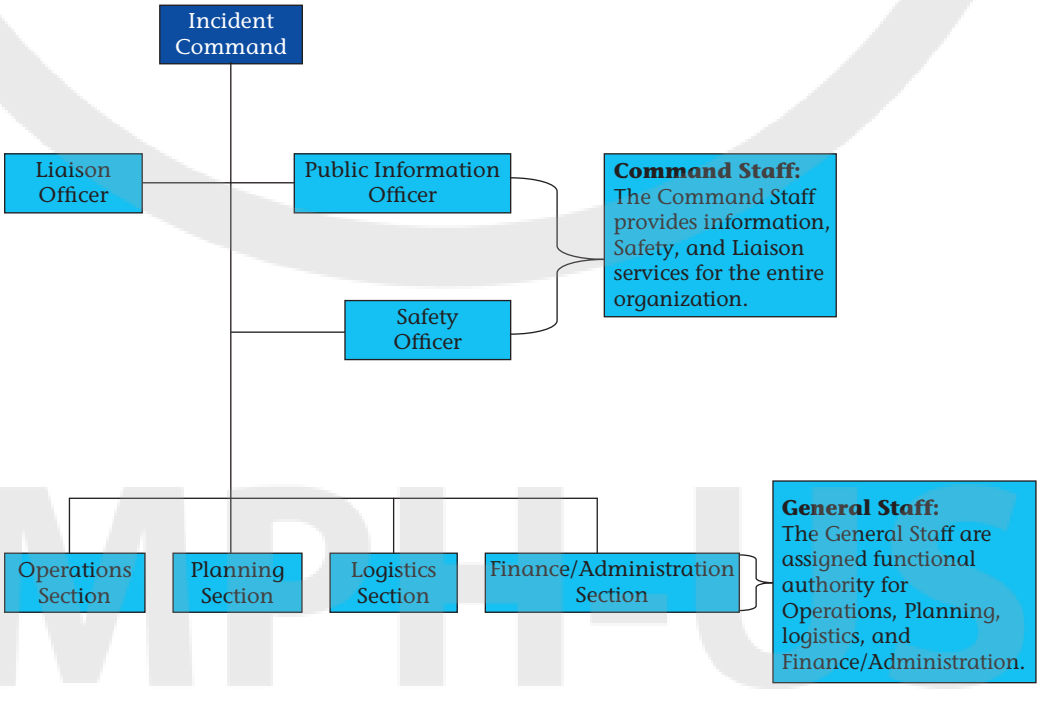



**Figure 4-3: IMS structure with Command Staff (expanded).**

## Titles

Titles for each position are standardized to prevent confusion[5] (summarized in Table 4-1) as follows:

- *Sections*: The organizational levels with responsibility for a major functional area of the incident (e.g., operations, planning, logistics, and finance/administration). The person in charge of each Section is called a *Chief*.
- *Branches*: Used when the number of Divisions or Groups exceeds the span of control. It can be either geographical or functional. The person in charge of each Branch is called the *Director*.
- *Divisions*: Used to divide an incident geographically. The person in charge of each Division is called the *Supervisor*.
- *Groups*: Used to describe functional areas of operations. The person in charge of each Group is called the *Supervisor*.
- *Task Forces*: A combination of mixed resources with common communications operating under the direct supervision of a person called the *Task Force Leader*.
- *Strike Teams*: A set of number of resources of the same kind and type with common communications operating under the direct supervision of a person called the *Strike Team Leader*.
- *Single Resources*: May be individuals, a piece of equipment and its personnel complement, or a crew or team of individuals with an identified supervisor who can be used at a scene.

It is critical that the designations for the leaders and sectors of IMS be standardized to allow ease and efficiency of communication.

### Table 4-1[5] IMS Organizational Levels and Titles

| Organizational Level | Title | Support Position |
|---|---|---|
| **Incident command** | Incident commander | Deputy |
| **Command staff** | Officer | Assistant |
| **General staff (sections)** | Chief | Deputy |
| **Branch** | Director | Deputy |
| **Division** | Supervisor | N/A |
| **Group** | Supervisor | N/A |
| **Strike Team/Task Force** | Leader | Single resource boss |

## The Span of Control

Other positions may open up in the IMS structure as the IC determines the need. The decision when to open up new positions is determined by the principle of *span of control*, as mentioned earlier. Each person in the IMS can have between 3 and 7 persons reporting directly to him/her, the ideal number being 5. When

more than 7 people are down line of a given supervisor, another sector of the IMS must be created with a new supervisor to avoid violating span of control. Similarly, remember that "unity of command" dictates that each person at the scene reports to *1 and only 1 person* above him or her. It is unacceptable in the IMS for someone who reports to the Operations Chief to go around him/her and report directly to the IC—this violates unity of command.

Although span of control is a good reason to open up multiple branches and divisions, there are other reasons as well, such as incidents that require multiple agencies, ones that are multijurisdictional, and very large, complex incidents. In each of these cases, the various Section Chiefs may open up multiple branches and divisions to meet the needs of the disaster response. This is graphically illustrated in Figure 4-4.

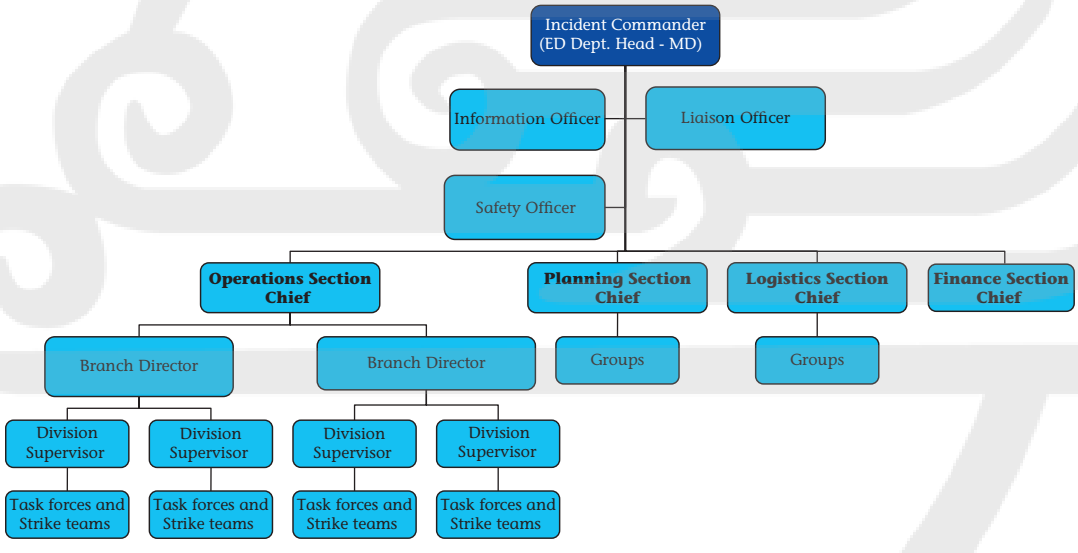



**Figure 4-4: The IMS fully deployed.**

**As an incident requires a more complex response, the IMS structure can expand unlimitedly to maintain an appropriate span of control for each supervisor. The information, liaison, and safety officers report directly to the IC but do not supervise the section chiefs. For complex incidents, an EOC should be organized to support the IC, coordinate multiple incidents, and interface with other agencies, organizations, or levels of government. The EOC is also responsible for maintaining the ongoing function of all other areas of the organization not directly involved in the incident.**

## EOC

In order to display a disaster response, using IMS or not, one needs a command Center. This is the EOC.

The EOC is the physical location at which the coordination of information and resources to support domestic incident management activities normally takes place. An EOC may be a temporary facility or may be located in a more central or permanently established facility, perhaps at a higher level of organization within a jurisdiction. Using an IMS structure, the EOCs may be organized by major functional disciplines (e.g., fire, law enforcement, and medical services), by jurisdiction (e.g., federal, provincial, regional, city, etc.), or some combination thereof.[6]

The use of EOCs is a standard practice in emergency management and is one type of multiagency coordinating entity. The EOC should be activated as part of the disaster plan.

An EOC needs to be in a defined location with a backup location available in case the disaster renders the primary location unavailable. The location needs to have an adequate infrastructure, providing shelter, communication capability, and keeping supplies available for clerical function (notepads, pencils, pens, tables, chairs, etc.). People who are participants in the EOC should have vests (or other appropriate methods) that identify them, so they can be easily located and their role clearly understood. Likewise, organizations and IMS branches occupying desks at the EOC should have their role clearly defined. The EOC should have the capability of closing itself to the public and media so as to allow the staff to work uninterrupted. A briefing area for media is useful but need not be (and is perhaps best not) near the EOC. If the EOC is also used as the Incident Command Post (ICP)—where the IC operates—then a separate area, which is physically isolated to prevent distraction, should be provided for the IC and his/her command staff to work. Within a hospital or other organization, it is common for the ICP and EECG to share an EOC. However, for mobile first responders (such as EMS or Fire Departments), it is most common to set up an ICP in proximity to the site of a disaster and the EOC in a central administrative area such as City Hall.

Within the framework of IMS, the size and complexity of any EOC will depend on the size and complexity of both the organization and the complexity and duration of the event. The level of EOC staffing will also vary with the specific emergency situation.

The EOC deployment plan must include an organizational chart with the IMS roles, the people fulfilling each of these roles, and a backup person in the event that they are unavailable. This chart needs to be available with all EOC members. An example of this is available in Appendix A under the heading of IAPs.

Appendix D shows an example of an emergency operation center (EOC) from Phoenix, Arizona. Note that the finance section is called Administration on this map.

# IMS Structure in Detail

## Operations

Remember that Operations carries out the day-to-day tactical field operations required under the IAP (that is why they are sometimes called the "Doers"). In a large, complex incident, the Operations Chief may have an organizational chart as shown in Figure 4-5.

Beneath the groups shown above, there might be multiple Task Forces, Strike Teams, and Single Resource units depending on the needs of the given situation.

## Planning

The Planning Section (the "Thinkers") has authority for the development of the *IAP*. Action plans or IAPs are written or verbal plans that reflect the overall incident goal (control objectives) and incident strategy, objectives for the designated operational period, specific tactical actions and assignments, and

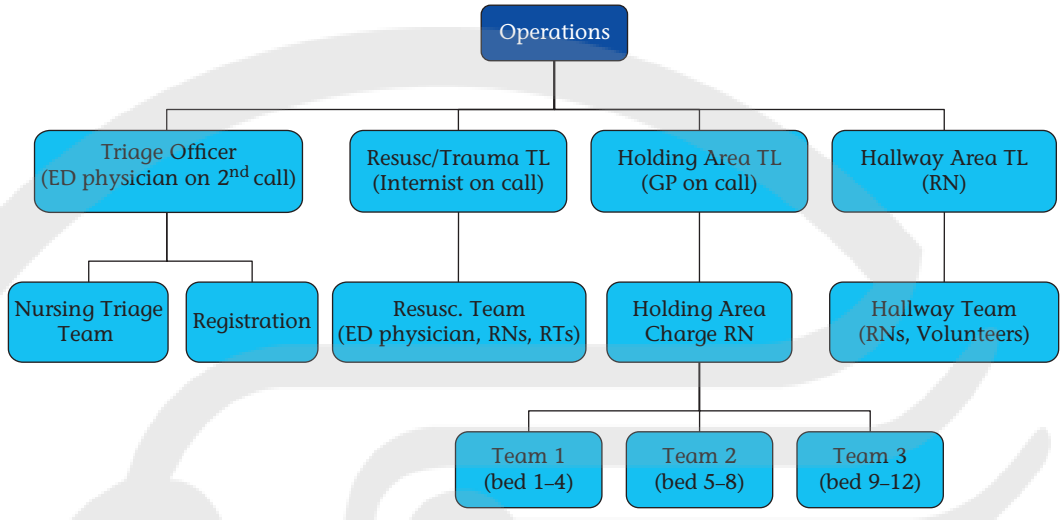



**Figure 4-5: IMS Operations Section (expanded).**

supporting information for the designated operational period. They provide designated personnel with the knowledge of the objectives to be achieved and the strategy and steps to be used for achievement, hence improving coordination across different levels of government and intrastate jurisdictional borders. Action plans not only provide direction, but also provide a metric for measuring achievement of objectives and overall system performance.

In large incidents, this would be a written document, whereas in small incidents, it would most likely be discussed verbally with the IC and other Section Chiefs, especially Operations. To assist in planning, there exist various software and technological tools to help develop the IAPs.

In addition to the IAP, the Planning Chief and his/her section do the following[5]:

- Collecting, evaluating, and displaying incident intelligence and information
- Conducting long-range and/or contingency planning
- Developing plans for demobilization
- Maintaining incident documentation
- Tracking resources assigned to the incident

A fully activated Planning Section can include 4 different units as well as Technical Specialists as shown in Figure 4-6.

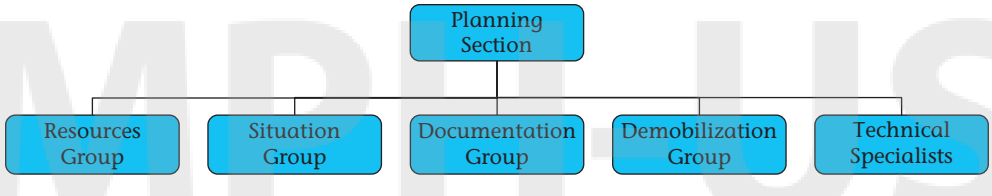



**Figure 4-6: Planning Section (expanded).**

The 4 units noted earlier serve the following roles[5]:

- *Resources group*: Carries out all check-in activities, maintains the status of all incident resources, and plays a significant role in preparing the written IAP.
- *Situation group*: Collects and analyzes information on the current situation, prepares situation displays and situation summaries, and develops maps and projections—the situation report (sit-rep) people.
- *Documentation group*: Provides photocopying (including the written IAP) and maintains/archives all incident-related documentation.
- *Demobilization group*: Assists releasing resources from the incident in an orderly, safe, and cost-effective manner. Note that demobilization planning should begin as soon as the Incident Command is stood up.
- *Technical specialists*: Specific content or skill experts.

## Logistics

The Logistics Section is sometimes called the "Getters." With the input of the Planning Chief, they are responsible for the following[5]:

- Ordering, getting, and maintaining necessary personnel, equipment, and supplies
- Communications planning and resources
- Providing food services
- Providing necessary incident facilities (e.g., linens)
- Providing required transportation
- Providing medical resources to response personnel—so-called "force protection"

Depending on the size and complexity of the disaster, the Logistics Section can be subdivided into 2 branches and 6 units as shown in Figure 4-7.

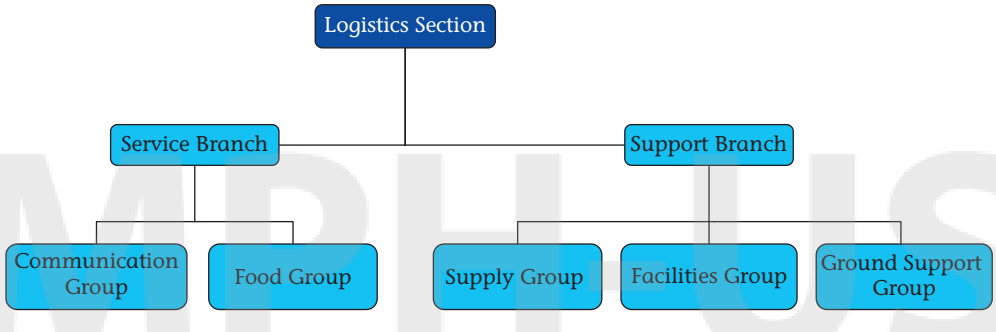



**Figure 4-7: Logistics Section (expanded).**

The groups have the following tasks[5]:

- *Communication group*: Prepares and implements the Incident Communication Plan, distributes and maintains communications equipment, supervises the Incident Communications Center, and establishes adequate communications over the incident.
- *Food group*: Responsible for providing meals and drinking water for incident personnel and obtains the necessary equipment and supplies to operate food service facilities at Bases and Camps.
- *Supply group*: Determines the type and amount of supplies needed to support the incident. The group orders, receives, stores, and distributes supplies and services nonexpendable equipment. All resource orders are placed through the Supply Unit. The unit maintains inventory and accountability of supplies and equipment.
- *Facilities group*: Sets up and maintains incident facilities and provides managers for the Incident Base and Camps. Also responsible for facility security and facility maintenance services such as sanitation, lighting, and cleanup. In a surge capacity expansion, the facilities group may set up additional treatment areas (see Chapter "Surge Capacity").
- *Ground Support group*: Prepares the Transportation Plan. Arranges for, activates, and documents the fueling and maintenance of assigned ground transportation. Arranges for the transportation of personnel, supplies, food, and equipment. May be involved in transporting patients from the facility to alternate care areas or bringing in staff.

## Finance/Administration

A benefit of IMS is that it incorporates often overlooked actions such as the documentation of financial costs and decision-making processes. Moreover, the collection of the information required to plan and document the incident also readily facilitates quality review and research that can help to improve future responses or produce "real-time" data for modifying the current response. An example would be an outbreak of a novel infectious agent where clinical trials are conducted as the outbreak evolves. These trials could help to define what treatments are effective.

Finally, the Finance/Administration Section (the "Payers") serves the following purposes[5]:

- Contract negotiation and monitoring
- Timekeeping
- Cost analysis
- Compensation for injury or damage to property

Under the direction of the Finance/Administration Chief, a fully functional Section looks like as shown in Figure 4-8.

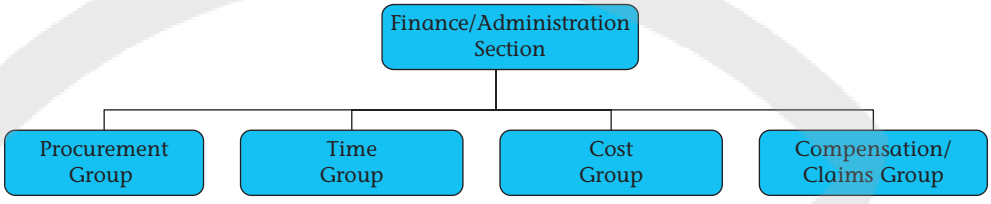



**Figure 4-8: Finance/Administration Section (expanded).**

The units depicted earlier serve the following purposes[5]:

- *Procurement group*: Administers all financial matters including vendor contracts, leases, and fiscal agreements.
- *Time group*: Logs incident personnel time recording.
- *Cost group*: Collects cost data, does cost effectiveness analyses, provides cost estimates, and recommends cost savings.
- *Compensation/Claims group*: Does the overall management and direction of administrative matters regarding compensation for injury and claims related activities kept for the incident.

## Hospital Emergency Incident Command System

For purposes of completeness, the authors should mention that a specific adaptation of IMS has been developed for hospital use in the United States—not surprisingly called the Hospital Incident Command System (HICS) or Hospital Emergency Incident Command System (HEICS). A line diagram for HICS appears in Figure 4-9.

The HEICS was developed to facilitate the uptake of IMS by health organizations.[3,7,8] HEICS is a substantially modified version of IMS that more closely resembles hospital organizational structure. Although this makes it easier for healthcare administrators to identify with, it reduces the flexibility of the system, fails to encourage an objective-driven response, and relies upon specific people to fill specific roles, thus leaving the response vulnerable, if these people are unavailable. Furthermore, organizational discrepancies between HEICS and traditional IMS can impede communication between outside agencies and the hospital, one of the key issues IMS was developed to address. Canadian hospitals that have adopted HEICS may find it prudent to shift to a more traditional IMS model to maintain consistency with emergency services and other organizations that have followed the National Framework and have adopted a traditional IMS model.[1]

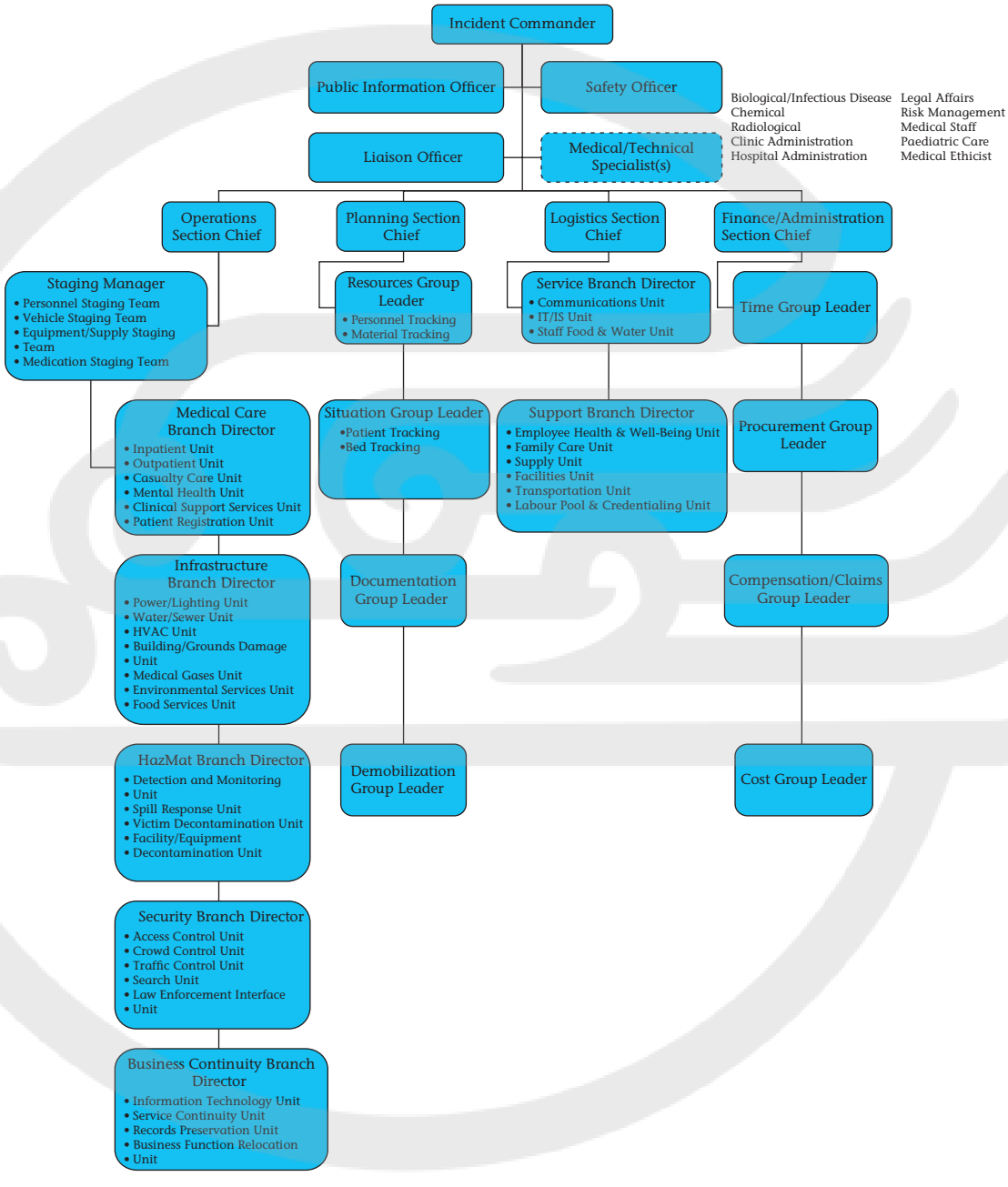



**Figure 4-9: The Hospital Incident Command System.[8]**

## Preparedness

The chapter would not be complete without a few words on the preparedness content in which IMS exists. Preparedness encompasses planning, training, equipping, and exercises. Although most, if not all, healthcare facilities in Canada have a disaster plan, in many cases, these plans are not up-to-date[4] and do not incorporate IMS. Often hospital emergency plans are static documents that are only reviewed every few years before accreditation; they should actually

be "living documents" that are reviewed at least every 6 months and after any internal or external event. Exercises should be done at least once yearly, either in a "table-top" or full-scale format, depending on resources. All staff should receive at least a basic orientation to the plan and IMS. When IMS is used, the emergency plan itself should include the following:

- how the plan is activated and by whom
- who will be notified upon activation and what information should be provided to them
- roles and responsibilities for each position
- members of the Emergency Control Group and who will be responsible for operating the EOC
- criteria for the establishment and role of the EOC
- how the IC will be assigned
- emergency public information plan
- contingency plans and mutual aid agreements
- resource lists
- who can stand down the emergency plan

During emergencies, healthcare facilities are often reluctant to activate their emergency plan. This can compromise emergency responses; therefore, clear criteria should be included in the plan to describe when and under what circumstances it should be activated. IMS-based emergency plans can even be used for "small" emergencies such as power outages or burst pipes. The full IMS need not be activated for these, only the components that are relevant. In this way, plans can be "exercised" in real time and updated in preparation for more disruptive disaster situations. Teamwork training, although not a traditional component of emergency preparedness, is important given that well-functioning teams are essential for a successful response during an emergency.

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# Appendix A – Sample IAP Forms

*Note that the specific sections (other than IMS) may need to be modified to fit individual situations and facilities.*

| INCIDENT OBJECTIVES | | |
|---|---|---|
| 1. INCIDENT NAME | | |
| 2. DATE PREPARED | | |
| 3. TIME PREPARED | | |
| 4. OPERATIONAL PERIOD (DATE/TIME): | | |
| 5. GENERAL OBJECTIVES FOR THE INCIDENT (AND ALTERNATIVES): | | |
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| 6. WEATHER FORECAST FOR OPERATIONAL PERIOD: | | |
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| 7. GENERAL SAFETY MESSAGE: | | |
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| | | |
| 8. ATTACHMENTS (CHECK IF ATTACHED) | | |
| ☐ ORGANIZATION CONTACT LIST | ☐ EXTERNAL CONTACT LIST | |
| ☐ ASSIGNMENT LIST | ☐ CHART _____ | |
| ☐ COMMUNICATIONS PLAN | ☐ INCIDENT MAP _____ | |
| ☐ OTHER _____ | | |
| IMS 202 | PREPARED BY: | APPROVED BY: |

| ORGANIZATION LIST | | | |
|---|---|---|---|
| 1. INCIDENT NAME | 2. DATE PREPARED | 3. TIME PREPARED | |
| POSITION NAME<br>5. INCIDENT COMMAND AND STAFF | | 4. OPERATIONAL PERIOD (DATE/ TIME) | |
| INCIDENT COMMAND | | 10. OPERATIONS SECTION | |
| DEPUTY | | CHIEF | |
| SAFETY OFFICER | | DEPUTY | |
| INFORMATION OFFICER | | STAGING AREA | |
| LIAISON OFFICER | | LABOR POOL | |
| 6. AGENCY REPRESENTATIVES | | a. BUSINESS CONTINUITY BRANCH | |
| AGENCY | NAME | DIRECTOR | |
| | | SERVICE ACCESS | |
| | | RECORD PRESERVATION | |
| | | BUSINESS RELOCATION | |
| 7. PLANNING SECTION | | b. PLANT & UTILITIES BRANCH | |
| CHIEF | | DIRECTOR | |
| DEPUTY | | TELECOMMUNICATIONS | |
| RESOURCES UNIT | | PATIENT CARE SYSTEMS | |
| SITUATION UNIT | | POWER/LIGHT | |
| DOCUMENTATION UNIT | | HEATING/COOLING | |
| DEMOBILIZATION UNIT | | WATER/SEWER | |
| 8. LOGISTICS SECTION | | BUILDINGS/ROADS | |
| CHIEF | | c. SAFETY & SECURITY BRANCH | |
| DEPUTY | | DIRECTOR | |
| | | ALERTING/WARNING | |
| a. SUPPORT BRANCH | | HAZMAT CONTROL | |
| SUPPLY UNIT | | FIRE SUPPRESSION | |
| FACILITIES UNIT | | SEARCH AND RESCUE | |
| TRANSPORTATION UNIT | | SECURITY | |
| b. SERVICE BRANCH | | d. HUMAN SERVICES BRANCH | |
| COMMUNICATION UNIT | | DIRECTOR | |
| FOOD UNIT | | MEDICAL CARE | |
| MEDICAL UNIT | | PATIENT RELOCATIONS | |
| 9. FINANCE SECTION | | SHELTERING | |
| TIME UNIT | | OUTREACH/HOME HLTH | |
| COST UNIT | | MENTAL HEALTH | |
| PROCUREMENT UNIT | | ENVIRONMENTAL HEALTH | |
| COMPENSATION/CLAIMS | | FATALITIES MGMT | |

| ASSIGNMENT LIST | | | | | |
|---|---|---|---|---|---|
| 1. SECTION/BRANCH: | | | | | |
| 2. GROUP/UNIT: | | | | | |
| 3. INCIDENT NAME | | | | | |
| 4. OPERATIONAL PERIOD (DATE/TIME)<br>OPERATIONS CHIEF_____ BRANCH DIRECTOR _____<br>DEPUTY CHIEF _____ GROUP SUPERVISOR _____ | | | | | |
| 5. OPERATIONS PERSONNEL | | | | | |
| 6. RESOURCES ASSIGNED THIS PERIOD | | | | | |
| RESOURCE DESIGNATOR: | LEADER | NUMBER PERSONS | TRANSPORT NEEDED? | COMMO TYPE/ CHANNEL | LOCATION |
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| 7. TACTICAL OPERATIONS: | | | | | |
| 8. SPECIAL INSTRUCTIONS: | | | | | |

| INCIDENT BRIEFING | |
|---|---|
| 1. INCIDENT NAME | |
| 2. DATE PREPARED | |
| 3. TIME PREPARED | |
| 4. MAP SKETCH | |
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| PAGE _____ | PREPARED BY: |
| 5. SUMMARY OF CURRENT ACTIVITIES | |
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| GENERAL MESSAGE | | |
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| TO: | POSITION: | |
| FROM: | POSITION: | |
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| MESSAGE: | | |
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| DATE: | TIME: | SIGNATURE/POSITION: |
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| GROUP/UNIT LOG | | |
|---|---|---|
| 1. INCIDENT NAME | | |
| 2. DATE PREPARED | | |
| 3. TIME PREPARED | | |
| 4. UNIT NAME/DESIGNATOR: | | |
| 5. UNIT LEADER (NAME/POSITION): | | |
| 6. OPERATIONAL PERIOD: | | |
| PERSONNEL ASSIGNED TO UNIT THIS PERIOD | | |
| NAME | IMS POSITION | NON-INCIDENT POSITION |
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| ACTIVITY LOG (CONTINUE ON REVERSE) | |
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| TIME | MAJOR EVENTS |
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# Appendix B – Command Contact List

| COMMAND CONTACT LIST | | | |
|---|---|---|---|
| | **TELEPHONE #** | **PAGER #** | **CELLULAR #** |
| President/CEO | | | |
| Leader on-call | | | |
| Leader, Emergency Preparedness | | | |
| Leader, Security, Fire & Safety | | | |
| Emergency Department, Physician Leader | | | |
| Site Leader | | | |
| Chief of Professional Practice and Nursing | | | |
| Leader Plant Services | | | |
| Director of Infection Control/Facility Epidemiologist | | | |
| Chief of Microbiology/ Laboratory Medical Director | | | |
| Chief of Medical Staff | | | |
| Risk Manager | | | |
| Department Chiefs | | | |
| Communications | | | |
| Information Services | | | |
| Security | | | |
| Director of Pharmacy | | | |
| Critical Incident Stress Management | | | |
| Social Services | | | |
| Ethics Officer | | | |
| Clergy | | | |
| Public Health | | | |
| Fire Services | | | |

| | | | |
|---|---|---|---|
| Ambulance and Pre-hospital Services | | | |
| Police Services | | | |
| Provincial Laboratories | | | |
| Local Emergency management agency | | | |
| Other Local Healthcare Facilities | | | |
| Coroner's Services | | | |
| Funeral Homes | | | |
| Regional Health Authorities | | | |
| Provincial Health Authorities (MOH, etc) | | | |
| Poison Control | | | |
| Ambulance Dispatch/ Communications Center | | | |
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# Appendix C – Sample Job Action Sheets

**SAMPLE JOB ACTION SHEET** *(from the New York City Department of Health and Mental Hygiene (DOHMH))*

## JOB ACTION SHEET

Section: Surveillance & Epidemiology

Title: Supervisor of Case Investigators

Name: _____

Reports to: Borough Coordinator

Mission: Supervise case investigators

Immediate: *Responsibilities and actions that need to be done first*

- ❑ Read this job action sheet
- ❑ Liaise with hospitals to assure surveillance cooperation
- ❑ Assists case investigators in the hospitals/facilities
- ❑ Assist case investigators with transfer of data from field to data unit

Intermediate: *Responsibilities and actions that need to be addressed after immediate responsibilities have been completed.*

- ❑ Provide supervisory support to case investigators
- ❑ Inform borough coordinator of supplies/resources needed
- ❑ Update borough coordinator on field activities

Long-Term: *Responsibilities and actions that need to be addressed when an emergency is controlled.*

- ❑ Participates in post-event debriefing
- ❑ Participate in routine unit meetings
- ❑ Make recommendations for future surveillance

Job Action Sheet Date of Completion: _____

**SAMPLE JOB ACTION SHEET** *(from the New York City Department of Health and Mental Hygiene (DOHMH))*

## JOB ACTION SHEET

Section: Surveillance & Epidemiology

Title: Case Investigator for Field Surveillance

Name: _____

Reports to: Supervisor of Case Investigators

Mission: Conduct field surveillance

Immediate: *Responsibilities and actions that need to be done first.*

- ❑ Read this job action sheet
- ❑ Review case investigation forms
- ❑ Obtain hospital assignments
- ❑ Conduct hospital surveillance for new cases (via emergency room, hospital admission unit, laboratory, infection control)
- ❑ Perform chart abstractions using standardized form
- ❑ Interview patients using standardized form
- ❑ Conduct contact tracing
- ❑ Collect data and submit forms to supervisor

Intermediate: *Responsibilities and actions that need to be addressed after immediate responsibilities have been completed.*

- ❑ Update supervisor on field activities
- ❑ Inform supervisor of supplies/resources needed

Long-Term: *Responsibilities and actions that need to be addressed when an emergency is controlled.*

- ❑ Participates in post-event debriefing
- ❑ Make recommendations for future surveillance

Job Action Sheet Date of Completion: _____

**SAMPLE JOB ACTION SHEET** *(from the New York City Department of Health and Mental Hygiene (DOHMH))*

## JOB ACTION SHEET

Section: Surveillance & Epidemiology

Title: Active Telephone Surveillance

Name: _____

Reports to: Co-Leader Field Surveillance

Mission: Perform active telephone surveillance and hospital notification

Immediate: *Responsibilities and actions that need to be done first.*

- ❑ Read this job action sheet
- ❑ Review case ascertainment forms
- ❑ Obtain hospital/facility assignments
- ❑ Call hospital/facility to inform staff of the event
- ❑ Conduct telephone surveillance to ascertain new cases (emergency dept.)
- ❑ Inform epidemiology unit of possible case

Intermediate: *Responsibilities and actions that need to be addressed after immediate responsibilities have been completed.*

- ❑ Conduct telephone surveillance targeting specific hospital staff (infection control, ICU)
- ❑ Collect and update hospital staff contact information
- ❑ Submit completed telephone surveillance forms
- ❑ Make call-backs to hospitals/facilities

Long-Term: *Responsibilities and actions that need to be addressed when an* emergency is controlled.

- ❑ Participate in post-event debriefing
- ❑ Develop recommendations for future telephone surveillance

Job Action Sheet Date of Completion: _____

**SAMPLE JOB ACTION SHEET** *(from the New York City Department of Health and Mental Hygiene (DOHMH))*

## JOB ACTION SHEET

Section: Surveillance & Epidemiology

Title: Clerical Support

Name: _____

Reports to: Unit Leader Field Surveillance

Mission: Provide clerical support to Field Surveillance Unit

Immediate: *Responsibilities and actions that need to be done first.*

- ❑ Read this job action sheet
- ❑ Notify and schedule field staff
- ❑ Maintain database to track time and location of staff in the field
- ❑ Maintain phone communication for field surveillance
- ❑ Liaise with operations unit for supplies and transportation

Intermediate: Responsibilities and actions that need to be addressed after immediate responsibilities have been completed.

- ❑ Xerox forms and instructions for staff
- ❑ Type and fax needed material
- ❑ Assure timecards are accurately submitted

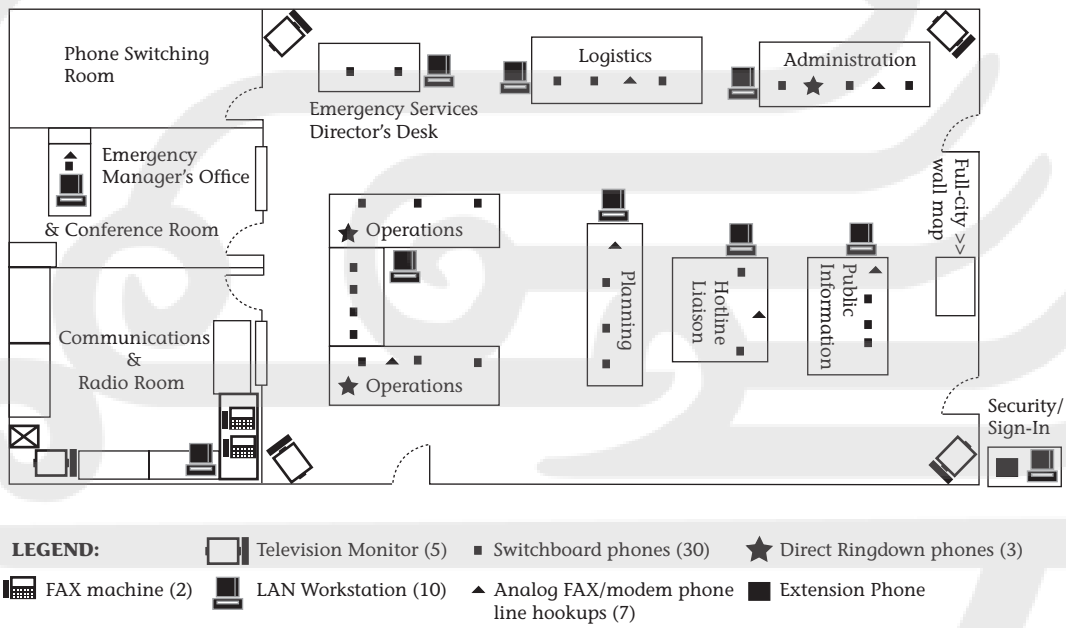
Long-Term: *Responsibilities and actions that need to be addressed when an emergency is controlled.*

- ❑ Participates in post-event debriefing
- ❑ Type and distribute reports
- ❑ Update field surveillance staff contact information
- ❑ Make recommendations for future surveillance

Job Action Sheet Date of Completion: _____

# Appendix D – Example of an EOC Layout

Example of an EOC[9]



# Chapter 5

# Triage

By David G.C. McCann, BSc, MD, MPH, CCFP, FAASFP
Joshua T. Bezanson, MS, BJourn, EMT-A
Daniel Kollek, MD, CCFP(EM)

# Preface

Triage is the emergent medical practice of sorting injuries and casualties into an order of care that will provide the maximum benefit for the largest number of patients. In mass casualty events or sudden surge situations, the standard triage performed by most emergency departments (EDs) is neither sufficient nor designed to meet the needs of so many at once. Thus, in disasters, the triage methods of the ED need to be modified. This chapter will review the background to triage and mass casualty events and triage models that are available for both the field environment as well as the receiving facility.

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# Mass Casualty Triage Systems

In ordinary situations, physicians are trained to do as much good as possible for each individual sequential patient, but this paradigm must change in Mass Casualty Incident (MCI) situations.

Mass casualty triage is a dynamic and inherently complex operation. A man-made or natural disaster such as a hurricane, toxic chemical release, or act of terrorism may require that a large number of patients be evaluated and prioritized in an extremely short period of time. Triage is that prioritization and involves ranking injuries and casualties according to the level of care they should receive in a given set of circumstances. It has been described as "the most important initial medical function during a mass casualty event" and the "system that occurs when available resources are insufficient to provide for the needs of all patients."[1] However since resources vary from place to place there can be no firm definition of what constitutes an MCI beyond a sudden creation of an acute health care scarcity.

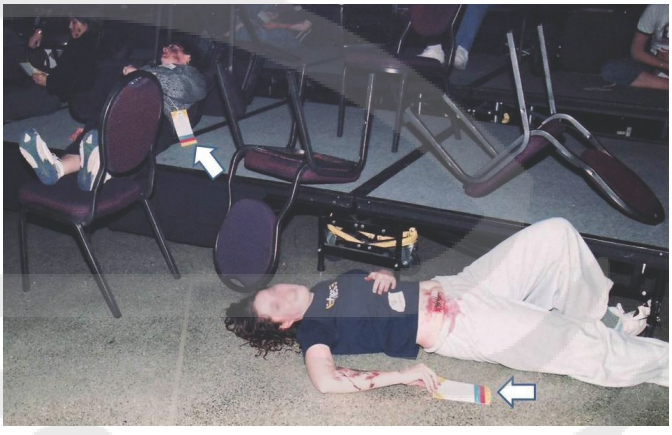
Often the sheer number of casualties associated with MCIs dictates that caregivers must become utilitarian in their allocation decision making and do the most good for as many as possible. Put another way, MCIs cause physicians to shift their perspective from individual health to population health. For example, in 1999, 3 nuclear plant workers in Tokaimura, Japan, were accidentally exposed to a significant dose of ionizing radiation. The radiation made them extremely ill and they received state-of-the-art care for Acute Radiation Syndrome (ARS). Now, suppose a 10-kiloton improvised nuclear device was detonated by terrorists in a major city. Perhaps half a million or more victims within a mile of ground zero would die instantly. What about the hundreds of thousands farther away from the blast zone who will likely suffer significant thermal burns as well as radiation exposure? How can that many casualties with life-threatening injuries be cared for? This is where the concept of *triage* becomes extremely critical. In the case of the 3 nuclear workers mentioned earlier, the victims were triaged as "immediate care" and transported to an appropriate tertiary acute care center, which was already awaiting transport and ready to begin life-saving treatment. In the latter case, however, the >100 000 casualties with thermal burns and ARS would be triaged as "expectant" (palliative only) because no healthcare system could provide state-of-the-art care for all these patients simultaneously. Instead, the system must concentrate on providing resources to the less severely injured who have a much better chance of survival. The ethical considerations of which are obviously complex.

The ideal triage method should be simple, reliable, reproducible, and subject to minimal interoperator variability.[2] Because a disaster may strike anywhere, there are many different players who could be involved in conducting triage such as emergency medical services, fire departments, hospitals, public health departments, volunteer first responders, or the military. Because disasters inherently overwhelm local resources, they require multiple agencies such as those listed above to work together in often unfamiliar relationships. Effective interoperability is essential, however, may be difficult if each agency uses discrete terminology and techniques such as applying various colors to indicate severity. As Lerner stated "Large scale disasters require cross-jurisdictional cooperation and highlight the need for a national, standardized approach to mass casualty triage."[3]

There are various triage systems in operation. Some of the more common triage schemes are Simple Triage and Rapid Treatment/Transport (START), Move, Assess, Sort, Send (MASS), Sacco triage method (STM), CareFlite, Sort, Assess, Life-Saving interventions, Transport (SALT), and military triage other systems have been described catering to special situations like hazardous materials incidents or avalanche response.[9] Although investigators anecdotally state that the START triage method is the most widely used in the United States, there are no firm data to support this nor could the same be said for Canada.[4–6]

Both the MASS (taught in the American Medical Association's [AMA] BDLS Course) and the START (or Respirations-Pulse-Mental Status [RPM]) systems are outlined below. Both schemes are based on physiologic criteria instead of the anatomic criteria that has been used traditionally however criticism remains regarding their predictive ability and tendency towards overtriage. Another limitation is a clear bias towards traumatic causes over medical causes of mass casualties (e.g., poisonings).[2]

## MASS Triage



MASS stands for MOVE, ASSESS, SORT and SEND.[7] First, consider the *MOVE*. One instructs the casualties in the area (perhaps with a bullhorn): "Everyone who can hear my voice and can move, please go to the area indicated and you will receive help" (e.g., the right corner of the field, etc). Those who can hear, understand, and follow the directions given are most likely not severely injured. They are now triaged as *MINIMAL* and are the lowest priority (tagged as GREEN). Next, the remaining casualties are told: "If you can hear me but cannot walk, move an arm or a leg to indicate where you are and you will receive help." Because they can hear and understand directions but cannot walk, they are triaged as *DELAYED* (tagged as YELLOW); they have sustained injury and need care but are not an emergent priority. The remaining casualties are now the *IMMEDIATE* (tagged as RED) priority. They are unresponsive (or deaf as a result of a blast) and must be *Assessed* individually. Each of these patients is examined using the A-B-C approach common in standard Emergency Medicine protocols. If a patient is not breathing, the airway is opened. If the patient breathes, he or she is tagged as *IMMEDIATE*. If opening the airway does not result in spontaneous breathing, the triage classification becomes *EXPECTANT* (BLUE or BLACK-tagged depending on which reference one reads) and one moves to the next patient. If the patient has uncontrolled bleeding, direct pressure is applied. Does the patient appear to have a fatal injury? If so, blue or black tag and move on.

The next step is to *SORT* the patients using the *ID-ME* mnemonic (Immediate—Delayed—Minimal—Expectant). Here, one must remember that triage is a dynamic process. As one deals with the Immediate patients (and evacuates them), the Delayed patients now become the new Immediates and so it continues until all the patients are cared for.

Finally, one must arrange to *SEND* the patients to appropriate facilities for further care. The Immediate patients may require air transportation, whereas the majority will require land-based ambulance transport. The Minimal patients likely will not need ambulance transport, but can usually be evacuated by bus. These patients should not be sent to already-overwhelmed hospitals. Instead, whatever first aid they need should be done at alternate sites.

## RPM (START) Triage

Another popular triage system is the RPM or START Triage. RPM stands for Respirations-Pulse-Mental Status while START is Simple Triage and Rapid Treatment (see Figure 5-1).[8] They both refer to the same system based on

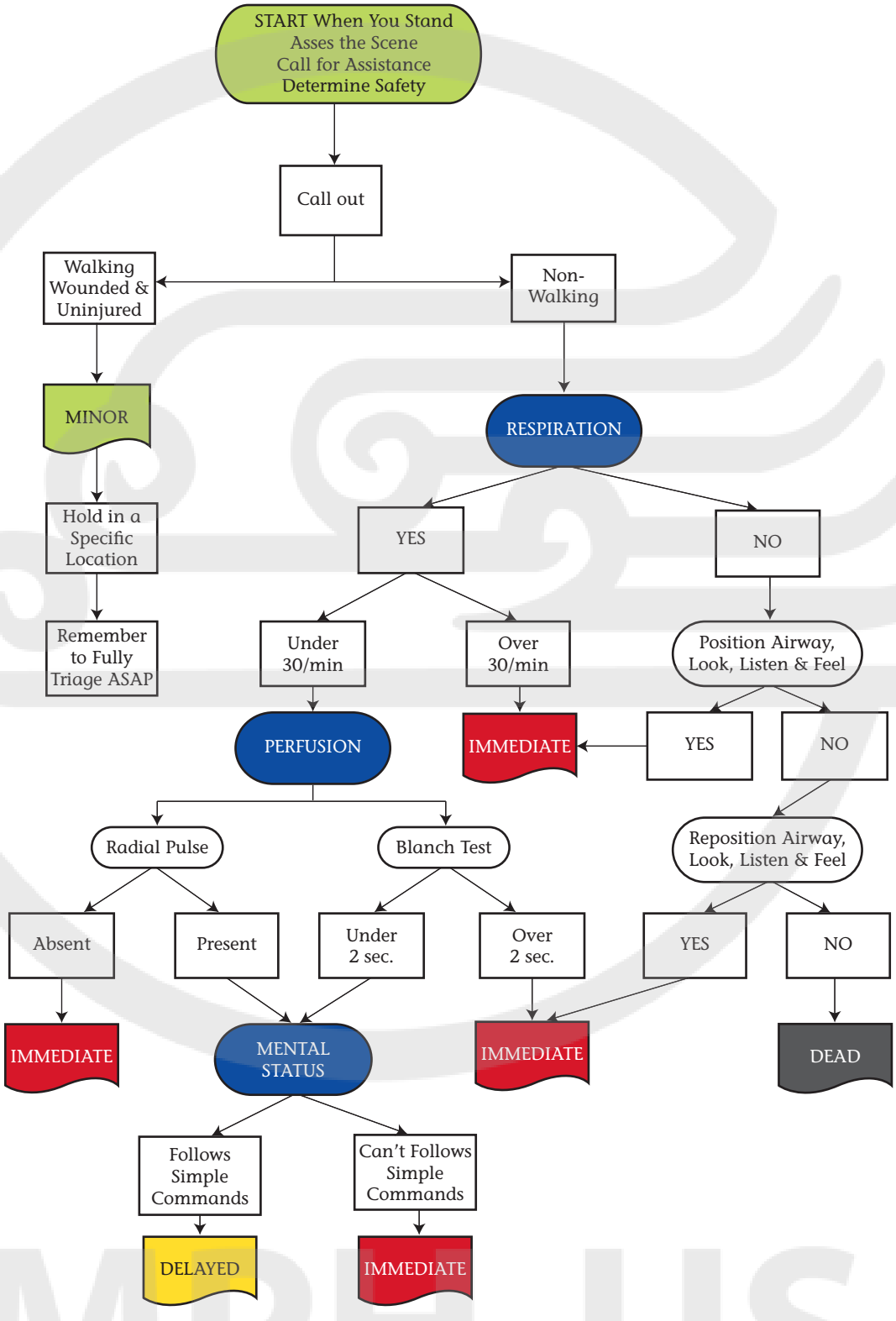



**Figure 5-1: The RPM/START triage system.**

(courtesy of Sonoma County, CA)[8]

physiologic signs. RPM is the mnemonic for the order in which the signs are assessed to determine the triage category.

Once again, the triage process begins by calling out "If you can hear my voice and can walk, come over here and you will receive help." Those who do as you say are considered "walking wounded" and are initially triaged GREEN (Minimal). They will need to be properly assessed as soon as practical in the "GREEN area" because a subgroup of the ambulatory actually will have significant, perhaps unappreciated injuries such as intra-abdominal bleeding.

Next, those who did not follow the command are assessed for Respirations. If the patient is apneic, the responder twice attempts to reposition the airway to check for return of spontaneous respirations. If no respiration occurs, the triage category is BLACK (Expectant/Dead). On the other hand, if the patient has respirations, one assesses the rate. If the respiratory rate is >30, the patient is triaged as RED (Immediate). For those patients with respiratory rate <30, one next assesses Perfusion—either the radial pulse or capillary blanching. If a radial pulse is absent, or if capillary refill is >2 seconds, the patient is triaged as RED (Immediate). When the patient has a radial pulse or cap refill <2 seconds, one moves on to Mental status. Those patients who can follow simple commands are triaged as DELAYED (YELLOW tag), whereas those who are obtunded or confused are triaged IMMEDIATE (RED tagged).

In the discussion about color coding of triage groups in an MCI, BLACK (or BLUE) tagging (EXPECTANT) has been mentioned a number of times. Except for those with battlefield triage experience, most physicians have never been faced with leaving a living, injured person untreated. However, the ability to do so is critical in an MCI situation. This is a difficult experience even for those who have responded to prior disasters. This is why training and exercising in disaster triage is so important. Unfortunately, far too few physicians ever have the chance to train in disaster triage until an event occurs. And when MCI triage training does occur it is often under the guise of unrealistic planning assumptions such as the notion that victims will wait idly at the scene of a disaster to be sorted by first responders when in fact most who can, will self present to the closest health care facility and overwhelm it. While full-scale MCI drills are expensive and logistically challenging to stage they are vital to preparedness efforts yet unfortunately are often overlooked by health authorities.This deficiency requires urgent remedy for the healthcare sector to be adequately prepared for future disasters. Training should occur at regular intervals and attempt to integrate with existing patient tracking processes as much as possible. An unfamiliar and unrehearsed triage system is bound to fail under the stress of a disaster if not well institutionalized. And while it has been demonstrated that most MCIs will present with little warning, if any, to the first receiving facility, the option of just-in-time training or quick reference resources should be considered as part of a comprehensive MCI plan.

In summary, the two triage methods described earlier exemplify the following characteristics of good triage systems:

- Simple
- Reliable
- Reproducible with minimal interoperator reliability

Bear in mind that there are other triage systems in use, particularly in the European Union. One should familiarize themselves with the system(s) in use locally and regionally. Also, please note that paediatric triage differs from adult triage and this is covered in Chapter 13.

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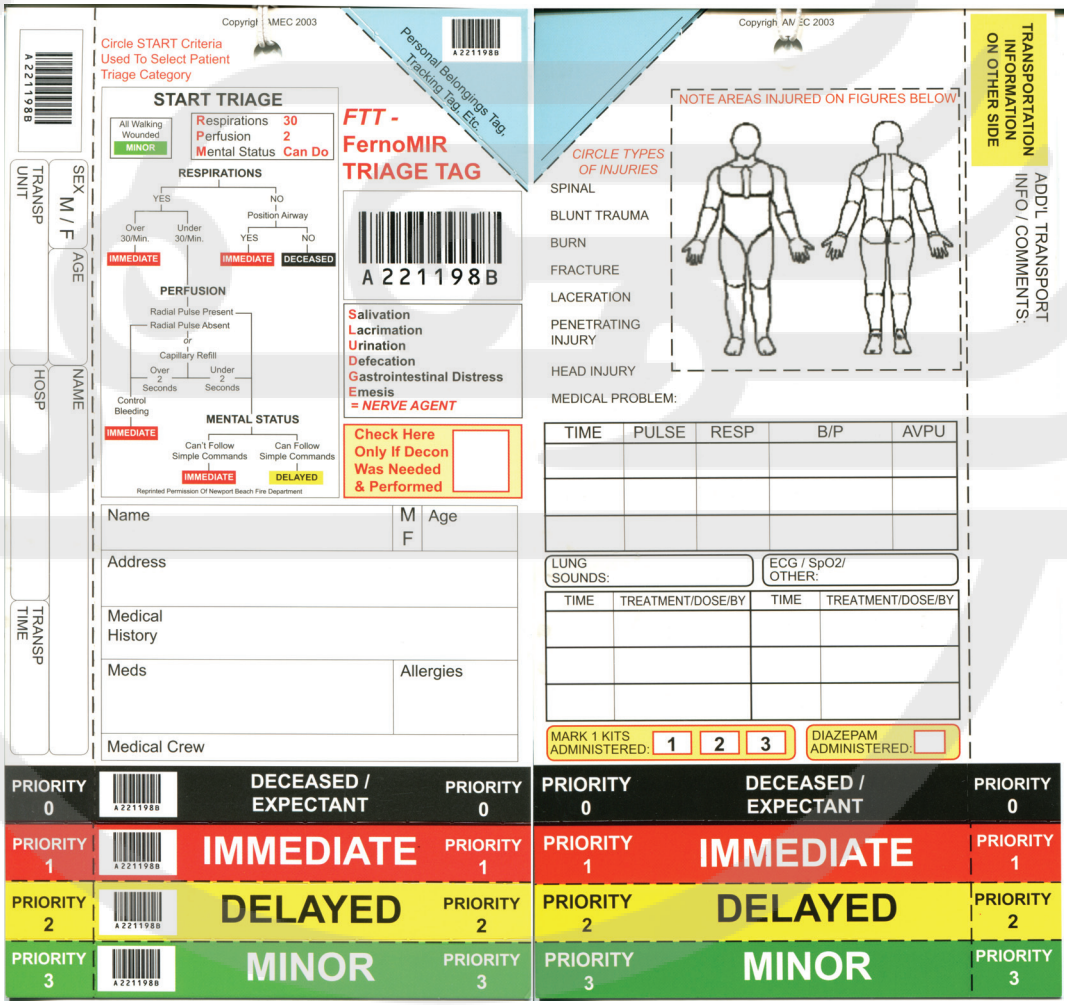
# Appendix A

## Example of a START Tag



Chapter 6

# Hospital Emergency Surge Capacity

By Daniel Kollek, MD, CCFP(EM)

# Preface

This chapter deals with the ability of the healthcare system to receive and treat a number of patients that rapidly exceeds the system's routine capacity. The term for this rise in patient volume is a "surge," and the ability to modify the system to deal with this is "surge capacity."

The chapter also defines the various forms of surges, the phases in preparing and responding to a surge, and provides guidelines for preparing a healthcare facility to deal with them. It also provides some recommendations with regard to general disaster preparedness.

Although this chapter focuses on surge capacity in hospitals, the reader should be cautioned that patients might present to other portals of entry such as walk-in clinics, family physicians, and rural nursing stations. Many of the principles for hospitals outlined below apply to other parts of the healthcare system. The reader should also note that this chapter is not a full outline of what is required in developing a disaster plan and is meant only to review the key points that might be relevant in a surge scenario.

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# Section 1: Definitions

**Medical Disaster:** When destructive effects of an event overwhelm the ability of a given area or community to meet the demand for health care.

**Mass Casualty Incident:** A disaster in which healthcare delivery is overwhelmed by the large number of individuals requiring care.

**Surge Capacity:** The ability to handle massive, rapid overload of emergency services. This is broken into a variety of subsets (see Table 6-1).

## Table 6-1[1] Definitions

| Term | Definition |
|---|---|
| Surge Capacity | Ability to manage a sudden unexpected increase in patient volume that would otherwise severely challenge or exceed the capacity of the current healthcare system. |
| Surge Capability | Ability of the healthcare system to manage patients who require specialized evaluations or intervention (e.g., contaminated, highly contagious, or burn victims). |
| Public Health Surge Capacity | Ability of the public health system to increase the capacity not only for patient care but also for epidemiologic investigations, risk communication, mass prophylaxis or vaccination, mass fatality management, mental health support, laboratory services, and other activities. |
| Facility-Based Surge Capacity | Actions taken at the healthcare facility level that augment services within the response structure of the healthcare facility. This may include responses that are external to the actual structure of the facility but are proximal to it (e.g., medical care provided in tents on the hospital ground).<br><br>These responses are under the control of the Facility Incident Management System and primarily depend on the facilities' operational plans. |
| Community-Based Surge Capacity | Actions taken at the community level to supplement healthcare responses. These may provide for triage and initial treatment, nonambulatory care overflow, redirection, or isolation (e.g., offsite "hospital" facility). |

## Section 2: Surge Timing

In considering surge capacity, it is important to recognize that there are, in fact, 2 kinds of surges that occur in an emergency setting.

- *Sudden or "spike" surge*: This is a sudden influx of patients secondary to a specific time-limited and nonrecurring event such as a major motor vehicle accident, a chemical spill, or a bomb explosion.
- *Prolonged surge* in which the intake of new patients continues over time and when it is harder—although not impossible—to project when the demand will plateau or decrease. A prolonged surge is more typical of biological events such as an epidemic–pandemic influenza or seasonal issues such as the heat waves experienced in France.

The type of surge event can often be anticipated based on the type of disaster. For this purpose, it is useful to classify disasters as static or dynamic (see Table 6-2 for the complete Potential Injury Creating Event (PICE) classification[2]).

- *Static events* are events where the cause of the injury or illness ceases after a finite time period and the number of victims is finite. This will often cause a spike surge.
- *Dynamic events* are ongoing situations where new patients are being recruited on a continuous or recurrent episodic basis causing a prolonged surge.

It is important to note that surges may be a combination of "spike" or "prolonged" or mixed, particularly in a prolonged event where there may be an initial spike followed by ongoing demands placed on the healthcare system.

### Table 6-2: PICE Classification System

| Select 1 descriptor from each column to completely describe your disaster | | | | | |
|---|---|---|---|---|---|
| Prefix | | | Stage | Need for External Aid | Status of External Aid |
| A | B | C | | | |
| Static | Controlled | Local | 0 | None | Inactive |
| Dynamic | Disrupted | Regional | 1 | Small | Alert |
| | Paralytic | National | 2 | Moderate | Standby |
| | | International | 3 | Large | Deployed |

Adapted from Disaster Medicine online and Rosen (1999), Koenig (1996).

## Section 3: Surge Phases

Similar to the classification of disaster management,[3] the response to patient surges can be divided into phases. These would include the following:

*Planning phase*: During this phase, the healthcare system has an opportunity to plan its response for when an event occurs. The disaster management cycle equivalent would be the *mitigation and planning phases*.

*Warning or presurge phase*: During this period of time, the healthcare system is aware of the upcoming need to process a large number of patients and activate its plan. This phase can range from months in advance (in the event of a known bioevent where there is a lag between the index case and the epidemic peak) to only minutes (when patients present to the emergency department (ED) having been exposed to noxious substance such as the Tokyo subway Sarin attack). During this phase, the healthcare system deploys its resources as per the appropriate disaster plan.

*The intake and treatment phases*: This is the actual period of patient care. The disaster management cycle equivalent to this would be the *response phase.*

*Intake phase*: This is a period during which patients are actively presenting to the healthcare system in need of treatment. The intake phase of a surge event will vary in its duration based on the type of event that has occurred as outlined above. It is during this phase that patients are triaged into treatment streams and decontaminated if necessary before registration.

In a surge, particularly a sudden surge, patients do not present randomly. When a large number of injuries occur, the first wave of patients presenting to the healthcare system are patients who have self-extricated, self-evacuated, and are able to walk. These patients are usually less ill or injured—needing care nonetheless. They are followed by the second wave of patients who require prehospital/EMS support to bring them to treatment. It is important to avoid consuming all resources on the less ill before the arrival of the more acute patients. This "reverse triage" occurred in London during the July 7, 2007 bombings when many of the priority 3 patients arrived before the priority 1 and 2 patients who had long extrication times.

*Treatment phase*: This is when patients are treated for their illness or injury. This phase would include acute care treatment as well as long-term, chronic, and rehabilitative treatment.

*The recovery phase*: At this point, having dealt with the surge, the healthcare system returns to a "neutral" status and prepares for its next surge. This phase must include a reflective and evaluative component to integrate whatever lessons may have been learned from the disaster into future plans. This is the same term used in the disaster management cycle.

These phases are not exclusive and will often overlap. Intake will continue during early treatment, planning and organization can continue during this time, and future planning can occur throughout the event.

## Table 6-3: Surge Phases in the Disaster Cycle

| Disaster Management Cycle | Surge Phase |
|---|---|
| Mitigation | May take place as part of recovery and planning phases |
| Planning | Planning phase |
| Response | Intake and treatment phase |
| Recovery | Recovery phase |

# Section 4: Present Status

The term surge "capacity" is somewhat of a misnomer, in that it implies the healthcare system has some surplus capacity to accommodate increased patient loads. This is untrue. It is important to recognize that hospitals across Canada, and particularly emergency departments, have been functioning in a chronic surge capacity status. This challenge does not only occur in Canada but is also present in many other developing and developed nations.

The overcrowding of emergency departments is probably the largest impediment in our healthcare system to deal with any surge event.[4] Hallway patients and those waiting in emergency departments because of a shortage of space in wards are effectively occupying the "extra" capacity required should there be a sudden surge of new patients. Dealing with this issue must receive high priority in any healthcare system that wishes to prepare itself for disaster.

Solving the problem of overcrowded emergency departments would improve hospital flow-through and function—a huge benefit in nondisaster settings. The system of the British National Health Service (NHS), which is closer to ours in function than the healthcare delivery in the United States, has demonstrated that the problem of ED overcrowding can be successfully dealt with.[5]

## Key Strategies in Dealing with Surge Events

The strategies below are arranged by the phases in which they apply. As mentioned earlier, there is much overlap and the classification has been occasionally arbitrary. Unless otherwise specified, the following strategies are applicable to both spike surge events and prolonged surges.

# Section 5: Command and Control During a Surge

The command and control aspect of responding to a surge event is part of a much larger topic of incident management. I will not dwell on this in this chapter other than to mention that a structured and organized Incident Management System (IMS, also known as Incident Command System [ICS]), is a critical component in responding to any kind of disaster. This has, in fact, been recognized by a variety of authorities and is gradually becoming accepted across Canada.[4,6] More details on IMS can be found in Chapter 4.

# Section 6: Risk Assessment

Facilities cannot plan unless they know what they are planning for; yet, there is currently no published Canadian tool designed to review the impact or likelihood of disasters for Canadian hospital risk assessment. In view of the large variability of disasters and the large variability of risk faced by different hospitals, this lack poses a significant problem. The Centre for Excellence in Emergency Preparedness has designed a risk assessment tool that can be found in Chapter 2.

Whatever plan a hospital develops, it is critical that an initial environmental risk scan is carried out and an annual review conducted to ensure the hospital

plan stays relevant to the risks at hand.[7] Table 6-4 outlines risks by category. The hospital has to formally review the probability of each type of potential disaster, what the impact of that occurrence would be, and what preparedness plan is in place to meet that event.

## Table 6-4: Hazard List Divided by Categories

| Natural Disasters | Technological Disasters | Man-Made Disasters |
|---|---|---|
| • Severe Thunderstorm | • Electrical Failure | • MCI—Trauma |
| • Snowfall | • Generator Failure | • MCI—Medical |
| • Blizzard | • Transportation Failure | • MCI—Hazmat |
| • Ice Storm | • Fuel Shortage | • Hazmat—External |
| • Earthquake | • Natural Gas Failure | • Terrorism—Chemical |
| • Tidal Wave | • Water Failure | • Terrorism—Biological |
| • Drought | • Sewage Failure | • Terrorism—Radiological |
| • Flood—External | • Steam Failure | • VIP Situation |
| • Wild Fire | • Structural Damage | • Infant Abduction |
| • Landslide | • Fire alarm Failure | • Hostage Situation |
| • Volcano | • Communications Failure | • Civil Disturbance |
| • Epidemic | • Medical Gas Failure | • Labor Action |
| • Extreme Temperature | • Medical Vacuum Failure | • Forensic Admission |
| • Infestation | • Information Systems Failure | • Bomb Threat |
| • Hurricane | • Fire—Internal | |
| • Tornado | • Flood—Internal | |
| | • Hazmat Exposure—Internal | |
| | • Supply Failure | |

Abbreviation: MCI, mass casualty incident.
Adapted from AHA documentation.

# Section 7: Impact Assessment

Because of the nature of surge events, surge planning needs to incorporate a projection of required resources. The most critical of these are beds, staff, equipment, and supplies. The need for each of these would be a function of

the nature of the event and the capacity of the system (see below for specific comments). In the absence of a critically appraised resource projection tool, the best alternative is to perform a formal risk analysis, identifying potential likelihood of high-impact disasters. Once a list of potential scenarios that require planning has been generated, each scenario can be reviewed with the local content experts.

There are a few assumptions that can be made about the pattern of resource consumption in a surge:

1. *The nature of the resources consumed* will depend on the clinical impact of the disaster. For example:
   a. Patients admitted to an acute care facility for an infectious disease may require individual or cohort isolation.
   b. Patients from a contaminated event will require decontamination at the hospital.
   c. Specific illnesses will require specific medications, possibly in doses that far exceed the usual (i.e., atropine in nerve gas exposure).
2. *Patient length of stay (LOS)* will vary depending on the type of pathology caused by the event. For example:
   a. Mass trauma patients will require large numbers of hospital beds initially but, after definitive care has been delivered, may be transferable to nonacute facilities if such exist.
   b. Patients admitted to an acute care facility for an infectious disease may require a longer LOS.
   c. Some chemical or radiological exposure may require very little initial bed use (after decontamination) but may require long-term clinic use and significant public health tracking.
3. *The speed, timing, and duration of resource use* vary, depending on the event type.
   a. Trauma or chemical mass casualty incidents (MCIs) will create a sudden but limited unimodal surge of patients with a very short preparation time at the local (primary) receiving facility.
   b. Biologic events will gradually increase demands on the healthcare system with a delayed peak of resource consumption and may be bi- or multimodal (have more than 1 peak with waves of infection).
4. *The availability of intake beds* at a specific facility will depend on the following:
   a. The number of empty staffed beds in the institution.
   b. The number of closed beds in the institution that could be opened if staffing was available.
   c. The ability to discharge existing patients or transfer them to alternate-care environments.
   d. The ability to create previously nonexistent “surge” beds (see Section 8.2).

e. The availability of nearby facilities (not necessarily hospitals) to receive overflow patients or to intake patients in the event of an evacuation. This requires that an evacuation/overflow plan exist and that prior negotiation with receiving facilities has taken place (see Section 8.2.7).

# Section 8: Planning

Once risk and impact have been assessed, it is possible to proceed with disaster planning. Hospitals must have a plan of response to any disaster that is either likely or of high impact. Although almost all hospitals in Canada have plans, 10%–30% have not reviewed their plans, of those that have, the majority has not reviewed them within the past year, and more than 50% have not carried out a full practice exercise in over 3 years.[8]

## Section 8.1: Common Misconceptions

There are common erroneous assumptions in planning for disaster-related surges.[9] These assumptions are as follows:

1. *Victims will arrive via the* Emergency Medical Services (*EMS*) *system.*

   The Tokyo Sarin attack is an excellent example of what actually occurs in a disaster "spike" surge. Of the 640 patients at a hospital, 541 came without EMS; they came independently—by cab, by car, or carried by their friends.

2. *Patients will only go to designated hospitals.*

   Because patients do not know the disaster plan and most arrive independent of EMS, the tendency is for them to go to the nearest hospital or the hospital with which they have the most familiarity or comfort.

3. *Victims at a nondesignated facility can be safely transported to the appropriate site.*

   It is highly unlikely that during an MCI, patients can be transferred from one hospital to another. There may be a lack of access to ambulances that are still dealing with patients incoming from the site, road access may be unavailable, or the appropriate hospital is on the other side of the disaster area. Even more crucial, the hospital may itself be the disaster area.

4. *Victims will be decontaminated on scene before arrival at the hospital.*

   In a 6-year review of 72 major contaminated incidents in the United States, not a single patient was decontaminated before arriving at the hospital. In most cases, patients who are ambulatory will leave before the decontamination crew arrives; and patients who are nonambulatory may be decontaminated if contamination has been recognized.

## Section 8.2: Bed Management

With any scenarios involving large numbers of patients, there must be a plan for where to put these patients. If a large number of nonambulatory patients is

anticipated, the accommodation required must enable these patients to lie down. If the absolute number of patients exceeds the number of existing beds, then beds must be added to the system. These do not need to be full hospital beds, and solutions can range from folding canvas stretchers to using collapsible bed frames with foam mattresses. Whatever the solution, the appropriate material should be stored in a safe place and in proximity to its deployment point.

An effort needs to be made rapidly to clear the ED. This is important because the ED will be the triage and resuscitative area for the most severely injured patients who do not go directly to the operating room (OR).

The steps involved in maximizing the number of beds available are as follows:

1. *Stopping all elective activity.*

   Immediately advising the appropriate hospital authorities to cancel elective procedures and elective admissions. This would involve discharging patients booked for elective procedures that have not yet occurred and advising all patients coming in for elective procedures that their procedure has been deferred until further notice.

2. *Expediting patient discharge.*

   Expedited discharge needs to occur for all patients for whom this is safe, and patients cleared to leave should be immediately moved (along with appropriate documentation) to a discharge area to clear the ward bed for the incoming casualties. The discharge area should be a location where they would not interfere with the clinical care being delivered and where the picking up of these patients will not interfere with incoming patient traffic flow. The discharge area should be able to handle a variety of levels of care, as some of the discharged patients may be nonambulatory, be appropriately staffed, and have access to telephone and the hospital's computer system.

   An up-to-date tracking system is essential to prevent "lost" patients. St. Mary's Hospital in London, England, cleared 100 acute beds in the first hour of the July 7, 2007 London bombings.[10]

3. *Transferring nondischargeable patients to other care environments,* such as hospitals away from the disaster.

   Note that in the case of a sudden surge, it is possible that patient transfer capabilities will be severely strained. Planners may not be able to rely on ambulance transfers from one facility to another. In such a situation (and if the medical condition of the patient allows), it may be reasonable to consider alternative transfer modes such as taxis, buses, or transfer by family.

4. *Assessing patients who cannot be discharged or transferred to other sites.*

   This review would consider the patient's need for a ward bed as opposed to a chair or a clinic setting within the hospital. Can they be cared for elsewhere within the facility? (See point 6 for further details.)

5. *Expanding inpatient units.*

   Each inpatient unit needs to have a plan that will allow it to increase its capacity by adding beds to an existing environment or beds to hallways.

There needs to be a predetermined number that can go from the ED to the wards (e.g., a ward may accept 2–4 extra beds). The location of the added beds and the allocation of care staff to those beds need to be defined ahead of time.

6. *Creating new inpatient units within the hospital.*

   Consider inpatient flow, moving ward patients who cannot be discharged or transferred into hallways to make ward beds available for incoming patients. Israeli hospitals have bed caches that can be deployed to corridors and lobbies already equipped with "hardwired" oxygen and power outlets. There is dedicated staff that, in a disaster, will shift from its usual work location to a new patient care area. In a very short period, a hospital can establish a series of new "wards"—staffed and equipped. The hospital makes the decision to relocate known, stable patients to these makeshift areas, clearing the usual wards for intake, or to intake directly to the "new" wards—or a combination of the above.

7. *Establishing nontraditional treatment areas away from the hospital.*

   A good example of this is in Moscow where, according to interviews with the city planners, the city can add anywhere from 5000 to 9000 beds within a matter of hours. This is done by deploying hospitals that are stored in subway stations, taking advantage of their large corridor areas and the natural shelter they provide in all weather. Doctors and support staff at specific hospitals are designated to respond to a specific station in their sector of the city. Some equipment is securely stored in the station (this includes hardware, but no medications). In the event of a deployment, the physicians take medication and equipment that is prepackaged and relocate to the station; staff on-site in the station deploys beds and other hardware. This has been repeatedly drilled and it is apparently extremely smooth. It is coordinated with the civil defense authorities, and the claim is that approximately 50% of the stations can have some form of hospital deployed in them. Another option is using hotels or community centers.

## Section 8.3: Staffing

The 2 key issues in staffing during a disaster include staff availability and staff training.

### Availability

It is important to identify key staff positions in all responding organizations and healthcare facilities and to develop a staffing plan that would include the following:

1. A fan-out procedure to call in staff as well as an update process to keep contact information up-to-date. This is also known as a "cascade call-out" and should be preset in the switchboard. In addition, each clinical area needs a list of staff contact details with an idea of ETA so that the nearest staff can be contacted first. Another option could be mass calling software or an autodialing package if this is available to the facility.
2. A list of roles that must be filled and their priorities.

3. A shift schedule to relieve the staff and avoid exhaustion (both of the individual and the organization).
4. A process for accreditation of medical staff across facilities within a region in the event of mutual aid.[11]
5. A plan to relocate staff within and between facilities including orientation and safety briefing as required.[11]
6. Daycare for the children of hospital staff and children of victims if appropriate.[12]
7. Sleeping quarters, toilet facilities, and food for staff who cannot go home or would not be able to return for further duty if they did.[12]
8. A communication plan allowing staff to call home at scheduled times while preserving the integrity of the hospital switchboard. The prevalence of mobile phones may make this unnecessary, however the mobile phone system might not be functioning well in a mass casualty incident.
9. A process for the safe integration of volunteers and their allocation to appropriate tasks.
10. A training schedule with at least 1 exercise every year.[7,13–15]

### Training

In ideal disaster plans, staff would perform tasks with which they are familiar and that are close to their usual (nondisaster) roles. Having said that, in a disaster scenario hospital, the staff will likely be treating patients at a different rate to which they are accustomed. They may be assigned to unfamiliar teams and using unfamiliar equipment. It is critical that they learn to adapt to working in these new situations and that they learn their new routines until following them becomes automatic. Disaster staff must know how to continue to work wearing any necessary personal protective equipment (PPE), specifically if they are dealing with a contaminated disaster. If the staff are not trained to work in a contaminated environment, or if they do not know how to put on, take off, and maintain their equipment, morbidity and potential mortality among staff are likely, in addition to not being able to provide adequate care. Wearing protective equipment may muffle speech, and so staff wearing protective clothing need some effective method of communication with which they are already familiar to enabling them to perform complex tasks such as decontamination or intubation. Training may need to be expanded to the security staff who may be involved in crowd control.

## Section 8.4: Equipment

It is essential that required equipment be stored in a safe place. Items stored in public environments for a long period are not secure; disaster equipment must be kept locked.

Supplies need to be stored close to where they will be deployed. It is unsafe to rely on "just-in-time" supply delivery in a disaster scenario, because the facility may not have access to the supply dump or the transportation capability to deliver supplies. The motto in disaster planning is not "just in time" but "just in case."[16]

A restocking or supply rotation plan needs to exist for supplies that may expire or "stale date."

Supplies need to be *appropriate* for the anticipated population and must take into account the local demographics. For example, if a large pediatric population is expected, the equipment must include pediatric supplies such as Broselow tapes and kits. For more details, see Chapter 8.

All equipment has to be laid out for use in a standardized fashion. For example, if designated intubation stations are part of the disaster response plan, all intubation trays need to be identical so that staff, when deployed, can easily find the item they require regardless of which intubation station they are deployed to. Generally speaking, the more one can standardize throughout the disaster plan, the smoother things will run. The less problem solving people will have to do, the less they need to adapt from location to location. There is already recognition of this in today's medical environment in that we have standardized kits for procedures such as central line kits, chest tube trays, and so on.

A common problem in the present hospital environment is that most procedural trays look the same and are wrapped in the same color towel or cloth wrapping, requiring the reading of labels every time to pick out the appropriate tray for the procedure. This may be difficult in a disaster scenario because of time, lighting, or decreased visibility due to PPE. To quickly identify the package contents, they should be listed in large letters on the outside and, ideally, kits should be color coded for easy recognition (intubation tray in blue, thoracotomy tray in red, etc.). Beware that this does not become confused with Broselow kits that are also color coded. A "stack" system for supplies is helpful, so cages full of relevant stock can be pulled out to use for resus/minor/major areas, and so on.

To ensure interoperability, it is important to integrate equipment with responders from other facilities and with first responders. In London, England, the regional health authorities have mandated that hospitals purchase equipment from a certain list so that any hospital can provide mutual aid and equipment to other hospitals in a disaster scenario. In Israel, in the past, ambulance crews delivering a patient in a disaster scenario could drop off a patient with his/her stretcher, and because the equipment was compatible, they could leave their stretcher and replenish their equipment from the hospital stores, allowing them to avoid transferring the patient to another bed, and quickly return to the scene and pick up the next patient.

## Section 8.5: Defining Patient Flow Route with a Forward Triage Point

In an MCI, large numbers of patients will present to the hospital attempting to access care or seek out loved ones through a variety of entrances. This can disrupt care and lead to chaos in the building. In the event that the disaster is contaminated, uncontrolled traffic can put patients, caregivers, and the public at risk. It is important to control all access to the building, as well as maintaining separate areas for decontamination and treatment ("hot" and "cold" zones).

The role of the security staff is crucial in guiding patients. Patients arriving will not know the building layout. The same applies to support staff from other hospitals or first responders from the public sector. Thus, it is critical to organize the flow of patients and staff.

The 2 key ground rules in flowing patients efficiently are as follows:

1. Flow is *always* unidirectional.
2. Initial triage should be as far forward as possible.

Patients must flow from the triage/arrival area to the appropriate treatment area (see below) and from there, hopefully, to discharge. It is important that this forward motion be maintained to maximize a patient flow through and to prevent patients "recycling" to the triage area where they will cause confusion, clog the system, impair statistics, lead to multiple registrations, and possibly contaminate the care area.

The decontamination process, if required, should take place between first (minimal) triage and treatment areas. Patients who have already been cleaned off should never return to the contaminated area, and if this occurs, they need to be fully decontaminated again. These patients pose the risk that if recontaminated, they bypass the showers (with the claim that they have already been washed) and spread the contamination to the hospital. Thus, particularly in a contaminated disaster, the flow of patients must always be in one direction only. The same also applies to staff who may be unfamiliar with plans or layout of the area.

To facilitate patient flow through:

1. It is critical to provide good signage.
    a. Signs could be printed ahead of time, be large, very clear, and in the languages of the local population.
    b. The signs should be able to stand-alone or have a prearranged place where they can be put without the need for tape, Velcro, or special tools.
    c. Every sign should have its own predefined location marked on a deployment map and also on the ground/wall at the signs location. In the event of activating of the plan, staff simply go to the sign storage area, pick up a sign, go to that sign's predetermined location on the map, verify that the location is current, and place the sign accordingly. Attention should be paid to the risk of misplacing signs with arrows that may be in the right location but facing the wrong direction.
2. All staff have to be very clearly identified.
    a. Individuals need to be identified by the role they will be playing in the disaster plan.
    b. Identification methods must be such that the hospital staff cannot be confused with other people who will be responding from the scene (i.e., paramedics, fire, police, etc).

    Hospital badges, although commonly used, will not be adequate in a large MCI. It is better to have vests in a reflective and very obvious color, or a series of colors identifying the various roles of the individual responders. It is useful to have the individual's role written on the vest so that people unfamiliar with the color code can see a vest labeled "intubator," "physician," "nurse," and so on and know to whom they are talking.
3. Mark the patient's route in some obvious fashion on the wall or the floor.

    In many Israeli hospitals, lines or arrows on the floor act as guides for people to follow. This is important for a variety of reasons. First, the triage officer will not need to explain the route (which can be difficult if wearing a gas mask) but simply advise patients to "follow this yellow line until the next staff stops

you." Second, this will decrease confusion when there are language issues or complex instructions. Third, this will make it obvious where the different areas are because they are physically demarcated in the field.

4. Operations must be able to continue despite both noise and darkness.

   Planners must consider either a public address system (ideally with at least one *portable* microphone or a bullhorn) or some other method that will allow them to coordinate the crowd and be heard. Caregivers also need to be able to light up the area very powerfully so as to be able to operate at night and while wearing equipment that might interfere with vision (such as a Stryker hood or a gas mask). As far as lighting is concerned, this should be built-in and not mobile. Mobile equipment gets lost, breaks down, and requires batteries to be kept charged as well as staff and time to deploy, whereas hard-wired lighting can be turned on with the flick of a switch and is stable and secure. This assumes that the hospital has a secure electrical supply. Battery backup is still useful, however a built in system is important.

5. Place the triage point(s) as far forward as possible so as to triage the patients to the correct areas of care as early as possible. Ideally, initial triage should be distant from the actual care areas of the hospital.

   Patients arriving at the hospital will vary in their acuity. Although some may be triaged in the field, the first presenting patients (those who self-extricated and self-evacuated) will likely arrive independent of EMS and will not have been triaged at the scene of the event. Patients need to be directed to different areas based on their triage level reserving the acute care areas for the sicker patients and separating the stream of patients who are less acute (or the "worried well") to areas that will consume fewer resources.

   There should be more than 1 triage point, initially sorting patients into ambulatory ("minor" or green-tagged patients) and nonambulatory then, at a second triage point, further subdividing the nonambulatory into "delayed" (yellow tag), immediate (red tag), or expectant/deceased (black tag). This also allows for reassessment of the patients. For further information, please refer to Chapter 5.

   The sooner patients are divided into treatment streams, the easier it is to direct them to the appropriate treatment areas of the hospital. For example, if all victims present to the ED, then that area will rapidly become crowded and dysfunctional. However, if triage occurs in the parking lot, minor patients can be diverted to an alternate area such as the hospital lobby keeping the ED free for those patients requiring resuscitation (see Figure 6-1).

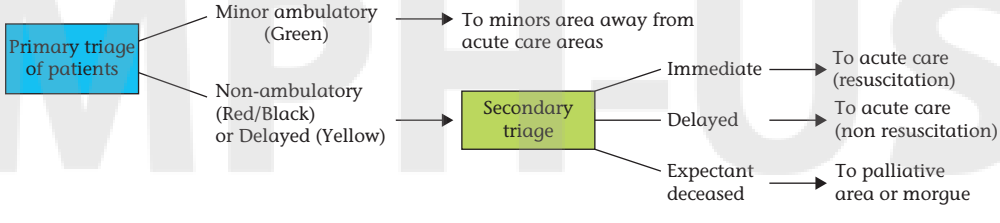


**Figure 6-1: Triage and patient flow.**

The same rule applies to scene response. In Moscow, a doctor is on scene at the disaster and decides which hospital will receive the patient. This is an interesting idea when compared to the Canadian scenario in which an ambulance dispatcher makes a decision at a distance from the actual event and based on second-hand information provided to him or her by the EMS crew. It must be recognised that this forward triage model refers only to patients arriving by EMS from a specific event. The equivalent in a pandemic situation would be to designate off-site assessment areas and use the media to direct patients to present there for initial assessment. Patients presenting to another site not designated for intake would, assuming this is clinically safe and operationally feasible, be redirected to the appropriate intake site.

6. Use all possible accesses to the hospital.

   The triage officer should ideally be outside the hospital where the ambulances and ambulatory patients are arriving and direct the crews to drop the patients off at different areas, thus dividing the patients up into streams of treatment before entering the building. This will prevent crowding and confusion to any one area in the hospital. Obviously there are weather considerations to be kept in mind. It is harder to do this in the depths of winter; if the triage point is unsheltered, one may have to take all patients into one area within the hospital and divide them up later, which is far from ideal.

## Section 8.6: Establish Dedicated Treatment Areas for Patients of Specific Triage Levels

It is important to have separate areas within the hospital for the treatment of different types of patients. Each of these areas should be staffed with healthcare staff with an appropriate skill set. For example, the acute care resuscitative area should be staffed with senior physicians, anesthetists, and a higher nurse to patient ratio, whereas the ambulatory/minor injury area may be only staffed with clerical staff, and in a teaching hospital, junior residents and medical students.

Each treatment area must have defined and fixed investigation and treatment protocols. The purpose of this fixed protocol methodology is to ensure that every patient coming in gets the same initial treatment and that treatment is not delayed waiting for a physician. The nurses would be authorized to initiate care using medical directives and, as the physicians catch up, the individual patient treatment plan can be fine-tuned.

There are patterns of injury in MCIs that lend themselves to care maps. For example, if an area is designated for walking wounded and minor injuries, this could be staffed by more junior staff with the instructions to perform basic first aid and minor procedures, provide analgesia, discharge wherever possible, temporize with the other patients, and reassess periodically. This will be different from an area designated for sicker, nonambulatory, patients where the protocol may include establishing intravenous access and drawing specific bloodwork, which would be the same for all patients from the scene of the disaster regardless of their history. Note that, although patient care supersedes criminal investigations, it may be helpful to have procedures in place to determine chain of evidence for samples collection.

The only area with significant variability in care plans should be the resuscitation area, where each patient will be treated individually based on the cause for his or her critical condition. Having said that, in a disaster situation, some patients who under normal conditions would have been provided resuscitation may receive only palliation, if it is decided the patient is not salvageable with the resources available at the time.

## Section 8.7: Prepare a Decontamination Plan

In the event that patients from the disaster have been contaminated with a noxious substance, decontamination has to take place before entering the hospital. In Canada, 57% of hospitals state that they do not have a decontamination area, 5% do not know if they have one, and only 31% of hospitals report that they do.[8]

In the United States, by comparison (pre 9/11 data), 44% of the US facilities in one survey had the ability to receive any chemically exposed patient, 39% had no designated decontamination facilities, and 30% had no protocol for handling chemical contamination.[17]

In every decontamination plan, there has to be a *decontamination area.* This is an area where the patients can be washed, ideally after undressing, and provided with uncontaminated clothes to wear. The decontamination area should be outside the ED and not within the building wherever that is possible. If it is within the building, then there should be a method of isolating and evacuating the air and fluid runoff so as to avoid contaminating the rest of the facility.

Decontamination areas must be able to accommodate both ambulatory and nonambulatory patients and should be able to function in all relevant weather conditions. Consider areas that would not be normally used for patient care, such as service corridors, and so on, where patients could enter at one end, discard their clothes, walk through built-in showers, and exit at the other end to receive clean clothes. This has been the plan for several years in some hospitals in Washington.

Patients who cannot walk need to be decontaminated on a stretcher or backboard. There are a variety of tools for this, from "roller" systems to decontamination beds that are designed for the patient and the bed to be hosed down simultaneously. Whatever option the facility chooses, it is important to have the equipment and train the staff to operate that equipment.

*What is most important is that the intake process of patients in a contaminated or noncontaminated disaster should be the same with the added step of decontamination if required.* Keeping these processes as similar as possible will minimize confusion, allow for training staff on one set of emergency guidelines only, avoid the need and cost for exercising different kinds of processes, and minimize the amount of documentation required in preparing disaster plans for hospitals. Further details on dealing with a contaminated disaster can be found in Chapter 12.

## Section 8.8: Organize the Data Flow

In the Tokyo Sarin Disaster, 640 patients presented themselves to St. Luke's Hospital within 90 minutes. Of those, 541 came independent of the EMS system. Even if it took only 1 minute to register each patient, intake would have taken more than 10 hours. *It is not possible to use the normal process of registration in an MCI.* In preparing for an MCI, a number of charts must be preprinted and

preregistered in the facility's computer system. The number of charts required will depend on the facilities' risk assessment. The preprinted charts and the preregistration ensure that the patients exist (as anonymous entries) in the computer system with laboratory work preordered, specimen stickers available, armbands are preprinted, and so on.

On arrival to the treatment area, the patient is allocated a number from the bank of preprinted charts, and this number is their hospital Unique Number (UN#) throughout their visit.

The only medical history that should be elicited from the patient on arrival is their premorbid status, medications, drug allergies, and some history of the present illness (what injuries the patient actually suffered). The mnemonic for this is *AMPLE*—*A*llergies, *M*edications, *P*ast History, *L*ast meal, and the history of the *E*vent.

Only later, and when time allows, should the clerical staff return to the patient and collect the other demographic data (name, address, etc.) and "marry" this data with the UN# disaster chart. This clerical work can be deferred if the registration staff is still overloaded by incoming patients. It is important to recognize that there are going to be a variety of labels on these patients including, hospital armbands, triage tags, and their own personal identifiers such as provincial insurance number, and so on.

In regional plans, it may be worthwhile allocating distinct numbers used by each of the hospitals within the region to prevent duplication and to allow central planners to use the UN# to identify immediately which hospital a patient came from. This would be more relevant in smaller communities where there may be 2 hospitals intaking patients from the same disaster and it would help to avoid confusion if there is only 1 chart with a certain number or prefix immediately identifiable as originating from hospital A as opposed to hospital B.

## Section 8.9: Other Plan Components

In addition to the usual disaster plan components, it is important to include the following:

1. Identification of partners such as the Red Cross, Salvation Army, and local industry that can assist in a disaster.[7]
2. Identification and plans to cooperate with other healthcare facilities (including but not limited to hospitals)[7,11] and the prehospital emergency response teams.[12,18]
3. Identification of key staff and volunteers in all responding organizations and healthcare facilities and development of a staffing plan (see below).
4. Outlining supply and waste disposal plans.
5. Defining alternate treatment and housing areas in case the hospital is the disaster site.[7]
6. Specifying an explicit chain of command[6,13] and communication process[12] (see Chapter 5).
7. Establishing an exercise schedule, both tabletop and full scale, that involve all responding agencies[7,13]. Full drills should take place at least once yearly to avoid the situation in which the executive level has been trained but the frontline responders have not[13–15]. Drills should be used to identify process issues that impede care and should be critiqued.

## Section 9 Warning Phase

Time between the warning of an impending event and the arrival of patients is variable. Good coordination with the public health authorities and other groups that can provide early warning (such as fire, police, and EMS) can maximize the duration of this phase and provide added preparation time to the hospital. The warning phase can be extended by improving:

a. Syndromic surveillance
b. Diagnostic surveillance
c. Transmission of relevant risk assessment information to frontlines
d. Interface between EMS/police/fire and healthcare facilities

The warning phase is the time in which the hospital can initiate the plan created in the planning phase. The steps should be undertaken as soon as possible and can continue even after patients have arrived with the goals of:

1. Preparing as many beds as possible
2. Maximizing available staff for immediate care and staff relief
3. Establishing triage point(s)
4. Activating treatment areas
5. Initiating the IMS and establishing an operations center (it is the assumption that the hospital already has a disaster plan in place with the appropriate color codes and IMS structures [see Chapter 4]).

## Section 10: Response Phase

The response phase will be the delivery of items outlined in the planning section of this document, as well as data collection and tracking of financial data (as per the IMS model). All these help to improve future response and provide an accounting and costing at the end of the disaster.

## Section 11: Recovery Phase

The recovery phase is beyond the scope of this document.

## Section 12: Recommendations

There are a variety of recommendations that flow out of the research done in preparing this chapter. These are as follows:

1. Establish national standards of disaster response driven by best evidence and derived by frontline responders.
2. Link accreditation of hospitals with meeting the aforementioned standards.

3. Establish a mandated training cycle for all healthcare facilities as part of accreditation.
4. Attempt to maximize the warning phase in a disaster scenario by improving:
   a. Syndromic surveillance
   b. Diagnostic surveillance
   c. Transmission of relevant risk assessment information to frontlines
   d. Improved interface between EMS/police/fire and healthcare facilities
5. Formalize frontline cooperation with other countries facing similar issues and with similar healthcare systems on the topics of
   a. ED and hospital design
   b. EMS role and function
   c. Training and exercises
6. Mount a public education campaign on appropriate use of the ED and its function in a disaster.
7. Promote volunteering in the healthcare sector.

## Section 13: Summary

This chapter dealt with the ability of the healthcare system to receive and treat a number of patients that rapidly exceeds the system's routine capacity. The term for this rise in patient volume is a "surge" and the ability to modify the system to deal with this is "surge capacity."

This chapter also defines the various forms of surges, the phases in preparing and responding to a surge, and provides guidelines for preparing a healthcare facility to deal with them. It has also made some recommendations with regard to general disaster preparedness.

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# Chapter 7

# Volunteers*

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# Preface

In many disaster situations, it is not uncommon for members of the public to want to assist and volunteer their services. The urge to help is a natural one and if appropriately channeled, it can be of great benefit to healthcare providers and their operating facilities.

In contrast, convergent volunteers who are not well-coordinated disorganized and lack adequate training and can pose a significant threat to rescue efforts. Uncoordinated volunteers can lead to an increased risk to a hospital's function and even to themselves.

This chapter reviews the guidelines for integrating volunteers into the disaster response using a team-based approach. These guidelines include job descriptions for the various coordinators and directors of volunteer centers, setting up a volunteer registration system, and a predisaster "drill" outline, as well as various templates of documents that might be useful to healthcare facilities.

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## Recruitment, Training, Response, and Maintenance of Volunteers in Disaster Management

It is human nature to want to help in response to disasters. Volunteers can be an asset or a hindrance, and the management of volunteers has been a major challenge in disaster situations.[1] Many Canadian cities along with the Public Health Agency of Canada have formulated plans for the management and use of volunteers in the event of a pandemic or disaster situation.[2] However, the management of volunteers in a hospital-based setting during a disaster situation has not been fully addressed.

A unified, practical, and easily implemented template that can be utilized nationwide, for use in both urban and community hospital settings, would have many advantages. This guide would also make the management of volunteers less of an effort, would be available and active in a timely manner, and would be available for peer review on a regular basis.[3] It may also behoove the current administration to form a volunteer "reserve corps" similar to the Medical Reserve Corps formed in the United States in 2007.[4] There are no complete guidelines or templates that exist on a national level to deal with volunteers in hospital or nonhospital settings.

Hospitals and communities across Canada require a practical and easily implemented plan or template for volunteer management in disaster situations.

## Background

All volunteers require careful, detailed, and supervised management, which must be guided by certain principles.[5]

1. Volunteers must be anticipated, planned, and managed.
2. Volunteers are a valuable resource when they are trained, assigned, and supervised within established emergency management systems. Clear designation of responsibility for the on-site coordination of volunteers, through a volunteer coordination team, is required.
3. Volunteers must have roles based on areas of community need.
4. Volunteers may have roles in mitigation, preparedness, response, and recovery.
5. The mobilization, management, and support of volunteers are primarily a responsibility of local government and nonprofit sector agencies. Therefore, specialized planning, information sharing, and a management structure are necessary to coordinate efforts and maximize the benefits of volunteer involvement.
6. Volunteers need to be flexible, self-sufficient, and aware of risks as well as willing to be coordinated by a local emergency management expert and must accept the obligation to "do no harm."
7. The impact on volunteers in assisting others can be quite positive and contribute to the healing process of both individuals and the larger community.
8. Clear, consistent, and timely communication is essential to successful management of volunteers. A variety of opportunities and messages should be utilized to educate the public, minimize confusion, and clarify expectations.

Volunteers can be divided into 2 types: affiliated and unaffiliated.

*Affiliated volunteers* are attached to a recognized voluntary or nonprofit organization and are trained for specific disaster response activities. Their relationship with the organization precedes the immediate disaster, and they are invited by that organization to become involved in a particular aspect of emergency management.

*Unaffiliated volunteers* are not part of a recognized voluntary agency and often have no formal training in emergency response. They are not officially invited to become involved but are motivated by a sudden desire to help others in times of trouble. They come with a variety of skills. They may come from within the affected area or from outside the area. This group is also known as convergent, emergent, walk-in, or spontaneous responders. Unaffiliated volunteers create a paradox in that their willingness to volunteer may not coincide with the system's capacity to utilize them effectively.

Cone et al.[6] have discussed the problems underlying the response and usage of unaffiliated or convergent volunteers. The arrival of unexpected or uninvited personnel wishing to render aid at the scene of a large scale emergency incident raises many concerns.

1. Security may be compromised as untrained volunteers attempt to aid at the site. Perimeters need to be established and maintained, so looting and crime does not occur, forensics can be performed if required, and the safety of the general public and personnel should always be a priority.

2. Safety of unaffiliated volunteers will be compromised if safety equipment is not worn, or volunteers attempt to carry out functions that they are not trained for, for example, search and rescue in hazardous field sites.
3. There is a lack of formal accountability as systems that normally keep track of on scene responders won't be able to track, communicate with, or properly utilize uninvited volunteers.
4. Unaffiliated volunteers can tie up lines of communication with use of cell phones, etc.
5. The housing, feeding, and toileting needs of uninvited volunteers can overburden and cause logistical problems for the affected community.

Although affiliated volunteers are much easier to deploy (one author claiming that each affiliated volunteer can be as effective as 10 unaffiliated volunteers [David Cone, personal communication, 2006]), given proper information, with a formal approach to organization established before the disaster, and utilized effectively, can be a valuable resource.[7] In addition, history has shown that unaffiliated volunteers will present themselves, needed or not, so it behooves any healthcare organization to integrate these into the organizational disaster plan and the incident management system. To paraphrase a popular movie—they will come, so build it.

## The 4 Phases of the Emergency Management Cycle

Emergency management has been traditionally divided into 4 phases and affiliated and unaffiliated volunteers may be used in all of these. The phases are

*Mitigation:* Disaster mitigation includes a wide range of activities at the household, community, state and national levels, which aim to reduce the damaging effects of all kinds of disasters. Mitigation is often integrated with preparedness since these 2 phases precede the event.

*Preparedness:* Disaster preparedness refers to proactive efforts undertaken by individuals, families, groups, or whole communities to place themselves in a better state of readiness to withstand or avoid the immediate impact of any kind of disaster.

*Response:* Disaster response occurs from the moment an incident takes place (fire, hurricane, earthquake, tornado, bio-terrorism, or other man made) through the time that basic emergency human and community needs have been met through rescue operations, mass shelter, mass feeding, and overall stabilization of the disaster-affected community.

*Recovery:* Disaster recovery follows the disaster response period and may extend for several years after a disaster. Disaster recovery relates to the collaborative efforts of individuals, communities, all levels of government, the private sector, the nonprofit sector, and others to re-establish a sense of normalcy, development, and growth in a community affected by a disaster.

The volunteer management tasks that need to be performed locally during these phases of the disaster management cycle require the recruitment and training of an in-hospital Disaster Volunteer Coordinator (DVC) who will be familiar with the hospital's disaster plan and its manpower needs. This person

needs to be integrated or connected to the Incident Management System (IMS) command and control structure of the hospital. The ideal person for each hospital may differ. Ideally, this should be a person already on staff and familiar with the workings of wthe organization.

## Phase 1 and 2 Mitigation and Preparedness

During these predisaster phases, the DVC will have the following tasks[8]:

1. Recruit physicians, nurses, paramedics, physiotherapists, social workers, and other required hospital personnel. This can be done using professional associations to act in disaster situations. For example, the Canadian Medical Association may be used to contact all local physicians interested in disaster response.
2. Register the volunteers in a database that would include key information such as a contact process, definition of the volunteers skill set, etc. (see Appendix A). All medical professionals will be asked to bring proof of licensure or professional association affiliation and, if applicable, malpractice insurance. This database will become the list of affiliated volunteers.
3. Coordinate the training of the above personnel for disaster situations including regularly informing various medical and professional associations of meetings and updates on disaster management.

   The DVC could also be party to the organization and development of a training/mock disaster event organized at least once a year as part of a larger medical conference. This has many proven benefits including reviewing the handling, structure, implementation, and barriers to care in disaster situations.[4]

   Appendix L is a role-play exercise to be organized by the DVC at the hospital, involving the setup of a volunteer recruitment center. This exercise should be conducted before a disaster event and should be reviewed and updated regularly.[8]
4. Develop a public information plan for deployment in a disaster, letting potential unaffiliated volunteers know how to get involved. They should be educated about where they are needed and where they are not (e.g., advised NOT to go directly to hospitals to offer help), where to present for registration, what to bring with them, and what needs are still yet to be met. This may require writing press releases for quick editing and dissemination to local and regional media after a disaster, having a dormant website that can be easily activated, pretaping of public service announcements (PSAs), and so on. As well, securing a commitment for a complimentary toll-free number is advised.
5. Investigate the legal aspects with respect to liability of volunteers in disaster response. This should be done in conjunction with the hospital's legal counsel.
6. Regularly attend local emergency planning committee meetings.
7. Build a community network of civic, fraternal, and other groups encouraging their members to affiliate with a local disaster response organization and to become trained. This would be part of a larger effort to educate local coalitions regarding their role of referring unaffiliated and affiliated volunteers.

8. Pursue mutual assistance plans with their counterparts in neighboring regions.
9. Develop a volunteer referral plan. This would include:
   a. A task list of jobs to be given to volunteers and the criteria for candidates to fill the position.
   b. Projected schedule of shifts required with number of personnel should the hospital be required to operate at full or extended capacity around the clock.
   c. Deployment process whereby volunteers can be contacted, briefed, and deployed to their tasks, tracked during their tasks, relieved of duty at the appropriate times and otherwise supported (i.e., provided food, shelter, and other needs, e.g., childcare, elder care, pet care, etc.).
10. Recruit, train, and orient volunteer staff to operate the Volunteer Registration Center (VRC).
11. Coordinate with in-hospital and out of hospital professional groups (physicians, nurses, physiotherapists, social workers, respiratory therapists, etc.) to develop a general outline of shift structure for each specialty in the event that extra coverage is required in a disaster.

    Students or those under training in these various fields can be allowed to work in disaster events but only at the discretion of each of the department chiefs and with close supervision. They should also be encouraged to call the Volunteer Registration Center at the time of an event to see if their skills can be better utilized elsewhere.

    Residents, fellows, and those with advanced schooling in a particular medical field should be encouraged to undertake training seminars in disaster medicine. They can then be registered as affiliated volunteers with their skills updated yearly on databases.
12. Link with business groups and potential partners in the area to plan for donated goods and services to future response and recovery efforts. These might include universities, youth groups, schools, ethnic associations, civic associations, foundations, faith-based organizations, special needs groups, voluntary agencies, and senior programs along with hospitals.
13. Review community demographic information for implications regarding the management of unaffiliated volunteers. This could include common languages spoken in the community, age structure, etc.
14. Establish a Volunteer Registration Center (VRC) deployment plan which will include equipment, transportation, communications, and deployment.

## The Volunteer Registration Center (VRC)

The VRC provides a place where large number of volunteers can be efficiently processed and referred to agencies or departments needing their services. It fulfils 3 key tasks: registration of volunteers, determination of needs, and documentation of deployment.

For each person presenting or contacting the VRC, staff must determine the volunteer's skills and interests, their ability to do the assigned work, available time, and limitations. These specifications should be added to the Volunteer Registration Forms and entered into the database. All medical professionals seeking to register as volunteers but who have not yet done so will be asked to bring proof of licensure, malpractice insurance, and other professional membership. See Appendix A for Disaster Volunteer Registration Forms used for preregistering or creating affiliated volunteers and for registering spontaneous or unaffiliated volunteers, Release of Liability Statement, and Appendix B for a safety training information form.

Please note that all the forms in this document are meant for guidance only and should be reviewed by the appropriate hospital and local authorities.

For each *request* for a volunteer, the VRC has to define the requesting agency/or the hospital, and department, with the name of the supervisor to whom they should report and who will be responsible for their safety briefing and enter the Requests for Volunteers into the database. The VRC should remind the agency/department that it is their responsibility to brief the volunteer.

For each *deployment*, the VRC must provide the volunteer with identification tags or bracelets with the date and agency/department to which the volunteer was referred, document of volunteer registration, fill in a referral form for volunteer to take on site, advise the volunteer of where and to whom to report, close out the completed requests, and provide a basic safety briefing, when appropriate. However, all volunteers should have a basic review of universal precautions and other relevant infection control protocols. Note that for each deployment to a specific area, it is the responsibility of the receiving agency or department to give specific job training to all volunteers and keep complete and accurate records of all such training.

Other tasks that will be fulfilled by the VRC will include keeping a detailed account of expenses, to be reported to the financial arm of the IMS (see Chapter 5), generating updated reports of volunteers available, unfilled requests and other reports as required and staffing the telephones so as to take calls from individuals and groups wishing to volunteer and from organizations needing volunteers.

See Appendix H for a floor plan for the VRC and Appendix G for an outline of job descriptions, types of supplies, and equipment required for each task, sample sign-in and sign-out sheets for employees and volunteers, expenses incurred by the VRC/VCA, and signage required for the VRC.

## Phase 3—Response

In a disaster, the DVC in conjunction with the hospital EOC would perform the following:

1. Implement the above Affiliated and Unaffiliated Volunteer Management Plan.
2. Deploy the Volunteer Registration Center (VRC) to receive volunteers and begin the registration process. Paid staff and a few key volunteers should be trained to set up the VRC, in case it becomes necessary.
   a. All medical professional affiliated volunteers not otherwise preassigned to a task will call and/or be registered at the VRC first. The VRC will have a database confirming CMPA, CPSO, RN degree status, etc, registration before the disaster. The VRC will note their availability, location, and contact information.
   b. Volunteer staff who have already been told to deploy to a specific task will call in to register so that the VRC knows that the task is staffed.

The VRC will then coordinate supplies, food, and relief staffing for that position for as long as it is filled by a volunteer.

c. All other affiliated and unaffiliated volunteers should report to the VRC for registration.

3. Open to/the VRC to request for volunteers.

4. Deploy and support the volunteer force.

*Note that public information should only come from the public relations officer (See Chapter 5 on IMS structure) assigned to the hospital or region and not the VRC.*

## Phase 4—Recovery

During the recovery phase, the tasks of volunteers may change but the process of managing volunteers will stay the same. It is important to follow this framework not only to document volunteer efforts, their financial impact, and overall efficiency, but also this documentation can be used eventually to thank volunteers both individually and as a group.

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# Appendices

| | |
|---|---|
| Appendix A | Volunteer registration form |
| Appendix B | VRC safety training and attendance record |
| Appendix C | VRC sign-in sheet |
| Appendix D | Request for volunteers sheet |
| Appendix E | Disaster volunteer referral form |
| Appendix F | Work site sign-in/sign-out record |
| Appendix G | Job action sheets |
| Appendix H | Sample VRC layout |
| Appendix I | VRC signage |
| Appendix J | VRC tracking forms |
| Appendix K | Volunteer recruitment letter |
| Appendix L | VRC exercise set-up, briefing and play |
| Appendix M | Volunteer instruction handout |
| Appendix N | Memorandum of agreement |

# Appendix A – Disaster Volunteer Registration Form

**(Please print clearly. Submit at Volunteer Reception Center or fax to _____)**

Mr.__ Mrs.__ Ms.__ Name_____ Birth Date_____ Day Phone_____

E-mail address _____ Evening Phone_____

Home address _____ City_____ Province ____ Postal Code _____

Emergency Contact _____ Relationship _____ Emergency Phone_____

Your Occupation _____ Employer_____

Business Address _____ City _____ Province ____ Postal Code _____

Are you a year-round resident? ____Yes ____No Months you are available _____

If you have any health limitations, please explain_____

I am willing to volunteer in: ____ this city ____ neighboring city ___ anywhere in this province ___ anywhere in Canada

Are you currently affiliated with a disaster relief agency? If yes, name of agency: _____

Special skills and/or vocational/disaster training: _____ _____

Are you a health care professional (as defined by the Regulated Health Professions Act or equivalent legislation)?

____ Yes _____ College registration number or equivalent (attach photocopy)

____ No _____ Malpractice insurance (attach photocopy)

**SKILLS: Please check all that apply.**

MEDICAL

____ Doctor Specialty:

_____

____ Nurse Specialty:

_____

____ Resp. Technologists

____ Physiotherapy/Occ. Health

____ Lab Technician

____ Diag. imaging technician

____ Speech pathology

____ Pharmacists

____ Chiropractors

____ Massage therapists

____ Emerg. medical cert.

____ Mental health counsel.

____ Veterinarian

____ Veterinary technician

COMMUNICATIONS

____ Hotline Operator

____ Own a cell phone

#_____

____ Own a skyephone

#_____

____ Public relations

____ Web page design

____ Public speaker

____ Other:_____

*(continued)*

Language other than English:

____ French

____ German

____ Italian

____ Spanish

____ Ukrainian

____ Hindi/Punjabi

____ Chinese

____ _____

____ _____

OFFICE SUPPORT

____ Clerical-filing, copying

____ Data entry software:

_____

____ Phone receptionist

SERVICES

____ Food

____ Elderly/disabled asst.

____ Child care

____ Spiritual counseling

____ Social work

____ Search and rescue

____ Auto repair/towing

____ Traffic control

____ Crime watch

____ Animal rescue

____ Animal care

____ Runner

*(continued)*

STRUCTURAL

____ Damage assessment

____ Metal construction

____ Wood construction

____ Block construction

Cert. #_____

____ Plumbing

Cert. #_____

____ Electrical

Cert. #_____

____ Roofing

Cert. #_____

TRANSPORTATION

____ Car

____ Station wagon/mini van

____ Maxi-van, capacity_____

____ ATV

____ Own off-road veh/4wd

____ Own truck, description:_____

____ Own boat, capacity_____

Type:_____

____ Commercial driver

Class and license _____

Camper/RV, capacity, and type_____

LABOR

____ Loading/shipping

____ Sorting/packing

____ Clean-up

*(continued)*

| |
|---|
| ____ Housekeeping<br>____ Portering/Pt. transport<br>____ Operate equipment<br>Types:_____<br>____ Have experience supervising others |
| EQUIPMENT AVAILABLE<br>____ Stethoscope<br>____ Flashlight<br>____ Other:_____ |

## Disaster Volunteer Registration Form (side two)

### Release of Liability Statement

I, for myself and my heirs, executors, administrators and assigns, hereby release, indemnify and hold harmless [Coordinating Agency, local, Provincial or Federal governments, the organizers, sponsors and supervisors of all disaster preparedness, response and recovery activities from all liability for any and all risk of damage or bodily injury or death that may occur to me (including any injury caused by negligence), in connection with any volunteer disaster effort in which I participate. I likewise hold harmless from liability any person transporting me to or from any disaster relief activity. In addition, disaster relief officials have permission to utilize any photographs or videos taken of me for publicity or training purposes. I will abide by all safety instructions and information provided to me during disaster relief efforts.

Further, I expressly agree that this release, waiver, and indemnity agreement is intended to be as broad and inclusive as permitted by law, and that if any portion thereof is held invalid, it is agreed that the balance shall, notwithstanding, continue in full legal force and effect.

I have no known physical or mental condition that would impair my capability to participate fully, as intended or expected of me.

I have carefully read the foregoing release and indemnification and understand the contents thereof and sign this release as my own free act.

Signature _____ Date _____

Guardian, if under 18 _____ Date _____

---

### This Section for Office Use Only

Volunteer's credentials were recorded as presented (verification of credentials is the responsibility of the receiving agency or hospital). ❑ Yes _____

_____ Name of Staff

Has volunteer participated in a local disaster exercise? ___Yes ___No If Yes, date of exercise:_____

Date of last review of universal precautions: _____(dd/mm/yyyy)

- ❑ Has Volunteer been fit tested for PPE? ___Yes ___No If Yes, date of fit testing _____ (dd/mm/yyyy) and PPE type N95
- ❑ SCBA
- ❑ Other_____

**Return this completed form to:**

Coordinating Agency name: _____

Address: _____ City: _____
Province:_____

Postal Code: _____ Fax number: _____

This volunteer was referred to the following agencies:

Date Request # ESF or Agency Contact Name Contact's Phone #

_____
_____
_____
_____
_____
_____
_____

Notes: _____
_____
_____
_____

# Appendix B – Safety Training for Volunteers

Presenter: Edit this training for the specific incident.

1. If you will be working outside, dress for the weather. Boots may be helpful, as debris on the ground can be sharp and dangerous.

   Bring work gloves, sunscreen, hat, and any appropriate tools you have. You will be responsible for your tools.

2. Water may be available at your work site, but you are encouraged to bring a personal water container. It is important to drink lot of water while you work.

3. While working, you may have a higher than normal exposure to bacteria. When you take a break, wash thoroughly with the medical soaps provided at the hospital.

4. When you arrive at your worksite, report to your supervisor. You will be warned if there is a possibility of encountering victims. **Follow the instructions given to you at your job site.**

5. The work you will be doing may cause you stress, anxiety, fear or other strong emotions. You are providing a valuable service by volunteering today. Please understand that, by helping, we will not be able to undo the effects of this event. We are each just one person. All we can do is help in our own small ways to assist victims into the recovery process. If you care for another volunteer's animal at home, transport a patient quickly to an X-ray, or hold the hand of one wheelchair bound senior in a shelter, you will have eased a little of the pain.

   Do not feel guilty because you are not able to *fix everything*. Just work your shift, then go home to rest and eat well. Both will help to relieve the stress. **Be sure to attend any debriefing that may be conducted at the end of your shift.**

6. *Older* children can help with the disaster recovery work in *some* areas, but parents must sign a release of liability form for each child under the age of 18. It is recommended that children remain in school, if it is open. *Older* children can participate with parents on weekends.

7. **Follow carefully any instructions given to you at your job site.**

8. **Please attend any debriefing activity provided at your worksite after your shift.**

9. **Make sure you have reviewed universal precautions and have conducted your mask fit testing prior to your job deployment.**

## VRC Safety Training Attendance Record

| Print Name | Signature | Date | Time |
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# Appendix C – Registration of VRC Volunteers

## VRC Volunteer Sign-in/Sign-out Record

| Date | Name | Time In | Time Out | Time In | Time Out | Total Hours |
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# Appendix D – Request for Volunteers

(Complete one form for each job description.)

Request # _____ Today's Date: _____ Start Date: _____
End Date: _____

Title of Volunteer Position: _____

Hospital/Department Name: _____

Hospital/Department Contact: _____

Hospital/Department Address: _____
Phone: _____

Ext: _____

Duties: _____
_____

Volunteers must be physically able to:_____

Number Needed: _____ Dates/Hrs Needed: _____

For this position, volunteers must be at least ____ years of age.

## Skills Needed

| Job Skill # | Description | | Job Skill # | Description |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |

## Follow-up Contacts with Requesting Agency/ Clarification of Need

| Date | Comments |
|---|---|
| | |
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## Volunteers Referred

| Name | Date | Name | Date |
|---|---|---|---|
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Request closed on ____/____/____ Completed ❑ No placements possible ❑ No longer needed ❑

# Appendix E – Disaster Volunteer Referral

Name of Volunteer_____ Date_____

Referred to (agency/hospital)_____ Request #_____

Agency contact name_____ Phone_____

Address of Agency/Site_____

Directions to Site_____

Title/description of volunteer assignment_____

_____

Dates & hours volunteer will work_____

**Note: Verification of volunteer's credentials and selecting an appropriate and safe task is the responsibility of the agency receiving the volunteer.**

**VRC Staff Initials:**

| Interview | Data Coord. | Safety Brief |
|---|---|---|

# Appendix F – Work Site Sign-in/Sign-out Record

**Location**_____

**Date**_____

**On-site Supervisor**_____

**Local Phone**_____

**Please read before signing**: I have received safety instructions for working at this site and agree to follow the safety procedures and the directions of the site supervisor.

Sign your name, times in & out, and the type of work you did today (e.g., medical care, cleanup, repair, sorting, etc)

| Volunteer's Name | Time In | Time Out | Time In | Time Out | Total Hours | Type of Work |
|---|---|---|---|---|---|---|
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# Appendix G – Job Action Sheets

## Job Action Sheet – VRC Director

Your job is to oversee the operation of the Volunteer Reception Center. **You will:**

- Clearly designate one entrance and one exit
- Set up the room for efficient flow of volunteers and information
- Brief and assign tasks to staff and volunteers of the center
- Monitor the operation and make staffing changes when necessary
- Maintain all records of safety and job training provided to volunteers and hours worked in the VRC by employees and volunteers
- Turn all records in to the **Finance Department** weekly or at end of the activation

**You should meet and thank all volunteers who help in the VRC and instruct them to sign in and out on the Volunteer Sign-in/Sign-out Record daily.**

**Items needed:**

- ID badge
- Tables and chairs (see sample room layout (Appendix H) for details)
- Office supplies and forms to stock your VRC for the first 2–3 days
- Items on the Supplies and Equipment lists

## Job Action Sheet – VRC Greeters

Ideally, you will be working with a partner, orienting volunteers inside and outside the volunteer entrance. **Your job is to greet people with a friendly and firm demeanor, determine the purpose of their visit and direct them accordingly**.

- **If they are there to volunteer, thank them, give them a "Volunteer Instructions" sheet and ask them to fill out a registration form. When the form is completed, direct them to the next available interviewer at Station #2. If no interviewers are available, direct them to the seating area and put their registration form in queue for the next available interviewer.**
- If they are media personnel, direct them to the Public Information Officer (PIO).*
- If they are disaster survivors, refer them to the nearest care facility.
- If they have food, clothing, etc., to donate, refer them to the appropriate agency, unless it is food for the volunteer reception center staff.

If there is a long wait, some volunteers may not understand the reason and may become impatient. **Please thank everyone for volunteering, briefly explain the process** and ask everyone to be patient or to come back later.

**Items needed:**

- ID badge
- Sign (Station #1 Registration)
- Table or clipboards and chairs for volunteers to use for filling out their forms
- Supply of "Volunteer Instructions" handouts (Appendix M)
- Supply of Disaster Volunteer Registration Forms (Appendix D)
- Pens
- Flag or hat to summon runners

*Note: There may be a PIO dedicated to the VRC. If not, then redirect them to the PIO at the Disaster Emergency Operations Center.

## Job Action Sheet – VRC Interviewers

**Your job is to do a quick interview of the prospective volunteer and refer him/her to a job at an agency appropriate to his/her abilities and interests. Volunteer requests may be posted on a white board and will be erased as they are filled, or if the center has a computer system, you might also receive a printed list of the current needs.**

**When a new volunteer approaches, ask for his/her registration form. Determine whether the volunteer is affiliated and pre-registered or unaffiliated. With the volunteer, verify the registration forms completeness and accuracy, and use it as a guide from which to inquire more about the volunteer's skills. At the conclusion of the interview, keep the form. When the volunteer accepts an assignment, complete a Referral form filling in all information requested, give it to the volunteer and instruct him/her to report to Data Coordination (Station #3).**

**For volunteers who have pre-registered via the phone bank, (or internet if applicable) they may have a printed on-line/phone bank registration form. You must then verify completeness and signatures.**

Before signaling the Greeter that you are ready for another interview, take a minute to jot down in the "Notes" section anything about the volunteer you feel is important, that the volunteer did not include on his/her registration form (a special skill, an obvious physical limitation, etc.) If your center decides to use the blind field labeled "Office Use Only*," check the appropriate box. Place his/her registration form in the bin or file.

**Key points to remember are:**

- **Disaster registration differs from a "normal" volunteer intake – there is less time to try to fit each volunteer into an ideal assignment.**
- **Refer the volunteer on the spot** if possible – it may be impossible to contact him later. If the volunteer has special training or unusual skills that you think might be needed soon, ask him to wait in the sitting area and to check the volunteer request board for new requests for their specialized skills.
- Be sure to watch for volunteers who would work well in the Volunteer Reception Center.
- It is likely that some volunteers will exhibit the stress of the disaster – an extra measure of patience and understanding is needed.
- You may be called upon to train volunteers to assist with the interviewing.

**Items needed:**

- An ID badge for each interviewer
- Two tables and eight chairs (see VRC floor plan – Appendix H)

**The VRC Director should determine appropriate use of the notes section of the "Office Use Only" field, with input from the local lead agency. It is intended to provide a customizable "blind" field in which special information can be noted about volunteers.*

- Sign (Station #2 Interviews)
- Supply of Referral forms
- Pens
- Flag or hat to summon runners
- Bin or file for maintaining Volunteer Registration Forms

## Job Action Sheet – VRC Data/Agency Coordinator

**Your job is to match the Referral forms to the Requests and to close out the Requests when they have been filled or are no longer needed.** You may have to call an agency contact to clarify the agency's Request. When you speak with an agency contact, record the information on the Request form in the section called "Follow-up Contacts with Requesting Hospital/Department or Agency."

**When a volunteer brings you his/her Referral form, enter his name and the date of the referral on the Request form to which he was referred. Place your initials on his Referral form.** If you have time, call the Hospital/agency contact to let him know who or how many volunteers have been referred. Confirm with the Hospital/agency contact whether you should continue referring volunteers or close out the request. **When a request has been filled, raise your flag or put on the hat to call a runner and ask him to remove that request from the board.**

If a volunteer who has been interviewed but not referred approaches your station, thank them for coming and ask them to please wait in the sitting area in the center of the room. Periodically review the list of unfilled request and unmatched volunteers in an attempt to close requests and use volunteer resources.

**In closing a request – enter the date and reason the request was closed (completed, no longer needed, etc.) at the bottom of the Request form.** If your Requests for Volunteers have been entered into a database, be sure to enter the date and reason the Request was closed as soon as possible. **Place open Requests in one file and closed Requests in the other,** in either numerical order or **alphabetically by hospital, department or agency.**

**Items needed:**

- An ID Badge for each staff member
- Sign (Station #3 Data Coordination)
- Two tables and four chairs
- Phone
- Two sets of files – one for open Requests and one for closed out Requests
- Pens
- Computer, if available, networked to the computers at the Phone Bank station
- Flag or hat to summon runners

## Job Action Sheet – VRC Phone Bank Staff

**You will be handling** two types of **calls**, those **from hospitals/departments/ agencies requesting volunteers** and those from people wanting to volunteer. **The information you record about each call must be complete and in sufficient detail to facilitate matching volunteers to the needs**.

**When you receive a call from a hospital, department or agency, fill out a Request for Volunteers form while you are speaking with the agency caller.** If there is a computer available for entering the needs into a database, Data Entry staff should enter the need as soon as possible.

**Next, call a runner by raising the flag at your station. Ask the Runner to post the volunteer request on the dry erase board in view of the Interviewers (Station #2) and then to give the Request for Volunteers form to the Data Coordinator (Station #3).**

When people call to volunteer, thank them and give them the following registration options:

- If they choose to register on line or by fax (assuming that option is available), they will be e-mailed or called to discuss possible assignments and given further instructions.
- If the caller represents a group that wishes to volunteer together, ask them to be patient while you determine where they can be of most help. It might take one day or several to match them with a need, especially if they are coming from out of town. Post the caller's inquiry on the board behind the Phone Bank.
- If you believe that the caller might not be an appropriate fit for the hospital setting that you are affiliated with, consider referring them to your provincial public health volunteer recruitment center or other appropriate agency.
- When a match (a mission) is found for that volunteer, e-mail or call them back and schedule a time for them to come to the VRC to sign their on-line registration form, pick up their referral form and ID bracelet(s), and attend a safety briefing. Make sure that the volunteer's on-line registration form is waiting with the Interviewers (Station #2) on their arrival date.
- If they choose to register in person at the VRC, they will be given instructions when they arrive.

**Items needed:**

- An ID Badge for each staff member
- Sign (Phone Bank)
- Supply of Request for Volunteers forms

- Push pins or masking tape
- Two tables and four chairs
- Phones
- Pens
- Flag

If the VRC resources allow, volunteers may be registered on the telephone and called to be interviewed/safety briefed in the VRC once a specific task is available.

## Job Action Sheet – VRC Data Entry

**Your job is to enter the information from the Volunteer Registration and Request for Volunteers forms into the database** so that there is an accurate record of who participated in the recovery effort, what kinds of work they performed and when. The computer will assign a number to each Registration and Request, which must also be hand-written on the paper forms.

After the initial influx of volunteers has subsided, you may have time to begin entering the referrals recorded on the Request forms and to close out the completed Requests. As needed by VRC staff, print updated lists of the unfilled Requests and ask a Runner to distribute copies to Phone Bank staff, Data Coordination, Interviewers and, if requested, the VRC Director.

**Even if you are familiar with the software being used by the VRC, please ask for a brief orientation before beginning your first shift.** Accuracy is more important than speed.

**If you have difficulty using the computer, please ask for help immediately. Do not attempt to fix the problem yourself.**

**Items needed:**

- An ID Badge
- One table and two chairs
- Printer
- Pens
- Flag
- One or more computers (multiple computers should be networked to provide all users access to information on the status of volunteer requests and the availability of volunteers.)

## Job Action Sheet – Volunteer ID Staff

**Ask if the volunteer for his/her Referral form.** If they have not been referred, thank them for coming and ask them to please wait in the sitting area in the center of the room.

**Clearly write on the ID wristband the name of the volunteer, dates he/she will be working, and the name of the agency to which the volunteer was referred, as shown on their Referral form. Place the ID wristband securely on the volunteer's wrist.**

**Explain to the volunteers that the ID will be "good" only for the date(s) written on the band. Authorities will not permit them to enter any of the disaster impacted areas on any other day, without a current ID wristband. If volunteers plan to work more than one day, you may write the beginning and ending dates of their service. Thank them for coming and direct them to Station #5 Safety Training.**

**If you need assistance, please raise your flag or put on the hat to summon a Runner.**

**Items needed:**

- An ID Badge
- Two tables and four chairs
- Sign (Station #4 Volunteer I.D. Tags)
- Supply of volunteer ID wristbands
- ID bracelet tool, if required
- Markers
- Scissors
- Flag or hat to summon runners

## Job Action Sheet – Safety Trainers

**Your job is to brief all new volunteers on what to expect at their job sites, how to be safe while volunteering and how to take good care of themselves after their experience. When a small group has gathered, thank the volunteers for offering to help. Pass around a clipboard with an attendance sheet (Appendix B) and check to be sure that all participants have signed it.**

**Be sure that the volunteer has had a recent review of universal precautions, and direct them to the appropriate station if this is not the case.**

**Read the entire Safety Training sheet slowly, emphasizing the importance of following supervisors' instructions at the worksite.** Encourage everyone to attend a debriefing, if available, at the end of their shift. Ask if there are any questions. If a question arises to which you do not know the answer, put on the hat to summon a runner. Ask the runner to summon the VRC Director or other VRC staff to answer the question.

Some volunteers will be required to take additional training for their particular work. Direct those volunteers to where that training is provided. When your briefing is concluded, explain where the volunteers should meet the transportation to their worksites, if transportation is provided.

**File the attendance sheet for each class in the folder** and turn them in to the VRC Director daily. If the content of your safety briefing changes (new material is added or safety instructions change), staple a copy of the new safety training script to the attendance sheet of the first class in which the new script was used. **Maintenance of these records is important to help protect the Coordinating Agency and local disaster officials from liability, should a volunteer be injured on the job.**

**Items needed:**

- An ID Badge
- Sign (Station #5 Safety Training)
- 10 or more chairs, preferably in a semi-circle so participants can see one another
- Clipboard with attendance sheets
- Pen
- Stapler
- Flag or hat to summon runners
- List of additional training required by specific worksites, training locations and instructors
- A supply of Safety Training handouts

## Job Action Sheet – Runners

**Your job is to carry information from one station to another within the VRC. When a station needs you to pick up forms,** restock their supplies or escort a volunteer from one place to another, **they will signal you by raising a flag or putting on a hat at their station.**

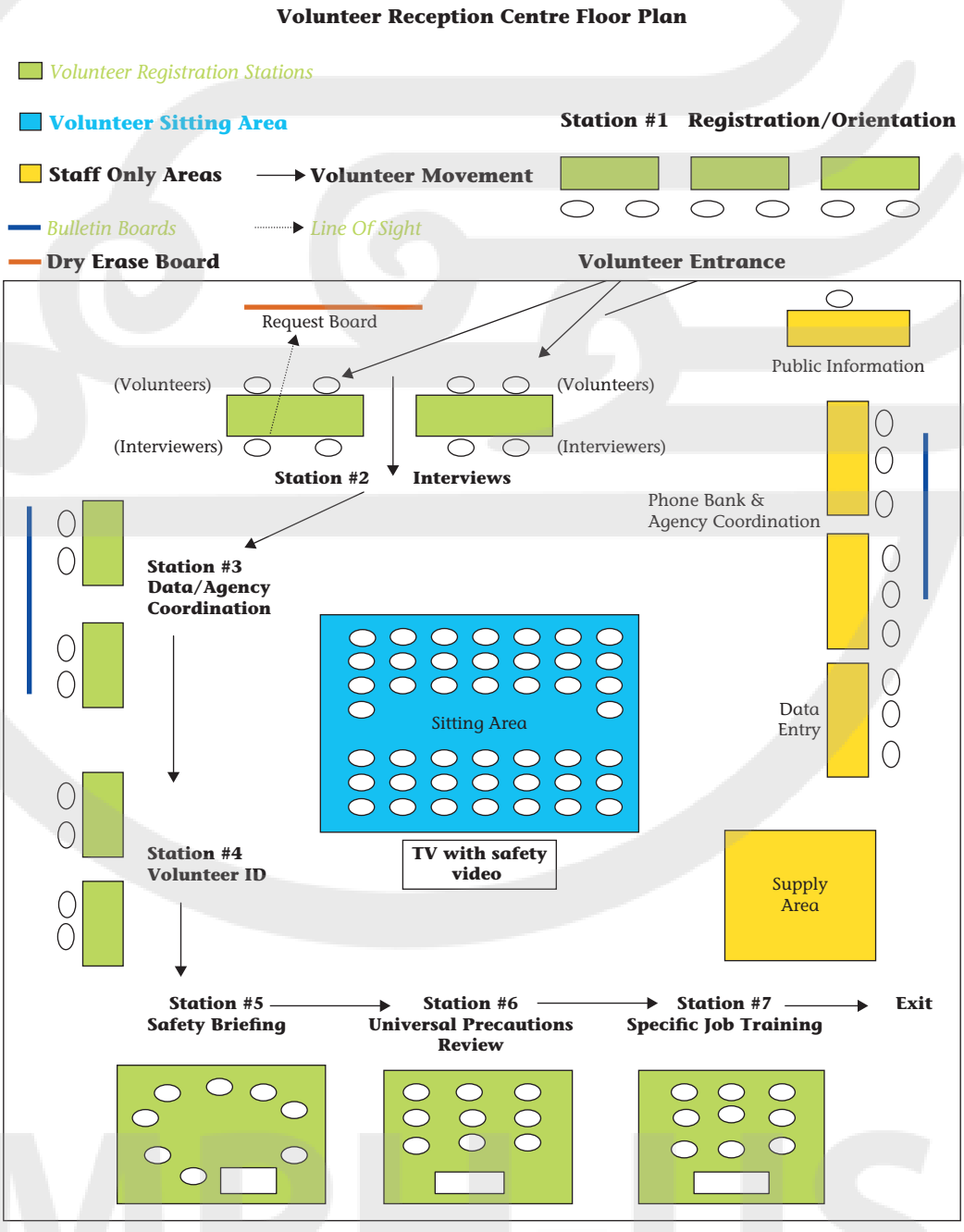
**Please watch carefully for this signal and respond promptly, in order to keep the information and volunteers moving smoothly through the registration and referral process.**

**When you are asked to post a new Volunteer Request on the board, be sure to use only the markers provided and write neatly and large enough so that the interviewers can see the requests clearly. After posting the request on the board, give the Request form to the Data Coordinator (Station #3).**

**Items needed:**

- An ID Badge
- Dry erase marker or water soluble marker (depending on the type of board available)
- Dry eraser or damp sponges

# Appendix H – Volunteer Reception Center Floor Plan



# Appendix I – Signage for Volunteer Reception Center

You will need one enlargement, unless otherwise specified, for each of the 17 station or directional signs shown in the left column. All signs should be laminated and large enough to be read from across a large room.

| Signs Needed | Where to Post |
|---|---|
| **Volunteer Registration Center (2)** | On street visible from either direction |
| **Station #1 Registration** | Registration/orientation area |
| **Enter** | Volunteer Entrance to VRC |
| **Station #2 Interviews** | Interview Area visible from Volunteer Entry |
| **Station #3 Data/Agency Coordination** | Data Coordination visible from Station #2 |
| **Station #4 Volunteer I.D. Tags** | Volunteer ID area visible from Station #3 |
| **Station #5 Safety Training** | Safety Training visible from Station #4 |
| **Station #6 Universal Precautions** | Universal Precautions Review visible from Station #5 |
| **Station #7 Specific Job Training** | Specific Job Training visible from Station #6 |
| **Exit** | Exit visible from Stations #6 and #7 |
| **Staff Only (2+ as needed)** | Staff rest area, supply area, etc |
| **Phone Bank** | Agency Coordination area |
| **Current Needs** | Dry erase board in Interview area |
| **Offers of Volunteer Help** | Top left of bulletin board in Agency Coord |
| **Individuals** | Beneath "Offers of Volunteer Help" sign |
| **Groups** | Beneath "Offers of Volunteer Help" sign |
| **Other Resources** | Top right of bulletin board in Agency Coord |
| **Public Information Officer** | Public Information Officer's Table (if deployed in VRC) |

# Appendix J – VRC Tracking Forms

## Expenses Incurred by VRC Coordinating Agency in Response to Disaster

Name of Event:_____ VRC Opened? Yes ❑ No ❑

**Save all receipts** and place them in an envelope with this form and turn in to VRC Director.

| Date | Item | Price | Quantity | Total | Auth. by |
|---|---|---|---|---|---|
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# Appendix K – Volunteer Recruitment Letter (for volunteers affiliated elsewhere)

Date

Dear Happybrook Hospital (for example) Volunteer

Thank you for your continued dedication to volunteering for Happybrook Hospital. Our organization has entered into a cooperative agreement with the Volunteer Center to support any disaster relief efforts that might become necessary in our community.

In the event of a disaster our office may close temporarily. Should this occur, we would like you to consider volunteering instead as a disaster relief worker through the Volunteer Center.

If you are interested in participating in a disaster relief effort, please fill out the enclosed enrollment form and return it to me or to the Volunteer Center. If a disaster occurs, you will be informed how/where to contact the Volunteer Center to get your disaster volunteer assignment.

Pre-disaster training is available to volunteers willing to help to operate a Disaster Volunteer Reception Center or to affiliate with a recognized disaster relief agency.

There are many kinds of needs in the aftermath of a disaster for both physical labor and less strenuous jobs. Your support of our community in such an effort will be tremendously appreciated.

Sincerely,

Volunteer Coordinator

Happybrook Hospital

# Appendix L – VRC Exercise Set-up, Briefing & Play

**Exercise Set-up (before participants arrive)**

- ❑ Arrange VRC Station tables and chairs for smooth flow of people through separate entrance and exit if available (see suggested floor plan)
- ❑ Distribute pre-packaged envelopes of materials needed at each Station
- ❑ Tape signs on walls over the VRC Stations
- ❑ Tape Job Descriptions to tables at each Station
- ❑ Place a hat or flag (to summon Runners) at each Station
- ❑ Tape portable whiteboard (laminated 3'x8' sheet of poster paper) on a wall. (Masking tape is safest.)
- ❑ Write the volunteer requests (alternating colors makes them easier to read) on the whiteboard

**Briefing**

- ❑ As participants arrive, ask them to fill up the chairs at the Stations first, then those in the middle of the room. Ask those at the Stations to quietly read the Job Descriptions taped there.
- ❑ Pass out disaster scenario sheets and Station badges
- ❑ Explain the premise of this training: Disaster volunteers will come to help, whether you have planned for them or not. Hundreds or thousands of unaffiliated (and unplanned for) volunteers will hinder rather than help the traditional response agencies.
- ❑ Discuss who will operate a Volunteer Reception Center, if one is needed locally.
- ❑ Review signs and ask each VRC staff member to explain what happens at their Station.
- ❑ Discuss the need for accurate record keeping. Explain how volunteer hours can be used as match for FEMA reimbursement. (See manual for details)
- ❑ Explain why the VRC doesn't do background checks on volunteers and that such checks are the responsibility of the receiving agency.
- ❑ Pass out volunteer registration forms. Ask each person to fill out one with their real-life information, and a second for a new persona (be creative!) with new skills.

**Begin the role play exercise**

- ❑ Begin processing volunteers, watching to be sure Runners respond as needed.
- ❑ To keep the play moving smoothly, Exercise Facilitator(s) and the VRC Director should respond quickly to raised hands, confused expressions and any signs of frustration in your participants.
- ❑ If a question pertains to only that one Station, such as clarification of the Job Description, try to answer it on the spot.
- ❑ For questions that seem to involve more than one Station, say something like "That is a valid question and a very important point. Could you please bring it up again when we stop the play to discuss some of these issues?"
- ❑ Pause the play once or twice as needed. Encourage participants to ask their questions, voice concerns, etc. (Often the problems are caused by forms not being completed properly.) Ask participants to suggest solutions to the issues and respectfully discuss the merits of all ideas.
- ❑ Stop play 15–20 minutes before the scheduled end of your training. Lead a discussion of the Post Exercise Questions. Answer participant questions. Ask each to complete an evaluation form.
- ❑ Reiterate the importance of this planning and training; thank all participants for their valuable input.

# Appendix M – Volunteer Instruction Handout

1. Reception Area: Please fill out a registration form and proceed as directed to an interviewer at Station #2.
2. Interview Area: Interviewer will take your form, talk with you about your skills and refer you to an agency needing your help. Next take your Referral form to the Data Coordinator (Station #3).
3. Data Coordination Area: Coordinator will record and initial your Referral Form and, if possible, notify the agency to expect you. Take your Referral form to the ID area (Station #4).
4. Identification Area: You will receive an ID bracelet that will allow you to enter restricted areas during the day(s) written on ID. Proceed to Safety Briefing area (Station #5).
5. Safety Briefing Area: You will be given special instruction about safety, security & transportation. You may be directed to Station #6 for additional job training.
6. Specific Job Training: Some jobs will require extra orientation or training that will be provided by the agency to which you are referred.

Thank you for volunteering!

# Appendix N – Memorandum of Agreement between (Volunteer Center Name) and (Community Agency Name)

Purpose: To ensure the maximum participation and utilization of unaffiliated volunteer relief workers and to meet our community's need for the effective management of those volunteers in the event of a disaster within the hospital setting.

The Volunteer Registration Center agrees to provide:

- Orientation for Agency staff and volunteers on disaster volunteerism
- Review of Universal Precautions and Mask Fit testing for all volunteers
- Sample forms and letters to be used by (Community Agency) to encourage their volunteers to become disaster relief workers
- Periodic updates on local planning regarding disaster volunteerism
- Notification of training or exercises relevant to the operation of a Disaster Volunteer Registration Center
- Referral of unaffiliated volunteers, as available after a disaster, to (Community Agency) to meet the post-disaster needs

(Community Agency) agrees to:

- Identify the agency's potential post-disaster roles/needs for unaffiliated volunteers
- Send a letter to all agency volunteers explaining the organization's Memorandum of Agreement to support a disaster relief effort should the need arise
- Notify agency volunteers of training or exercises relevant to the operation of a Disaster Volunteer Reception Center
- Encourage interested volunteers to take pre-disaster training and become affiliated with a relief agency
- Encourage volunteers who are not interested in pre-disaster training but would help in a disaster to utilize the VRC to become involved in a relief effort
- Promote agency, staff and family disaster preparedness

This agreement will take effect upon the date it is signed by representatives of both organizations. This Memorandum of Agreement may be amended upon agreement of both parties or terminated by either party with 30 days written notice.

| | |
|---|---|
| Director, Volunteer Registration Center (Organization) | Director, (Community Agency) |

Chapter 8

# Preparing for Mass Gatherings

By Katherine Rouleau, MD
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# Preface

The structure, organization, and management of medical services for large events are a vast and evolving field. Over the past decade, a host of reports, guidelines, and articles have been published on this topic. This chapter does not seek to repeat that extensive body of work. Rather, we propose a basic framework from which to approach the organization of medical services at large gatherings. This framework, which follows a W5 approach, considers in turn the what? (types and levels of health services), who? (health services providers at large gatherings), where? (points of care), when (planning, deployment, and wrap up), and how? (essential supports) of necessary and appropriate medical services planning at large gatherings.

To illustrate the concepts proposed in this chapter, examples are drawn from the organization and implementation of medical services for World Youth Day 2002 (WYD2002), a 6-day event that included a number of large gatherings ranging from 250,000 to 850,000 participants in Toronto, Canada, in July 2002.

Many of the sections of this chapter, in fact, deserve an entire chapter of their own. This discussion can thus be considered one of many building blocks toward developing the tools and strategies that will enable and preserve the safety and well-being of people as they come together in large numbers. While the backdrops of these gatherings have and will continue to span a wide range of circumstances, locations and spirits, the provision of quality medical services to the participants of large gatherings acknowledges what they all share, namely the draw of humanity to come together.

The principal author (KR) wishes to thank for their support, insight, and expertise the Canadian Conference of Catholic Bishops and the leadership of WYD 2002, St-Michael's Hospital, Toronto EMS, Toronto Public Health, Dr. Dan Cass, and the members of the WYD 2002 Health Committee (Mr. Robert Burgess, Mr. Walter Chandon, Dr. Bonnie Henry, Dr. Doug MacPherson, and Mr. Ric Rangel-Bron).

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## Organization of Medical Services for Large Gatherings

For the purpose of this chapter, a mass gathering (also called a large gathering) refers to "the temporary collection of at least 25,000 individuals at one site or location for a common purpose."[1,2] Mass gatherings encompass a wide variety of events including indoor and outdoor functions, concerts, sports, and religious gatherings. These may last anywhere from one hour to several days or even weeks. Each type of event draws a particular crowd with its own demographic composition and behavior pattern. Consequently, large gatherings present various levels of risk and various ranges of morbidity and mortality patterns. Because of this wide range of factors, planning medical services for a large gathering can be challenging.

In this chapter, we consider in turn 5 of the key elements of a health services plan (HSP) for large gatherings. These include the following:

1. What: the scope of services
2. Who: the types and number of healthcare staff required
3. Where: the number and types of facilities required
4. When: the timing of planning, preparation, staging, care delivery, and wrap up
5. How: key enabling support services described as "the 3 C's" (collaboration/partnerships, command and control, and communication)

Some issues raised below have been more fully addressed in other chapters of this book and are mentioned here for the sake of completeness.

In addition to the relevant literature, the information presented below draws largely from the planning and delivery of medical services during WYD2002. WYD

2002 took place over a 6-day time frame in Toronto during the month of July 2002. It involved spiritual and cultural activities aimed at youth aged 16 to 35.

Most of the activities of WYD2002 were held in 2 large venues. The first 4 days included conferences, cultural and spiritual events held at Exhibition Place, a large fair ground in downtown Toronto. During the weekend portion of the event, an estimated 750,000 participants gathered at Downsview Park, a former military airport located north of the city centre, where activities spanned 34 hours. Participants started the day with a 5 to 7 kilometers pilgrimage walk to Downsview Park, trickling into the venue from early morning to early afternoon. Various spiritual and cultural events were presented throughout the day and culminated in a youth Vigil hosted by Pope John Paul II. Participants then stayed on-site overnight, sleeping outside. On Sunday morning, the crowd swelled to 850,000 as the general public joined the youth for a Papal Mass presided by the Holy Father.

## The Bigger Picture and Key Preliminary Steps

It is a fact that mass gatherings, as significant as they are to their organizers and participants, occur in a much broader social, economic, and civic context and may not bear the same relevance to other potential stakeholders. In the case of WYD 2002, for example, although many saw the Pope's visit as a significant spiritual and cultural highlight for the City of Toronto and indeed for Canada, many others focused primarily on the burden and chaos resulting from having such a large influx of visitors and dignitaries to the city in a short period of time. Given the wide ranging impacts of such events, the very first task in planning for medical services for such large gatherings is to clarify the goals of the HSP.* This seemingly obvious first step is actually far more complex than might initially appear. One of the challenges facing those responsible for the planning and provision of medical services at large gatherings is that their portfolio is rarely the focus of the event. In fact, although this is becoming less common, in many cases, medical services are an afterthought. The implication here is that those organizing the event itself might not recognize the logistical, clinical, ethical, and organizational implications inherent in the planning and delivery of medical care to such large groups.

### Step 1

Before the details of the medical services plan are developed, it is suggested that a preliminary plan including the following elements be drafted and approved by ALL the key stakeholders.

1. Develop or identify a clear governance structure and paths of accountability

*"Medical services" and "medical care" refer to the delivery of clinical care to individual patients while "health services" is a broader term, which includes preventive as well as complementary health services. In this document, because we consider both public health (surveillance planning) as well as the planning of clinical services, we use medical services, medical care, and health services interchangeably.

2. Develop or identify clear principles, goals, and objectives for the event's medical services program
3. Develop a preliminary budget and clearly identify funding sources
4. Ensure that the above elements receive approval from the event's leadership

Once these key preliminary steps have been completed and agreed upon, those in charge of the planning and delivery of medical care for the event can proceed to the development of the detailed HSP.

# What: Types and Levels of Health Services

## From First Aid to Full Resuscitation

Early in the planning process, a decision will need to be made regarding the types and levels of care to be provided on-site to event participants. These levels of care can be divided into the following:

- Prehospital services: first aid and paramedic services
- On-site (field) hospital services: minor, intermediate, and acute care/resuscitation
- Complementary health services such as massage, acupuncture, and so on

In determining the types and levels of services, it is useful to use existing services available to the general population in ordinary times as a benchmark. Once the "existing baseline" level of services is clearly identified, the medical services team can decide how the event's medical services will compare to the level of services that is usually available.

*Keypoint: In the case of WYD 2002, one of the key principles that informed the medical services plan was "to provide participants with a level of medical services comparable to that available to the general population at local emergency rooms."*

This principle includes 3 key elements. First, it obviates the need to use vague terms such as "basic" or "primary" services that are commonly used to describe the scope of health services at large gatherings. Second, it conveys the ethical imperative to provide participants (and citizens NOT participating in the event) the same level of care as would reasonably be expected by any local resident or visitor. Third, it reflects one of the basic tenets of health services planning for large gatherings, namely to change as little as possible to the way in which medical services are usually delivered locally. **That is to say that optimally functional HSP for large gatherings ideally use the existing expertise and systems already in place**. A large gathering is not the time to try to reinvent the healthcare wheel, especially in the Canadian context where emergency medical services are delivered according to the highest of standards. In unknown circumstances, people (healthcare providers included) typically function best when they perform the tasks they know, in an environment they recognize. Clearly, by definition, a medical services plan for a large gathering will present new and unexpectedelements. This does not negate but rather enhances the need to keep

as much of the elements of the plan as familiar as possible to those who will need to deliver the care.

Once a decision has been made to provide participants with a level of care comparable to that generally available locally, factors such as crowd size, ease of egress (itself related to crowd density, the layout of the venue, access to transportation, etc.), and the proximity of tertiary care facilities will help further determine what specific services actually need to be provided on-site. The type of activities featured during the event and the demographic and behavior profile of the participants will also inform the type of services that should be provided. In the case of WYD2002, for example, previous Papal events had demonstrated that participants tended to delay seeking medical assistance to stay on-site. Many in fact refused to leave the site to seek medical attention having waited long period of time to ensure that they would see the Holy Father. In addition, the crowd size was expected to be above 500,000 for a number of the week's events, especially those held at Downsview Park. The size of the crowd, the limited number of access routes into and out of the site, and the reluctance of individuals to leave the site informed the decision to include a full range of medical services, including resuscitation at Exhibition Place and Downsview Park. This was further supported by the fact that the event took place in July when the emergency rooms of the Greater Toronto Area (GTA) are typically overcrowded.

*Keypoint*: *The decision to offer a full range of emergency services on-site during WYD 2002 was based on a goal to optimize care for the participants and maintain existing Canadian standards of care while minimizing the impact of the event on existing services.*

However, the commitment to treat most participants on-site was carefully balanced with a decision to ensure prompt transportation of the patients to local hospitals for those likely to require more than a few hours of care.

## Beyond medical care

In addition to determining the level of clinical care required/expected at any one gathering, a number of important health-related services should be included in the planning. These services play a key role in mitigating the health risks of large gatherings. We classify them here as surveillance, safety, and security.

### Surveillance

Surveillance is extensively discussed in another chapter. For our purpose, suffice it to say that a clear surveillance plan should always be included in the planning and implementation of a HSP for a large gathering. For international events, this should include international surveillance as well as the monitoring of local sentinel sources. In addition to the local public health authorities who may identify conditions subject to mandatory reporting, other sentinel sources can include local emergency rooms, family physician offices, and pharmacies to tract the sale of over-the-counter preparations for conditions such as diarrhea and fever, for example. In addition, a surveillance system designed specifically to pick up surge incidences in presenting complaints at on-site facilities can play a crucial role in identifying a source of infection or trauma in a timely manner. An effective and efficient surveillance system enhances the ability of the event's health services system to respond in a timely manner. This enhanced responsiveness is particularly important given the many unknown factors affecting morbidity rates and patterns at large gatherings.

## Safety

Optimizing the safety of the site is key to minimizing the demands on the event's medical services. Water and weather mitigation deserve particular attention. The sale of drinking water is frequently used as a revenue-generating tool in large gatherings. It is worth noting that even at low cost, selling water decreases access and increases the risk of dehydration with potentially disastrous consequences on the patient presentation rate (PPR). An integrated water strategy should be developed for all large gatherings. This includes having a sufficient supply of water that is both available and accessible (low or no cost) as well as an effective communication strategy to inform and encourage participants to remain well hydrated. In addition to drinking water, some large gatherings benefit from a strategy to mitigate weather conditions. In hot climates, water sprinklers and shaded areas can go a long way toward minimizing the harsh effects of the sun. In cold and wet weather, shelter and protective blankets can be equally beneficial. Planning for the impact of weather in outdoor events is well worth the effort.

Optimization of the site, venue, and terrain is another key aspect of the safety plan that has a direct impact on the PPR. So-called smart stadiums that can accommodate large and varying flows of people as well as intelligent landscaping for outdoor venues can go a long way toward minimizing injuries such as limb trauma and crush injuries.

> At the end of World Youth Day in Denver in 1993, egress from the site of the final Mass was delayed due to a bottleneck effect at the venue's exit. Participants were tired and dehydrated, having stood in the sun for several hours during the final Mass. The crowd congestion which developed at the end of the Mass resulted in a high incidence of symptomatic dehydration and prompted the organizers to call in the National Guard for the administration of intravenous rehydration to thousands of people.[3]

In addition to illustrating the impact of site design and event programming on the casualty rate, this incident also points to the importance of contingency planning responding to surge demand during large gatherings. This issue is further discussed later.

## Security

Security at large gatherings is a complex issue and is discussed in detail in the chapter on scene safety. We mention it here to highlight the fact that security and medical services are intimately linked and should ideally be planned in concert. One of the most obvious impacts of security on medical services is to secure access to medical facilities for participants and to secure unencumbered egress for those who need to be promptly evacuated from the site. Another aspect is the protection of the healthcare facility and personnel.

Surveillance, safety, and security have direct and potentially major impacts on the demand for health services at large gathering. Individuals responsible for each of these elements should be identified early in the planning process and planning efforts should be coordinated.

# Who: Health Services Providers at Large Gatherings

Once the types of services to be included in the HSP have been identified, the HSP should outline the types and numbers of healthcare providers needed to deliver them. We will focus this part of the discussion on those providing the clinical services and will not discuss those responsible for public health, surveillance, safety, and security.

We identified earlier 2 broad categories of medical services at large gatherings, namely prehospital care and field-hospital care. As mentioned, wherever possible, each of these levels of services should be provided by individuals who are experienced in doing so. In addition to the healthcare providers mentioned below, we should note that a properly functioning field hospital facility will require staff for nonclinical activities such as registering patients, translating, cleaning, and restocking. The number and tasks assigned to nonclinical staff varies greatly depending on the type, length, and site of the event. We will not be discussing this in detail here except to recommend that plans be made to recruit nonclinical staff in numbers proportional to the expected PPR and in keeping with the size of the health facility.

## The Elusive Calculation of Predicted PPR

In 1997, De Lorenzo[4] demonstrated that the prediction of casualty rates, now commonly called the PPR, could NOT be based on size of the crowd alone. Since then, a number of authors have proposed more or less complex formulae to calculate the PPR. Much work still needs to be done to develop a consistently accurate method to determine the PPR, a key step in the planning of medical services for large gatherings. From the standpoint of accountability, it is important that those responsible for the planning of health services for large gathering make use of as much information as possible, both published and unpublished where accessible, in predicting the PPR. Regardless of the formulae or method used to predict a PPR on which to base the HSP, it is recommended that organizers clearly report on how they came to their decision, and include in their plan a contingency element to respond to unexpected surges up to double their predicted PPR. Factors such as weather (temperature, humidity, and precipitation), crowd size, crowd density, type of venue, crowd mobility, age of the participants, the prevalence of drug and alcohol use, and the type of activities of the crowd (spectator, religious, and ambulating) have been found to influence the PPR.

## First Aid Providers

Most, if not all, HSPs for large gatherings will include first aid providers. Although the delivery of first aid is often mistakenly assumed to be so basic as to require little formal training, the effectiveness of first aid is in fact greatly enhanced when it is delivered by a properly trained and experienced individual. In addition to the actual delivery of care, experience in working in diverse settings and in dealing with the public can significantly enhance the capacity of the event's medical system to respond to the health services demand. Experience in triage and communication through existing channels of command is also extremely

valuable in the context of large gatherings. For this reason, clearly identifying an experienced agency to coordinate the delivery of first aid is recommended. In some instances, the size of the event might require the collaboration of several existing first aid organizations in which case clearly identifying the lead agency is important.

## Emergency Medical Services Paramedics

The scope of practice of Emergency Medical Technicians and paramedics varies greatly among countries, regions, and jurisdictions. Furthermore, a single organization can include paramedics of different levels of training and scopes of practice. In terms of their scope of practice, expertise, and professional organization, paramedics are invaluable resources during large gatherings. For the purpose of this chapter, these prehospital providers will be collectively referred to as paramedics, as is the practice in Canada. In the Canadian context, they typically constitute the professional group best adapted to the variable conditions of prehospital care at large events. In addition to their clinical scopes of practice per se, the command and control system used by paramedics is well adapted to respond to health services demands during mass gatherings.

The involvement of paramedics in the delivery of care during large gatherings can be organized in a number of ways. In some jurisdiction, the event organizers (and/or the medical services leadership) can hire paramedics to provide care. In this situation, it is important to clearly outline command and control as well as reporting lines both among the various groups of health services providers as well as between the health services providers and other event programs. The pivotal role of optimal coordination in ensuring the success of healthcare delivery at large gatherings cannot be overstated.

More commonly, paramedics employed by a municipality will be called upon to assist with the provision of care for an event taking place in their area. In large enough events, a number of Emergency Medical Services (EMS) organizations may be called upon to collaborate. In this case, a lead organization should be clearly identified and there again, reporting lines should be clearly established. In some large gatherings, if the casualty rate is not expected to be high, the involvement of the local EMS services might simply require a few additional crews to be deployed according to the usual organizational practices. In large Canadian cities, Emergency Medical Services commonly have policies that dictate how many crews need to be stationed and deployed for crowds of any given size. In larger events, however, EMS organizations might opt to create a quasi-parallel fleet of crews dedicated exclusively to the event. The term "quasi-parallel" is used here because the two are rarely completely separate. Should a major incident occur outside of the event but during that same event, a good EMS system would be able to redeploy crews away from the event to where they are needed most urgently in their territory or vice versa. As said, the establishment of an event-focused paramedic fleet with a dispatch service integrated into the broader local dispatch system provides optimal coordination when events span several hours/days and occur over large geographical areas (e.g., WYD and Olympic Games). For more information on event command and control, please see the chapter on Incident Management Systems.

*Keypoint*: *In the case of WYD 2002, a large number of paramedic crews were assigned to the event. Crews included all levels of paramedics, each with increasing levels of skills and broader scopes of practice. Dispatch for the event was integrated with the city dispatch system, such that a request for EMS assistance was triggered by a 911 call whether the call was placed from a WYD 2002 venue or from the rest of the city. This capitalized on the principle highlighted earlier, which sought to maintain existing practices during the event. Calls placed to EMS were received at central dispatch. The operators quickly identified whether the call was coming from a WYD 2002 venue or not and dispatched the appropriate crew accordingly.*

The presence of EMS crews with increasing level of expertise is also very useful in providing some expandability to the health services system.

> On the second-to-last day of WYD2002, as 850,000 people spent 34 hours in a field for two separate events, the triage area of the main field hospital at Downsview Park was congested by the high volumes of people presenting with heat stroke and dehydration. The observation area of the main field hospital was congested with patients who monopolized a great deal of nursing resources as they received intravenous or oral rehydration while remaining clinically stable. To address this patient flow issue two strategies involving the redeployment of paramedics were implemented. First, paramedics were posted outside the entrance of the hospital to screen, assess and treat the minor problems in patients who were presenting to the main field hospital. This diverted minor health problems away from the limited resources of the field hospitals. Secondly, higher trained paramedics were deployed inside the main hospital, in the overflow area, where they monitored intravenous rehydration of hundred of patients under the supervision of the lead physician of the Base Hospital. This strategy freed both nurses and physicians to attend to other, less stable patients.[5]

## Field Hospital Services

In keeping with our recommendation to plan health services for large gatherings in a manner that maintains existing practices as much as possible, we recommend to have both nurses and physicians to staff field hospitals.

## Nurses

Like many other healthcare practitioners, nurses have wide scopes of practice depending on their training, regulation, and area of experience. They constitute the backbone of a responsive field hospital system as they provide the bulk of the care and have a key role in both triage and reassessment. Our recommendation is to select emergency nurses to work at large gatherings whenever possible. Primary care nurses who are accustomed to seeing a wide range of undifferentiated presenting complaints can also be a significant asset to staff the low acuity area of the field hospital. Furthermore, whenever possible, hiring nurses who are used to working together provides added efficiency and may also enhance quality.

## Physicians

Although some authors have questioned the need for physicians to be present on-site during large gatherings, others have demonstrated that physicians can improve triage decision and affect transportation rates at mass gatherings.[6] In certain

venues and with certain types of events, the presence of a physician on-site might not be essential, especially if there is good access to emergency response with easy evacuation in the case of an acute cardiorespiratory event. In the case of very large gatherings, occurring over long period of time, or with a high predicted casualty rate, having a physician on-site ensures prompt medical attention while minimizing the impact of the event on neighboring emergency departments.

Here again our recommendation is to staff the field hospital with physicians experienced in emergency medicine. At the very least, a generalist physician with experience in treating a broad range of medical problems will be most effective in responding to a variety of presenting complaints. A pitfall to avoid here is to schedule physicians based on their political or social profile. In the context of large gatherings, the climate is often ripe to offer positions as a matter of courtesy, based on some professional hierarchy. It is equally important to remember that first and foremost, the physicians involved need to be hard working, adaptable, good problem solvers, good team players, and, mostly, competent in dealing with a wide range of medical issues. The role of the subspecialist is debatable in providing care at large gathering. With limited space and largely undifferentiated presenting problems of mostly minor and intermediate degrees of acuity, only specialists who have the skills to respond to a wide variety of presenting problems should be considered.

The presence of residents (or physicians in training) at large gatherings can offer a rich learning opportunity for trainees in emergency or family medicine while providing an extra pair of hands, provided the trainees are advanced enough in their training to offer a good level of service without drawing excessively on the supervising attention of the staff.

## Training and Orientation

Regardless of the types and number of healthcare staff recruited to provide health services during a large gathering, the provision of adequate orientation and training, including a manual with key information, can greatly enhance the performance (and satisfaction) of the staff. The chaos inherent to the unfamiliar settings, the varying flux of patients, and the new physical surroundings are challenging for healthcare staff working at large gatherings. Because the demands posed on healthcare staff are already significant, organizers will often refrain from mandating training and orientation for fear of overburdening the staff. In actual fact, an effective training session or at the very least, an introduction to the team and to the physical space will go a long way toward mitigating the challenging conditions of the event itself and will ultimately result in better care and greater staff satisfaction. Providing information to the healthcare staff about reporting and command and control is also essential, because despite best efforts to avoid this, it is likely that staff will be working together for the first time.

## Staff Care

Issues that are often overlooked in organizing health services for large gathering include staff coordination, deployment, and care. Where space permits, having a room dedicated to the healthcare staff, where they can rest and decompress away from the patient area, is important. It contributes to maintaining the energy and the morale of staff under challenging conditions. Showers and cots should be available where possible. Staff meal distribution or access to food outlets as well

as transportation to and from the field hospital should also be considered. In large gatherings, access to the site is often limited and credentialing is required weeks prior to the event. Having a clear plan to stage healthcare staff, distribute ID badges, and then transport them to and from their respective "posts" should be considered. Letting staff know who to go to in case of difficulty is also important.

## Paid Staff Versus Volunteer

The decision to have paid or volunteer staff is typically taken by the leadership of the event itself, not by the medical leadership. Identifying the source (or sources) of funding for medical services and obtaining approval for that portion of the event should occur very early in the planning process. It is a fact that many events rely on volunteers to provide a variety of services, including health services. The use of volunteers is not only seen as a cost cutting measure, but in many instances, getting "members of the local community" involved in an event is seen as a way to enhance participation and buy in. In the current context of security awareness and health consumer expectations, the exclusive use of volunteers, particularly volunteers who may not have the exact skill profile required to fulfill the medical services plan, is falling out of favor.

One cannot overstate the positive contribution of a healthcare staff who is well equipped to address the challenges inherent to large gatherings. For that reason, we recommend that a clear and sufficient portion of the budget of large gatherings be dedicated to the provision of health services including the remuneration of healthcare staff. At the very least, a cadre of reliable and knowledgeable staff should be paid, even if certain less-skilled tasks can be assigned to well-trained and reliable volunteers. In the case of first aid agencies, the individuals providing the care often do so on a volunteer basis, but the organization itself requires funds to function. Their contribution should be remunerated. Paramedics belonging to EMS organizations are typically remunerated for their work according to clear labor agreements. These should be taken into consideration by all members of the health services planning leadership. Nurses and physicians likewise should be remunerated. By their very nature, large gatherings can be associated with chaotic circumstances that present significant challenges to the provision of health services. While there are numerous examples of volunteer nurses and physicians rising to the occasion in the face of dire practice circumstances, it is far easier to maintain leadership and direction over a group of healthcare professionals when they are being fairly compensated for their hard work. And given that unpredictability is among the main threats to the effective provision of health services during large gatherings, any measure that can contribute some predictability and lend weight to the medical leadership and direction is worth considering.

It should be further noted that in some jurisdictions, insurance coverage for nurses is related to whether they are volunteering or being paid and to the location and context of their practice. Health services planers for large gatherings should understand and, where needed, obtain adequate insurance coverage for all healthcare staff early in the process.

## Numbers

An estimation of the number of first aid providers and of paramedics is best left to the organizations that locally coordinate these activities. They possess the data and experience to gage the needs of a given event and are best positioned to estimate the needs. Once the entire health staff plan is drawn, the medical director of

the event should ensure that the proposed numbers of providers for first aid, paramedics, and field hospitals are congruent with the overall plan and PPR and that no one group ends up shouldering a disproportionate amount of work.

With respect to the numbers of nurses and physicians required at large gatherings, the literature offers a wide range of suggestions. We recommend beginning with a rough estimate of the PPR. On the basis on that number and assuming that 10%–20% of presentations will be serious enough to require observation, the number of beds and chairs needed can then be estimated. Next, the location and distribution of these beds and chairs should be determined based on the physical configuration of the site. Once the number of field hospitals and the intermediate and acute beds needed in each field hospital have been estimated, the number of staff required can be calculated based on the staffing ratio of large local emergency rooms. This again reflects our principle to maintain the existing standard of care for the event's participants.

*Keypoint*: *In the case of WYD 2002, for example, we based our calculations on the staffing standards of the emergency room at St-Michael's Hospital in Toronto. We used varying nurse-to-bed ratios in the minor, intermediate, and acute areas, adjusted shifts according to the expected peak times and built in a buffer of a few additional nurses per shift to account for the "unknown." We further tried to schedule at least 2 physicians per field hospital, including the smaller ones, to ensure that the physicians were never "alone."*

In addition to this coarse "formula," the following general factors should be considered in planning for the numbers of nurses and physicians:

1. PPR and acuity rate: The higher the casualty rate, the more staff you need to assess and treat. Although a high PPR by itself may well be addressed by nonphysicians (80% of presentations will likely be minor or intermediate), a higher acuity rate would benefit from the presence of more physicians. A very high acuity rate, one likely to overwhelm the field hospital system, would dictate a need for more paramedics to transport patients off-site.
2. Ease of access to the site: If there is a chance that access to the field hospitals might be limited by crowd density at some point during the event, especially in an event that is predicted to last over 6 hours, additional staff should be scheduled for each shift to avoid burn out and attrition should the next crew be delayed.
3. Inefficiency (Cushion) factor: It is assumed that health professionals working in a new environment with new colleagues and new equipment will be less efficient than in their habitual environment. Although we recommend that the planners of medical services make every effort to create work conditions that resemble the staff typical environment as closely as possible, we recognize that despite the best efforts, field hospitals will constitute a new environment. That novelty, along with the energy and chaos generated by the event itself, is likely to decrease the efficiency of the staff. We therefore recommend that an additional 2–4 nurses be added to each shift when possible. Some planners may consider the nurse assigned to one-on-one nursing for the acute beds to constitute one of those contingency nurses as the likelihood of having patient in the acute beds for prolonged period of time is small. It is expected that should

a patient require acute care or resuscitation, they would be stabilized and then transferred to a hospital.

## Contingency

In addition to the "inefficiency factor" described earlier, the planning of health services for large gatherings should include a contingency plan for the rapid expansion of staff and space in the event of a surge in the demand (see contingency below). Contingency planning is challenging on a number of levels. A very large surge in demand should activate the incident management response (see IMS Chapter) in which case the command and control of the event as well as the deployment of staff and resources would be taken over by the appropriate incident management lead. The challenge comes when demands exceed the planned resources but not in such a dramatic way as to trigger the incident management system. In its most simple formulation, a contingency plan should include a strategy to quickly increase the number of healthcare providers on-site in the event of a surge.

## Recruitment

Once we have established the types of services to be provided on-site and the types and numbers of staff needed to deliver them, a number of strategies can be used to recruit staff. Some agencies that specialize in recruiting emergency room personnel might be able to recruit staff for large gatherings provided the budget allows for such a process. Other events have used general volunteer registration to identify healthcare professionals who then get scheduled to a field hospital. As discussed earlier, this is the least efficient way to plan for healthcare personnel for large gatherings. One method that has been used with success is to partner with emergency departments located in relative proximity to the event and get them to provide entire healthcare teams to the event for any number of shifts. Partnering with a given emergency department to staff one or several shifts offers two advantages. First, it allows a given emergency department, which may be otherwise overrun with event participants, an opportunity to meet the demand for health services on-site without engaging the additional resources involved in using its own facility. Second, it fosters the collaboration of healthcare providers who know each other and ideally who may have worked together previously.

*Keypoint*: *In the case of WYD 2002, emergency departments in over 10 hospitals in the GTA provided teams of physicians, nurses, x-ray technicians, and other nonclinical personnel to staff the WYD 2002 field hospitals. Emergency departments registered for the number of shifts they were able to fill. In some cases, additional staff from the general volunteer database needed to be added to these teams, but a solid core of healthcare professionals who were used to working together provided a safe and effective team to integrate others.*

# Where: Points of Care

Once the types and scopes of services and the staffing detailed have been determined, the location of service delivery can be considered. In actual fact, the issue of location can and often does arise prior to all the others depending

on the configuration of the site. Decisions regarding the location of points of care can be divided into two broad issues namely the number and types of mobile prehospital healthcare units (first aid foot patrols, bike and/or golf cart paramedics, and so on) and the number, size, and location of the field stations and hospitals.

## Mobile Units

By mobile units, we refer here to one or a pair of health providers, typically with a prehospital scope of practice, who circulate over a defined geographic area of the event site to provide health services as close to the location of the "patient" as possible. Mobile units typically circulate on foot, on bicycles, or in golf carts. Some mobile units are "stationed" and mobilize only in response to a dispatch call, whereas others roam the site, ready to respond to health issues as they encounter them. To function optimally, mobile units need to be closely integrated with the rest of the event's health services. This should include a clear and streamlined communication system for command and control and a plan for escalating services from first aid to prehospital paramedic care to on-site transportation to a field hospital and lastly, if needed, off-site transfer. It is also important for roaming teams to have a clear shift schedule as well as a physical home base where providers can return to top up supplies, get hydrated, report in to the leadership, and rest. Similarly, a clear area for staging and deployment of the mobile units is key and should be taken into consideration when planning the space requirement for health services at a large gathering.

## Fixed Facilities

In addition to mobile units, the delivery of health services at large gathering will require a number, and often of a variety of fixed points of care. These can range from a small, preferably shaded or sheltered area, such as a canopy and a few chairs, to a stationed mobile unit (a truck or a van); to a tent, mobile home or reassigned container; to a reassigned permanent building (in part or in its entirety); to the building of a new and dedicated structure. All of these can assume a wide range of dimensions and levels of sophistication.

The size and location of the facilities should be planned based on the expected PPR and the expected flow of the crowd over the course of the event. Access is paramount to the value of medical facilities during large events and a significant element of this access is adequate signage and the ability for participants to locate the facility easily.

In large outdoor events held over a large venue, thought should be given to establishing health stations close to each entry point into the site. Similarly, when large crowds are expected to cover a large geographical area, such as during large concerts for example, positioning smaller health stations infield, in the middle of the crowd but close to access paths, will greatly improve access to health services for participants. Conversely, such a disposition will also allow for greater access to sick participants by mobile teams stationed at those health stations. Larger facilities with more sophisticated levels of care are typically best located at the periphery of the site where off-site transport can be easily achieved if needed.

The number of each type of health facilities should be a function of the configuration of the venue and of the type of event, including the expected

flow of crowds. Events that involve highly mobile crowds over large areas will obviously require more points of care, whereas a stadium in which crowds are sitting for most of the event may not require more than one point of care. (Although organizers of large gatherings taking place in stadiums should plan for surge contingency in the event of a structural collapse or stampede phenomenon as these have been shown to occur with some frequency at sports events, for example.)

## Content: Equipment and Supplies

The equipment and supplies required at various health services delivery points are a direct function of their purpose in the overall HSP of the event.

## First Aid Stations

Facilities dedicated to first aid do not require much in terms of structure and equipment. Shade provided by a tarp or a canopy of some type, seating, and in some cases a cot or two are all that is required. Basic supplies such as adhesive bandages, water, and a few other first aid supplies should be available. Some would argue that making first aid stations too elaborate (and inviting) can result in congestion and overuse from individuals who do not necessarily need attention, but welcome the comfort of respite in the midst of the challenges presented by large crowds. The goal of the facility should be to deliver the right level of care and either discharge the patient promptly (minutes, not hours) or transfer to the next level of care.

## Health Stations

Between the basic setting of the first aid station and the fully equipped field hospital, large gatherings can benefit from the intermediate comfort and sophistication of health stations. These can be equipped to provide care for slightly longer period of time (such as that required for oral rehydration or for analgesic to take effect in the case of a sprain or a headache, for example). They correspond roughly to the scope of practice of paramedics and nurses. This level of facilities can be particularly useful infield to enhance access to care for participants who are not motivated to seek medical attention in a more remote field hospital. When a health station is positioned in the middle of a crowd, steps should be taken to ensure that the staff is safe, well equipped, and well protected from the elements.

## Field Hospitals

By field hospital, we refer here to a facility equipped to function as a Canadian emergency room. The vocation of the field hospital will vary according to the event, the crowd, the venue, and the length of the event. Regardless of these factors, as discussed earlier, the role of the field hospital is to treat as many of the participants on-site as can safely be achieved without delaying the off-site transfer of patients to definitive hospital care when needed.

The issue of how to handle unstable conditions should factor into the determination of the field hospital configuration. For some large gatherings, the event parameters are such that a paramedic response and immediate evacuation are most appropriate. This is particularly true of events where access and egress

to and from the site are not likely to be compromised and where the volume of medical complaints is low. In such circumstances, having a designated paramedic crew to transport patients off-site can be most efficient. However, in other events, the very large crowd, challenging access to and throughout the site and high levels of casualty rates strongly favor the inclusion of resuscitation beds in the field hospitals. Furthermore, once the decision to have resuscitation capacity on-site is made, plans for uniform access to such services throughout the site should be made.

In keeping with our recommendation to recreate as faithfully as possible practice settings *that* are familiar and effective for the staff, we recommend that field hospitals be planned and set up essentially like an emergency room. One of the reasons for this is that much thought has been invested in the design of emergency rooms over of the past decades. Issues like patient flow, nursing assignments, monitoring, and logistical issues such as the storage of medications and supplies are complex. Using a functioning unit as a model provides a useful starting point for the planning process.

## When: Planning, Deployment, and Wrap Up

The issue of timing in the planning, roll out, and wrap up of health services at large gatherings is subject to a delicate balance between the need to provide services in a timely manner while not wasting precious resource on a premature deployment.

### Planning

The planning process for health services for large gathering should be initiated at least a year prior to the event. In addition to the development of the actual HSP, the relationships that are so crucial to the efficient delivery of health services require time to develop and reach maturity. Well beyond the content of the plan, those relationships have the potential to make or break the HSP. Allowing ample time for all stakeholders to come together and reach an optimal level of collaboration is worth the effort.

### Deployment

Although some venues, such as stadiums, may have a designated health services area, many large gatherings will rely on temporary healthcare facilities that need to be put in place specifically for the event. Health facilities should be set up early enough to be functional when the first participant arrives. In some cases, opening up the facilities in advance of the event, albeit in a reduced capacity, allows the staff time to get familiar with their new environment. Early setup can also allow for the provision of care to crew setting up the larger venue and provides an opportunity for training and orientation.

### Wrap Up

The HSP should clearly spell out the end of each shift, the time at which new patients will be allowed to register, and the time at which patients still on the

premises will be to be either discharged or transported to a local hospital. This information further needs to be clearly communicated to the event's organizer to avoid any undue expectations from participants who may present to the facilities after they are closed. Likewise, plans need to be made for the dismantling of the health facilities at the end of the event. Health facilities will typically stay open for services for some time after the end of the event to respond to the demand of participants on their way out of the venue. A clear plan will allow the medical leadership to ensure that the staff remain on-site as long as they are needed.

## How: Essential Supports

Successful delivery of health services during large gatherings does not only rest on the availability of the right mix and numbers of healthcare staff and facilities. Equally important are the ancillary or support elements that should be optimally integrated into the planning, delivery, evaluation, and reporting phases of the event. We review 3 of these key elements as follows:

### Collaboration (Optimal Partnerships)

As is true for all effective healthcare delivery, the provision of quality health services during large gatherings is best achieved through collaboration among knowledgeable and committed partners. As mentioned earlier, it is essential that key partners and stake holders be identified and included at the very onset of the planning process. Under clear and consensual leadership (a goal that admittedly can be difficult to achieve in high-profile events), allowing expert partners to contribute their knowledge and skills to the overall plan and delivery model is likely to provide added value and quality to the end product. In other words, "allowing people to do what they know how to do" is most likely to result in a HSP that achieves the desired standards of quality. Implied in this principle is the need for a leadership that is both able to identify key collaborators and is effective in bringing the various players around a common vision. To this effect, identifying the right key individuals in each partner organization is also important. In the organization of health services for large gatherings as for most projects, large and small, success is far more dependant on *who* collaborates than on *what* collaborators do.

### Coordination (Command and Control)

Related to the element of collaboration is the importance of clearly identifying an overall command and control. By definition, the command and control function is not consultative. Consultation is best sought in the planning stages, prior to the event. Regardless of people's input throughout the planning process, once the event begins, it is important that those responsible for command and control be clearly identified and recognized as the authority should there be a surge of demand on health services. Ideally, the overall command and control for the event should have a clear and direct communication with a single individual responsible for the overall health services on-site. In very large events, two health services leads will be required; one located with the Command and Control team, potentially off-site, and one on-site. It bears mentioning that the best laid

out plans can quickly become obsolete if clear Command and Control is not established and endorsed well in advance of the event.

## Communication

Communication around large events is both complex and crucial. We focus here on communication related specifically to the delivery of health services.

A. Event-wide communication

B. Health services-related communication

### Event-Wide Communication:

At the level of the event as a whole, the internal communication strategy (communication aimed at those working for the event) should include a clear algorithm outlining the flow of information from the event's highest leadership all the way to those delivering care and from those delivering care, up to the event's leadership. The respective roles of the event's leadership, Command and Control, and of the health services leads can vary among events. Those roles and protocols for communicating from one level of the organization to another should ideally parallel lines of authority. These need to be well laid out and broadly communicated. The details of effective Command and Control are reviewed in the IMS chapter. Suffice it to say here that they deserve careful attention.

Event-wide communication aimed at the participants should include proper signage. Clearly identifying points of care and points of access to drinking water are keys to insuring adequate access to health services. Without proper signage, even the most sophisticated HSP may fall short of its goals. Health-related signage is most effective when it is part of a wider communication strategy for event's participants. In addition to signage, a communication strategy for participants may include other health-related messages such as information regarding expected weather, the need for sun protection, hydration, and appropriate clothing, for example.

### Health Services Communication

Communication related to the delivery of health services can be divided into the following:

i. Information and logistical support

ii. Health records and surveillance tools

Communication intended for information and logistical support of the healthcare staff may include the live communication plan (radio frequencies and communication algorithm) and the health services orientation material that outlines a list of equipment, available drugs and dosages, the communication algorithm, and other information pertinent to the effective delivery of care.

Health records may include a number of formats and versions adapted to each level of care providers. Surveillance tools based on clinical presentations can be integrated in the health record to optimize the efficiency of data collection (see Appendix D).

As technology advances, some events will be able to resort to electronic health records. When the infrastructure is robust enough to support this technology without jeopardizing content, the use of electronic records may

open up the possibility of more rigorous evaluation, debriefing and reporting. It is worth noting, however, that the technology to support electronic health records at large gatherings is not always available and that in very large gatherings, access to air waves might be at a premium. Furthermore, the appeal of technology should not supersede the need for a reliable strategy to produce high-quality medical records.

The actual record needs to conform to local privacy laws and the HSP should include a clear strategy for the storage and safekeeping of records in accordance with local regulations.

A common record can be used for clinical information, surveillance, and research provided appropriate ethical protocols have been established.

*Keypoint*: *For WYD2002, two separate medical record forms were used, one for the prehospital care (provided by first aid volunteers and paramedics) and one for the hospital care (provided by nurses and physicians). In the hospital, patients were registered on computers as they would in a GTA hospital. A single-page medical record was printed on-site. Efforts were made to develop a form using checklists to optimize efficiency. The form was machine readable. At regular intervals throughout the event, the medical forms were collected from all delivery points and were scanned to a central surveillance site where staff reviewed the cumulative information in an attempt to identify epidemiological trends.*

It was noted after the event that despite efforts to optimize efficiency in note-taking by providing a variety of check boxes on the medical records, physicians tended to maintain their previously acquired charting habits, often bypassing the check boxes and writing down information (often incompletely or ineligibly). Despite this limitation, a sufficient number of physicians completed the area of the medical record dedicated to syndromic surveillance for that information to alert Toronto Public Health to an outbreak of diarrheal disease in a small group of participants. This information further prompted an investigation that established that the source of infection was a food outlet located outside of the event's venue.

A number of authors have highlighted the importance of developing better record keeping tools for large gatherings, both to enhance the ease of record keeping and to foster the collection of information that is comparable among different events.

## Conclusion

In conclusion, the planning and delivery of health services during large gatherings is a complex and lengthy process. Although the components of the HSP are consistent, the implementation of each component will vary greatly from event to event. The success of the HSP begins with strong leadership, effective collaboration and clear mandates, principles, goals, and objectives. The calculation of an accurate PPR on which to base the various aspects of the HSP remains a challenge, although some authors have provided useful models as a starting point. In the face of expected uncertainty, keeping the staffing, roles, and settings as close to those of a local emergency department can enhance the ability of the HSP to respond to the demand. Ultimately, collaboration, coordination, and communication offer both the direction and the flexibility to enable the delivery quality health services at large gatherings.

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# Appendix A – World Youth Day 2002 Formulary

**Gastrointestinal:**
Bismuth Chewables
Aqueous Charcoal
Diarrhea Relief
Docusate Sodium
Extra Strength Calcium Antacid
Famotidine
Fleet Enema
Gravol (Adult/Pediatric)
Heartburn Relief
Immodium
Laculose
Ranitidine
Senna Laxative
Ultra Strength Gas Relief

**Metabolic:**
Glucagon
Glyburide
Humulin N & R
Regular Insulin N & R

**Neurological:**
Phenytoin

**Paralysing Agents:**
Pacuronium
Succinylcholine

**Psychiatric:**
Haloperidol

**Respiratory:**
Inahled Steroids
Ipramide
Methylprednisolone
Salbutamol

**Sedative:**
Diazepam
Lorazepam
Midazolam

**Skin:**
Acyclovir Ointment
Calamine
HC 1%
Novoclobatasole Cream
Tissue Glue (Dermabond)

**Toxicology:**
Naloxone

**Other:**
Aloe Vera
Colchicine
Mannitol
Prednisone
Silver sulfadiazine
Tetanus

# Appendix B – World Youth Day 2002 Field Hospital Formulary

**Allergic Reaction:**

Allertin (Adult/Pediatric)

Diphenhydramine (Adult/Pediatric)

Hydroxyzine

Epinepherine 1:1000

**Analgesia:**

Acetaminophen (Adult/Pediatric)

ASA

Diclofenac

Extra Strength Muscle & Back Relief

Fentanyl

Ibuprofen

Indomethacin

Meperidine

Morphine

Tylenol #3

**Topical Anaesthesia:**

Lidocaine 1% (without epinephrine)

Lidocaine 1% (with epinephrine)

LET

**Antibiotic:**

Azithromycin

Cefazolin

Cephalexin

Clauvulin

Cloxacillin

Fluoroquinolone

Gentamicin

Norfloxacin

Sulfamethoxazole/Trimethoprim

**Antiseptic:**

Chlorhexidine

Hydrogen Peroxide

**Cardiac:**

Digoxin

Diltiazem

Enalapril

Epinephrine

Isosorbide dinitrate

K-Lyte

LMW Heparin (Anoxiparin)

Metoprolol

Nifedipine

Nitrogylcerin

TNK-tPA

Verapamil

**Cold Remedies:**

Antitussive

Children's (and junior strength) Cough & Cold

Daytime Cold Relief

Decongestant

Lozenges

Sinus Cold

**Diuretics:**

Furosemide

Hydrochlorothyazide

**Ear:**

Mineral Oil

Sodium Sulamyd

**Eye:**

Fluorescein Strips

Homatropine

Irrigation Solution

Ocular Lubricant

Pilocarpine 1%

Tetracaine

# Appendix C – Encounter Report

**ENCOUNTER REPORT**

**Group No:** ☐☐☐☐☐☐☐☐☐☐ **Subgroup No:** ☐☐☐☐☐☐☐☐☐☐ **Date (mm/dd/yy):** ☐☐/☐☐/☐☐ **Time (hh:mm)** ☐☐ ☐☐

**Sex:** ☐ Male ☐ Female

**Venue:**

☐ Ex Hosp
☐ Ex FA Tent #: ☐
☐ Ex Site

☐ Downsview Hosp #: ☐
☐ Downsview FAU #: ☐
☐ Downsview Site

☐ PR 1 ☐ PR 2 ☐ PR 3
☐ PR 4 ☐ WR ☐ WOC

☐ Other ☐☐☐☐☐☐☐☐☐☐

**Provider:** ☐ First Aid ☐ EMS ☐ RN

**Also Seen By:** ☐ First Aid ☐ EMS

**Reason for Encounter:**

☐ Heat Related
☐ Short of Breath
☐ Lacerations
☐ Sprain
☐ Weak/Dizzy
☐ Headaches
☐ Skin
☐ Chest Pain
☐ Gastro Intestinal
☐ Other: ☐☐☐☐☐☐☐☐☐☐

**Treatment:**

☐ Band Aid
☐ Gave Water
☐ Tensor/Soft Immobiliz'n
☐ Sun Screen
☐ Advice Medical
☐ Advice General
☐ Dressing
☐ Splint/immobiliz'n
☐ CPR/Started at: (hh:mm): ☐☐ ☐☐

**Disposition:**

☐ Call EMS
☐ To FAU
☐ To On-Site Hospital
☐ F/U Recommended
☐ Release to Crowd
☐ To Off-Site Hospital

Name of Hospital:

**To MD: Only fill if patient to be seen by MD at hospital**

Patient Last Name: ☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Patient First Name: ☐☐☐☐☐☐☐☐☐☐☐☐

# Appendix D – Health Record

## Health Record

Chart #:_____

**Group No.:** **Subgroup No.:** Venue: **Date (mm/dd/yy):** **Time:**

**Patient Last Name:** **Patient First Name:** **DOB (mm/dd/yy):** **Sex:** ☐ M ☐ F **PWSN:** **Age:**

**Billing Address:** **Permanent Address:**

**Local Phone Number:** ( ) - **City:** **Country:** **Prov/State:**

**Permanent Phone Number:** ( ) - **Email:** **Postal Code:**

**Triage:** ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 **Also Seen By:** ☐ First Aid ☐ EMS **Previous Encounter#:** **Td Req'd:** ☐ Yes ☐ No Allergies: ☐ NKDA

**Reason for Encounter:** ☐ Heat Related ☐ Weak/Dizzy ☐ SOB ☐ Skin ☐ Sprain ☐ Chest Pain ☐ GI ☐ Headaches ☐ Other:

**Time Seen:** : **Chief Complaint:**

**Nursing Assessment** (Add'l Notes on Back):

**SYMPTOMS:** **Temp:** . **Pulse:** **Resp:** **BP:** /

**GI:**
☐ Diarrhea/Nausea ☐ Bloody Stool
☐ Vomiting ☐ Jaundice
☐ Abdo Pain

**Resp:**
☐ SOB ☐ Wheeze
☐ Cough ☐ Sore Throat
☐ Stridor

**Neurological:**
☐ Altered Mental Status
☐ Fever

**Skin:**
☐ Burns
☐ Lacerations/Burns
☐ Blisters
☐ Rash

| **Doctor's Notes** (Add'l Notes on Back): | **Doctor's Orders** (Add'l Orders on Back): | **Init.** |
|---|---|---|
| | | |
| | | |

(Choose One)
**DISEASE SURVEILLANCE:**
☐ GI illness (bloody stool)
☐ GI illness (non-bloody stool)
☐ Acute febrile illness w. rash
☐ Suspected Meningitis/Encephalitis
☐ Resp. distress w/o fever
☐ Acute resp. infection w. fever
☐ Temp. related illness
☐ Suspected acute viral hepatitis
☐ Botulism-like syndrome
☐ Unexplained death
☐ No syndromes applicable

**Diagnosis:** (Choose All That Apply)

**ENT/Opthalmology:**
☐ Conjunctivitis,Ocular FB
☐ Dental Pain/trauma
☐ Nosebleed
☐ Cardiovascular:
☐ Hypertension, BPCheck
☐ Angina
☐ Palpitations
☐ MI

**Respiratory:**
☐ Asthma
☐ COPD
☐ URIT, Pneumonia
☐ Anaphylaxis
☐ Allergies

**Skin:**
☐ Lacerations/Abrasions
☐ Rash NYD

**Neurology:**
☐ CVA
☐ Seizures
☐ Migraine, Tension headaches

**MSK:**
☐ Back Pain
☐ Injury lower extremities
☐ Injury upper extremities

**GI/GU:**
☐ GERD/PUD
☐ Diabetes
☐ Fever NYD

**Exanthema:**
☐ Chicken Pox

**Mental Health:**
☐ Psychosis
☐ Anxiety

**Systems:**
☐ UTI
☐ Vaginal bleed
☐ Heat exhaustion
☐ Suspected intox'n

**D/C to:**
☐ Home
☐ Venue
☐ Morgue

**Accompanied by:**
☐ Family
☐ Friend
☐ Group Leader
☐ First Aid
☐ EMS
☐ RN/MD

**Follow-up:**
☐ GP
☐ Other
☐ Given Script

**Cognition/Approval of D/C Plan:**
☐ Patient
☐ Family/Friend
☐ Other

**Other Discharge Diagnosis:** **D/C Date (mm/dd/yy):** **D/C Time** :

Chart #: _____

**Additional Nurse's Comments:**

| |
|---|
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**Additional Doctor's Notes:**

| |
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| **Additional Orders/Treatment/Medication:** | **Init.** |
|---|---|
| | |
| | |
| | |
| | |
| | |

**Diagnostic Results:**

| | Ordered | Result |
|---|---|---|
| Hb | ☐ | ☐☐☐.☐ |
| Gluc | ☐ | ☐☐☐.☐ |
| Na | ☐ | ☐☐☐.☐ |
| K | ☐ | ☐☐☐.☐ |
| BHCG | ☐ | ☐☐☐.☐ |
| Urinalysis | ☐ | ☐☐☐.☐ |
| ECG | ☐ | ☐☐☐.☐ |

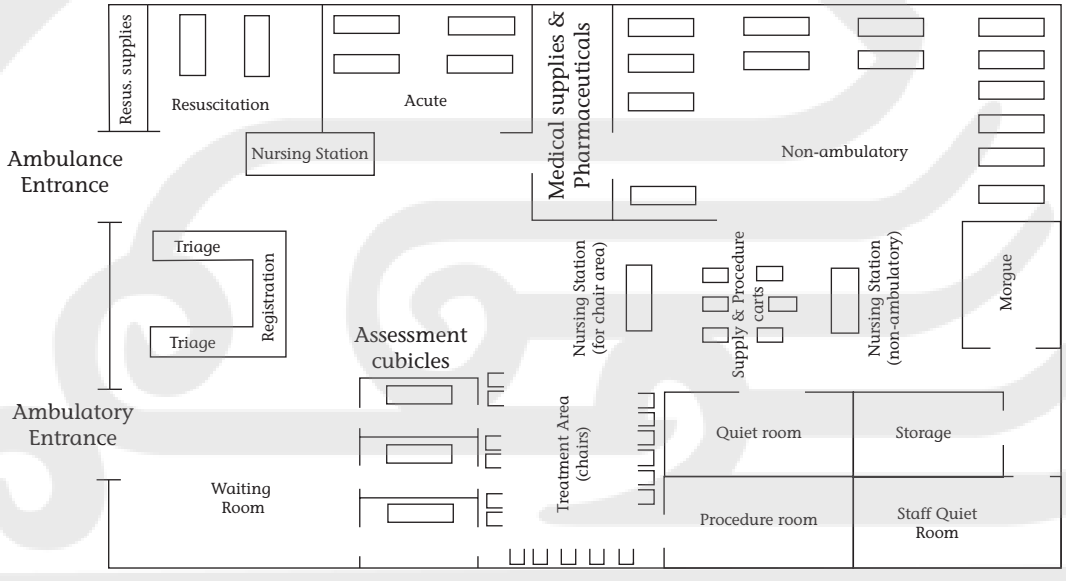
**X-rays:**

| Type | Result |
|---|---|
| ☐☐☐☐☐ | ☐☐☐☐☐ |
| ☐☐☐☐☐ | ☐☐☐☐☐ |
| ☐☐☐☐☐ | ☐☐☐☐☐ |
| ☐☐☐☐☐ | ☐☐☐☐☐ |
| ☐☐☐☐☐ | ☐☐☐☐☐ |
| ☐☐☐☐☐ | ☐☐☐☐☐ |
| ☐☐☐☐☐ | ☐☐☐☐☐ |

_____

Physician's Signature

# Appendix E – Possible Layout for Field Hospital



Chapter 9

# Scene Safety and Security

By David G.C. McCann, BSc, MD, MPH, CCFP, FAASFP

# Preface

Disasters pose numerous challenges to first responders, especially in terms of personal safety. Even in nondisaster situations, there is some evidence that prehospital workers are at an increased occupational risk. A study by Maguire and coworkers[1] found an annual rate of 12.7 fatalities per 100,000 EMS workers when compared with a national average of 5.0 per 100,000 workers. This lends credence to what prehospital responders have long known intuitively—responding to emergencies in the prehospital environment is inherently dangerous.[2]

This is all the more true in disasters. Unexpected hazards wait at every turn and well-meaning but ill-advised heroics place first responders at an increased risk. First responders and hospital-based personnel must be trained to put their own safety and that of their team ahead of all other concerns. This is counterintuitive for most healthcare workers, especially EMS workers "who feel that being a rescuer means going into a situation when others are going in the opposite direction."[3] Changing this hero mindset is essential within the disaster zone. When a rescuer is injured through lack of safety awareness, assets needed by other disaster victims are diverted and the situation within the disaster zone is further compromised. It would have been better if he/she had not come to work that day.

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## Safety Issues in Disaster Response

In 2004, the Rand Corporation initiated a comprehensive study of first responder safety issues in disaster and terrorism response[2] under the auspices of the Centers for Disease Control and Prevention (CDC). The resulting report noted several characteristics of disasters that place first responders at an increased risk:

- Large number of affected people injured or killed. For example, almost 300,000 people were lost after the Tsunami in Southeast Asia in 2004.[4]
- Large geographic scale. Hurricane Katrina affected nearly 90,000 square miles of the US Gulf Coast.[5]
- Long duration of response. World Trade Center disaster operations continued for 8 months after the terrorist attacks on September 11, 2001.[6]
- Multiple hazards of various types depending on the type of disaster, for example, after hurricanes, downed power lines pose a serious threat, whereas structural collapse is a significant concern after major earthquakes.
- Potential for chemical, biological, and radiation hazards associated with terrorist incidents.[7]
- Deployment of a wide range of capabilities (e.g., cranes, reinforced concrete cutting machinery, etc.) that responders are not used to working with and that increases the risk to them.
- Large disasters require multiagency response where poor communication among different agencies can increase the risk to response personnel.[8]
- Convergence of large numbers of self-deploying volunteers who take resources and supplies from regular response personnel; such volunteers are usually not trained or equipped for disaster operations.
- Damage to infrastructure—landmarks obliterated, road signs destroyed, and roads blocked making access to the disaster site risky.

In addition, psychological trauma associated with disaster response leaves responders at a significantly increased risk for post-traumatic stress disorder (PTSD).[9]

Because disasters place responders at increased risk, it is critically important that scene (or zone) safety issues are taken seriously. The majority of disaster responses in North America use the Incident Management System (IMS), where safety issues are a top priority for both Command Staff and responding personnel. Within the IMS structure, the role of the Incident Safety Officer (ISO) serves as the lead for anticipating and managing safety concerns. In fact, the ISO is the only person in the IMS who can overrule the Incident Commander in matters concerning safety.[10] It is very important that the IMS be established as quickly as possible in any disaster situation. There is an old adage in the IMS—for every 5 minutes you hesitate to set up the IMS, it will take an extra 30–60 minutes to get control of the scene.[7] For more information on the IMS, please refer to Chapter 5.

Scene safety is best approached using the *safety management cycle,* which involves 3 functions that should occur continuously throughout any incident[2]:

1. Gather information (about safety issues, hazards, etc.)
2. Analyze the options and make a decision (to minimize/mitigate safety issues)
3. Take action

Ideally, the ISO should be properly trained to use the safety management cycle as a framework to guide scene safety. Furthermore, the ISO should follow an "all-hazards" mindset; that is, he/she should always be mindful of the disaster environment and be scanning for any and all types of hazards, expected or not.

Major safety issues that should be addressed at any disaster scene include the following:

- Personal protective equipment (PPE)—what level is needed? Where will the PPE be obtained and for how many?
- What specific hazards are likely in this disaster?
- Where is the disaster scene? By what route(s) will it be accessible?
- To whom will responders report? (This is an issue if the IMS has not yet been activated. Once it is activated, the Incident Commander or the appropriate Section Chief would be the person).

## PPE

There are 4 levels of PPE, and responding personnel should be properly trained in donning and doffing PPE *prior to an actual incident*.[7] The level of PPE required will be determined by the hazards at the disaster site.

### Level "A" PPE

This is the highest level of PPE protection. It requires a vapor-resistant suit with a self-contained breathing apparatus (SCBA). Level "A" PPE is appropriate when protection is needed for skin, mucous membranes, and lungs. It protects against petroleum products, nerve agents (e.g., VX, sarin), and blister agents (e.g., nitrogen mustard). HAZMAT teams entering a "hot zone" with unknown potential chemical hazards must wear Level "A" PPE until the type and concentration of the hazards are known to be compatible with a lower level of PPE.

Unfortunately, Level "A" PPE is notoriously difficult to work in. The large gloves are thick and severely limit the manual dexterity and tactile sensation. Responders cannot wear Level "A" PPE for more than 20 minutes because of heat, increased sweating, and dehydration with electrolyte imbalance. Donning and doffing the equipment require extensive training to avoid contamination.

### Level "B" PPE

One step down from Level A, Level "B" is used when the highest level of respiratory protection is required but less skin protection is needed. There is no true vapor barrier in Level "B"—it requires a hooded, chemical-resistant suit and full face mask with SCBA.

## Level "C" PPE

Level "C" PPE uses a powered air-purifying respirator (PAPR) with a hooded, chemical-resistant suit and full face mask. PAPRs are appropriate when the concentration and type of airborne substances are known with certainty and safe for use with a PAPR.

## Level "D" PPE

This level involves wearing ordinary street clothes accompanied by a waterproof apron, boots, a face shield, safety goggles, and gloves—the equivalent of "universal precautions."

Level "A" and "B" PPE require physically fit, extensively trained personnel who are properly fitted and regularly retrained in the appropriate use of the outfits. Level "C" PPE is easier to work in for long periods but still requires proper fit testing and use of the appropriate PAPR filter for the particular inhalational hazard.

Further information on PPE, decontamination, and hot/cold zones can be found in Chapter 12, "Managing Chemical, Biological, Radiological, and Nuclear Disasters in a Healthcare Facility."

# Disaster Specific Hazards

It is worth repeating that an all-hazards approach is critical to an appropriate disaster response. With this mindset, one does not require a different plan for each type of disaster. Rather, a common approach to all disasters is used which recognizes those commonalities inherent in disaster scenes.

This "all-hazards" approach is used as the basis of plans that are adapted to specific disasters. There are hazards that are common to many scenarios and should be looked for aggressively while always keeping in mind that other, less common hazards may also be present. Some examples follow:

- Hurricanes—look for downed power lines, trip hazards, flooding that can easily wash away persons and vehicles, contaminated water supplies (sewage), displaced venomous animals (e.g., rattlesnakes), downed trees blocking roads, structural instability of storm surge-ravaged buildings, falling debris, increased vectors of disease (e.g., mosquitoes with West Nile Virus), possible HAZMAT situations (e.g., during Hurricane Katrina, Murphy Oil based in New Orleans leaked 220,000 gallons of crude oil from a holding tank ruptured by the storm surge), potential for drowning, and need for personal flotation devices (particularly during search and rescue operations).
- Earthquakes—ruptured gas lines, downed power lines, tri hazards, structural instability and collapse, falling debris, inaccessible roadways, sinkholes, fires, and possible HAZMAT situations (e.g., chemical factories in earthquake zone).
- Terrorism—chemical, biological, radiological, nuclear, and explosive hazards (CBRNE), fires, secondary off-gassing of nerve agent prior to decontamination, radiation exposure, and so on. It is important to realize that any terrorist incident may involve secondary devices timed to go off after first responders have arrived. A perfect example of this occurred on September 11, 2001 when the second plane hit the World Trade Center

15 minutes after the first plane and injured or killed first responders who were already on scene.

Clearly, it is incumbent on the ISO to have "situational awareness" and to manage both the expected and unexpected hazards. No matter what the type of disaster, the ISO must constantly be mindful of such dangers as excessive fatigue, dehydration, and exposure for his/her response personnel. Examples include summer heat, with the risk of heat stroke, whereas in the winter, hypothermia is a major threat. When responders are overtired, they become careless and are more likely to be injured. Therefore, the ISO must insist that a 12-hour shift is never breached for first responders.[2] It is essential that Command Staff lead by example in this area—if the Incident Commander does not take necessary sleep breaks, those reporting to him likely will not either.

## What Route(s) to the Disaster?

This can be a real issue especially when landmarks and road signs have been destroyed. GPS devices are a big help and should be readily available. However, downed trees and other road hazards may render usual routes inaccessible.[2] It is therefore important to have first responders familiar with the local environment. Self-deploying so-called "convergent volunteers" can easily become lost when they are in unfamiliar topography. It may be advisable to have a police escort if road conditions are hazardous. First responders should don appropriate PPE before arriving at the disaster scene, since many first responders will forget to don PPE on arrival.

## On Arrival at the Scene

The seasoned disaster worker knows that scene assessment before exiting the vehicle is a must. If unknown hazards (e.g., HAZMAT) exist, park "uphill and upwind" of the disaster scene. Do not park near any damaged trees or structures that could collapse and render the vehicle unusable. Do not park anywhere near downed power lines or flooded areas. Remember, it takes only 2 ft of water moving at 6 miles per hour to carry a vehicle away in a flood situation. If an Incident Command site has been set up, park near the command post and report to the Incident Commander or the appropriate Section Chief.

## Scene Security

An important aspect of scene safety is the concept of scene security. Most hospitals assume that the local police will be on-site to maintain security in a mass casualty incident. However, in a large scale disaster, police, fire, and EMS will be stretched to the limit. Hospitals cannot count on the police for their security under such circumstances. Therefore, security personnel and planning should be factored into the hospital's emergency planning. Furthermore, in a disaster, hospitals are frequently overwhelmed and need to secure all doors but one to ensure controlled access by the public.[11] This is even more important during a contaminated event where uncontrolled traffic can compromise the hot/cold zone systems.

In the prehospital disaster site, it is critical to set up a security perimeter around the scene to prevent onlookers and media from intruding, as well as to prevent potentially injured/contaminated victims from leaving the scene. In a terrorist incident, this is all the more important as the perpetrators may still be near the scene and a security cordon will prevent their escape. This concept of scene security was poorly managed at the World Trade Center in 2001, and it took far too long to establish an effective security perimeter.[8]

## Summary

Scene safety and security are critical issues in disaster management. An all-hazards approach to disaster preparedness is not only essential for good planning, but is also essential for injury prevention. The role of the ISO within the IMS structure is pivotal in this regard. Healthcare providers and first responders must change their mindset from "patients ahead of self" to "safety first" and the ISO should reinforce this message at all times.

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Chapter 10

# Analgesia and Mass Casualty Incidents

By Daniel Kollek, MD, CCFP(EM)
Brian Goldman, MD, FACEP, MCFP(EM)

# Preface

Because of the nature of the injuries involved, pain management is a key component to the management of mass casualty incidents (MCIs). Although various agents have been assessed for their risks and benefits related to specific individual clinical scenarios, there is no good evidence for generalized use of any specific analgesic agent over any other in MCIs. The present practice of using morphine for all significant field analgesia in MCI situations has not been proven to be either the best or safest practice and further research into other agents is warranted.

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# Pain Management

The classical definition of pain is "an unpleasant and sensory emotional experience associated with actual or potential tissue damage, or described in terms of such damage."[1]

Pain management is a key component of the medical response to mass casualty situations, yet the evidence regarding optimal pain management in mass casualty situations is extremely limited. A review of both the PUBMED and OVID databases using the terms "disaster, pain, analgesia, and mass casualty incident" gleaned a total of 147 articles. Of these, only 4 satisfied the criteria of relevance, availability in English or French, and recentness (defined as published within the past 10 years).

Part of the reason for this lack of information is that mass casualty situations tend to occur unpredictably. Overall, in mass gatherings, the incidence of trauma

requiring any significant intervention is 0.032%.[2] Thus, it is not surprising that there is little research done on the topic.

Although there is variability in the pathology that occurs in mass casualty events, there is a characteristic pattern to the nature and distribution of the injuries. A review of mass casualty terrorist bombings by Arnold et al. found that 7461 of 8364 casualties survived their initial injuries.[3] The review was completed in 2002 and thus did not include the more lethal subsequent suicide bombings on buses. That said, the data do point out that depending on the type of the event (structural collapse, closed space, open air, etc.), there have been 75%–90% survival rates. There is a pattern of injuries in the survivors, the most common being penetrating soft tissue (48%–63%), fractures (29%–45%), intracranial injuries (8%–10%), and crush injuries (13%).[2] The Trauma Care under Combat Conditions guidelines teach that the distribution of the injuries across the body tend to be 21% to the upper extremity, 35% to the lower extremity, 13% to the chest, and 17% to the head and neck, with abdomen and other body parts sustaining the other 14%.[4] Thus, on the basis of past review, it is possible, at least in situations involving explosions and structural collapse, to predict what type of injuries will occur, what their distribution will be across the body, and also what percentage of the population affected will require hospitalization. Following from this, it should be possible to make some reasonable assumptions to the type of analgesic agents that will be useful.

Research into battlefield medicine has also focused on pain management and some of the comments that follow are collected from that literature.

Finally, some clinical experience can also be extrapolated from the research into management of pain in the wilderness, which is similar to MCI situations in that it may involve dealing with pain in the field with minimal diagnostic, therapeutic, and monitoring resources.[5] According to Wedmore et al., the ideal pain medication for wilderness and operation would be light and compact, something that can be carried without concerns such as environment or temperature; has a very high therapeutic index, particularly with regard to ensuring that airway reflexes are protected; does not require an IV or other equipment to administer; and can be used regardless of patient's level of stability. In the urban setting, there are other issues also that need to be addressed such as the control of trafficable narcotics and providing safety for the crews responding to the scene. In some settings, cost may be an important factor as well.

## General Concepts

Pain is a concept well known to everyone, yet it is difficult to standardize its definition or allow direct comparison of pains. The International Association for the Study of Pain (IASP) has defined as mentioned earlier.

Untreated pain can cause many problems, both emotional and psychological. On the psychologic aspect, the cardiovascular system responds to stress by activating the sympathetic nervous system increasing heart rate and blood pressure, as well as cardiac work load and oxygen demand. At the endovascular level, it decreases fibrinolysis and can induce a hypercoagulable. From the respiratory viewpoint, pain can cause high pressure, small tidal volume, high respiratory rate, and lead to pneumonia and atelectasis. In addition to this, pain has an effect on the endocrine system and the immune system.[6,7,8]

The target of a caregiver should be tolerable pain as opposed to no pain at all. Although no pain at all may be an ideal situation, the potential risk from some analgesics does make it sometimes difficult to achieve without exposing the patient to risk. Thus, it is the responsibility of the caregiver to titrate to an acceptable balance of mild pain versus adverse affects.[9]

Pain can be measured through various scales, all of which, by pain's very nature, are subjective. Similarly, the World Health Organization has described a pain ladder that allows for progression between management of mild, moderate, and severe pain. The model outlines the steps in provision of analgesia and, while based on cancer pain, does use principles that are equally applicable to MCIs.

The first step in the pain ladder is for the mildest of pains and would involve a nonopioid such as a nonsteroidal, anti-inflammatory drug (NSAID) or acetaminophen. This level could also include so-called adjuvant treatments such as antidepressants or anticonvulsants. Some would also include local anesthetics at this level.

At the next step on the pain ladder, a weak opioid with or without a nonopioid with or without an adjuvant would be considered.

The next step on the pain ladder would be a strong opioid, again with or without a nonopioid or an adjuvant.

The general concept is one of stepped care in the provision of analgesia and the scale provides a framework for caregivers when considering what medications to use.[10]

Although the mainstay of analgesia remains chemical, it is important to remember the nonpharmaceutical approaches to analgesia. These are easy to administer, safe, and cost nothing making them ideal for deployment in any situation. The Battlefield Advanced Training Life Support (BATLS) defines these as management of airway breathing and circulation, correcting of hypoxia, hypercarbic, hypervolemia, reassuring the casualty to relieve emotional distress, splitting of fractures, and cooling of burns.[11]

Having covered the basic concepts of pain management in a battlefield or mass casualty situation and the nonpharmacologic interventions, the rest of this chapter deals specifically with various pharmacological agents. The analgesic efficacy of these agents is summarized in Table 10-1.

## Table 10-1: Abridged Version of the 2007 Oxford League Table of Analgesic Efficacy[12]

| Analgesic | Number of Patients in Comparison | Percent with At Least 50% Pain Relief | NNT |
|---|---|---|---|
| Ibuprofen 600/800 | 165 | 86 | 1.7 |
| Ketroolac 20 | 59 | 57 | 1.8 |
| Paracetamol 1000 + Codeine 60 | 197 | 57 | 2.2 |

## Table 10-1: Abridged Version of the 2007 Oxford League Table of Analgesic Efficacy[12]

| Analgesic | Number of Patients in Comparison | Percent with At Least 50% Pain Relief | NNT |
|---|---|---|---|
| Ibuprofen 400 | 5456 | 55 | 2.5 |
| Ketorolac 10 | 790 | 50 | 2.6 |
| Paracetamol 650 + Tramadol 75 | 679 | 43 | 2.6 |
| Diclofenac 50 | 1296 | 57 | 2.7 |
| Ibuprofen 200 | 3248 | 48 | 2.7 |
| Pethidine 100 (IM) | 364 | 54 | 2.9 |
| Tramadol 150 | 561 | 48 | 2.9 |
| Morphine 10 (IM) | 946 | 50 | 2.9 |
| Paracetamol 1000 | 2759 | 46 | 3.8 |
| Tramadol 100 | 882 | 30 | 4.8 |
| Codeine 60 | 1305 | 15 | 16.7 |

Abbreviations: NNT, number needed to treat; IM, intramuscular.
Number needed to treat are for 50% pain relief over 4–6 hours compared with placebo in randomized double-blind single-dose studies in patients with moderate to severe pain. The lower the NNT, the more efficacious the analgesic. Oral administration unless otherwise stated.[12]

## Acetaminophen and Paracetamol

Acetaminophen is effective for mild to moderate nociceptive pain or as an adjunct to opioid analgesics for severe pain.[13] It is believed to act by inhibiting cyclooxygenase-3 (COX3). A single dose of 1000 mg of acetaminophen has a number needed to treat (NNT) of 3.8 for at least 50% of postoperative pain for 4–6 hours.[14] The maximum dose for short-term use (up to 10 days) is 4000 mg per day.

Paracetamol is the UK equivalent to North American's acetaminophen (Tylenol). By itself, it is a weak analgesic; however, it does enhance the effect of other NSAIDs, weak opioids, and morphine when used concurrently.[15–17]

Both acetaminophen and paracetamol have a remarkable lack of side effects and toxicity. They should be given regularly to all patients. IV paracetamol formulations do exist and may have significant advantages over oral forms. However, they are not as yet found in the North American market.[18]

## NSAIDs and Coxibs

Anti-inflammatory drugs are effective for nociceptive pain. Ibuprofen 400 mg has a NNT of 2.4 (range 2.3–2.6) for postoperative pain.[19] Diclofenac has a NNT of 2.3 (range 2.0–2.7), whereas naproxen has a NNT of 2.6 (range 2.2–3.2).[20,21] According to Wedmore et al., ibuprofen (known colloquially as "Ranger Candy") is used frequently in the operational setting.[22] Likewise, ketorolac, an injectable NSAID, has often been selected by the military as the intramuscular analgesic of choice for moderate or severe pain.[23] A single dose of IM ketorolac 30 mg has a NNT of 3.4 for at least 50% pain relief over 4–6 hours with few side effects when administered as a single dose.[24]

Unfortunately, NSAIDs have several potential risks associated with their use. The first concern is the risk of NSAID gastropathy. Taking an NSAID for 2 months or more carries a 1 in 5 risk of an endoscopically proven ulcer and a 1 in 150 risk of a bleeding ulcer.[25] The risk for NSAID gastropathy rises with age and a previous history of peptic ulcer disease.

Renal impairment is a second risk associated with NSAIDs. In younger patients, the risk of NSAID-induced renal impairment is small. The incidence of hospitalization for acute renal failure in individuals under the age of 64 is 0.6 per 100,000 person years of NSAID use.[26] Military casualties tend to be younger. Many of the victims of terrorist bombings may be older. The use of NSAIDs in this patient population may result in a greater risk of acute renal failure, especially if the victims suffer from dehydration.

NSAIDs increase the risk of hypertension and can precipitate acute congestive heart failure. Some NSAIDs increase the risk of cardiovascular events, including myocardial infarction and cerebrovascular disease.[27]

Platelet dysfunction is the fourth adverse effect of NSAIDs. The resulting prolongation of bleeding time could result in increased bleeding from severe injuries associated with mass casualty situations. Concerns regarding this adverse effect led the Committee on Tactical Combat Casualty Care consensus panel to recommend that coxibs be used instead of NSAIDs as the analgesic of choice in combat operations.[28]

Celecoxib 200 mg has a NNT of 4.5 (3.3–7.2).[29,30] Coxibs have roughly half the risk of gastrointestinal perforations, ulcers, and bleeds compared to NSAIDs.[31] However, rofecoxib (marketed as Vioxx®) use was found to double the risk of myocardial infarction and stroke, a finding that resulted in rofecoxib being withdrawn from the market. There are concerns that the risk of cardiovascular events is a class-based effect.[32] More recently, valdecoxib (marketed as Bextra®) was withdrawn from the market due to an increased risk of cardiovascular events as well as an increased risk of serious skin reactions.[33]

Coxibs are not routinely used in emergency departments (EDs) or battlefield situations; hence, little data exist to extrapolate to MCIs.

## Opioid Analgesics

Opioid analgesics are a mainstay of the management of severe pain. Opioids work by binding to μ receptors in the central nervous system and also have peripheral antinociceptive effects. There is tremendous variation in the effective

dosage of opioids due to genetically mediated interindividual differences in opioid efficacy and toxicity. Morphine is often regarded as the "gold standard" for opioid analgesia.[34] However, morphine should be considered as part of an opioid armamentarium that also includes hydromorphone, fentanyl, and oxycodone.

Opioids can be administered intramuscularly, intravenously, or by mouth. This flexibility makes them applicable to multiple scenarios.

A qualitative systematic review found that a 10-mg intramuscular dose of morphine has an NNT of 2.9 for at least 50% pain relief over 4–6 hours compared with placebo in pain of moderate to severe intensity.[35] A similar review found that meperidine 100 mg IM also has a NNT of 2.9.[36] However, meperidine is not recommended for repeat dosing due to the risk of neurotoxicity and seizures associated with the accumulation of the toxic metabolite normeperidine.[37,38] A systematic review of hydromorphone in acute pain found analgesic efficacy comparable to that of other opioids.[39] However, heterogeneity of the studies precluded meta-analysis. As well, most studies that investigated hydromorphone involved small numbers of patients, making it difficult to determine real differences between hydromorphone and morphine.

Codeine, fentanyl (transmucosal), and oxycodone are available as orally administered analgesics. Acetaminophen 1000 mg with codeine 60 mg has a NNT of 2.2.[40] A systematic review found single-dose oxycodone, with or without acetaminophen, is of comparable efficacy to IM morphine and to NSAIDs.[41]

All opioids have adverse effects. These include nausea, vomiting, dizziness, and lightheadedness. Some opioids have active metabolites that are cleared by the kidneys. A recent review by Dean recommended that morphine and codeine be avoided in patients with renal failure and that hydromorphone or oxycodone be used with caution and close monitoring. However, fentanyl appears to be safe to use.[42]

The ideal route of administration for opioid analgesics is somewhat controversial. The oral route has the advantages of being the most practical and the most portable. However, there are significant limitations to the oral route of administration. Both the onset and the time to peak analgesic effect are significantly slower than with parenteral administration. As a consequence, oral titration is much more difficult than through the parenteral route.

In the ED, IV is the preferred route of administration for rapid titration of opioid analgesia. However, the IV route has been considered problematic in operational settings.[43,44]

Recently, oral transmucosal fentanyl citrate has been proposed for use in operational settings. Fentanyl citrate is a lipophilic synthetic phenylpiperidine derivative that has been used for years in the ED as an analgesic for painful procedures. It has also been used for years in epidural analgesia. Oral transmucosal fentanyl is a crystalline form of fentanyl citrate (marketed under the name Actiq®) that is incorporated into a flavored lozenge. The lozenge is intended to be administered over 15 minutes.

Oral transmucosal fentanyl appears to possess the characteristics of rapid onset of action and relatively long duration of action. Its rapid onset is because approximately 25% of the fentanyl contained in the lozenge is absorbed transmucosally. The transmucosal component has an onset of action of 5–10 minutes, which is comparable to the onset of intravenously administered opioid analgesics.

However, the remainder of the drug is swallowed and absorbed through the gastrointestinal tract, which accounts for the product's duration of action. There is a significant first-pass effect of the component of drug that is absorbed through the gastrointestinal tract.

A study by Kotwal et al. evaluated the use of oral transmucosal fentanyl administered by medical personnel during missions in support of Operation Iraqi Freedom over a 2-month period in 2003. A total of 22 patients met the study criteria. Twenty-one of 22 patients received a single dose of 1600 µg fentanyl. One patient received 2 doses of 1600 µg fentanyl. Three patients required IV analgesics in addition to the oral transmucosal fentanyl citrate. The results of this small study were impressive. Oral transmucosal fentanyl citrate reduced verbal pain scores by a mean of 5.77 and the benefits were sustained for an average of 5 hours.[45] Adverse effects included nausea (13.6%), emesis (9.1%), lightheadedness (9.1%), and pruritus (22.7%). One patient experienced an episode of hypopnea requiring the use of naloxone. Patients in the study were instructed to remove the lozenge from the mouth once adequate analgesia or significant side effects developed. This helped to prevent overmedication. The authors found taping the stick of the lozenge to the patient's index finger also helped reduced accidental overadministration, by ensuring patients had to remain alert enough actively self-administer the medication.

Intranasal administration of analgesic agents is becoming more commonplace in the United Kingdom civilian emergency practice, but as of yet, it is not as common in Canada. Concerns had been expressed over the opportunity for abuse of these medications, if only because the method of delivery is so simple; however, opportunity for abuse in an operational environment is no greater for intranasal, oral, or buccal therapy than for existing injectable opioids. As long as the distribution and counting is carefully controlled and the penalty for misuse is appropriate, the opportunity for overdose could effectively be avoided if each nasal applicator is restricted to a single adult dose.[46]

## Ketamine

Ketamine is a dissociative anesthetic that has been used extensively in the ED as an analgesic. Ketamine has been used for pain associated with burns and procedural sedation.[47,48] The drug has been used quite effectively for procedural sedation in children.[49] Ketamine has many of the characteristics of the ideal analgesic. It works quickly and provides effective analgesia without compromising airway or cardiovascular reflexes.

Ketamine has been used extensively in the prehospital setting, for extrications and entrapment situations. It is generally avoided in head-injured patients because of the increase in intracranial pressure. Because ketamine preserves airway reflexes, it is an attractive agent in the prehospital and mass casualty environment and has had extensive use in the Vietnam and Falklands wars. Some authorities would suggest providing it with a small dose of benzodiazepine in order to reduce dysphoria.

Ketamine has been used in operational settings.[50,51] The recommended dosage of ketamine used for analgesia is 0.44–1.0 mg/kg IM or 0.2–0.5 mg/kg IV. Some authors recommend a starting dose of 0.1 mg/kg titrated to effect.[52]

There are anecdotal reports of ketamine being used as an IV anesthetic to perform austere surgeries in Somalia and Uganda.[53]

As a result, ketamine, aside from the aforementioned contraindication of head injury, has been proposed as an ideal analgesic for mass casualty and disaster situation.[54]

For most indications, ketamine is administered IM or IV. Ketamine is also available in oral, rectal, and sublingual preparations. Intranasal ketamine has been studied for pain control in the operational setting. It has superior bioavailability to oral, rectal, and sublingual preparations.

There is growing clinical experience with intranasal ketamine. This modality provided statistically significant relief of breakthrough pain in patients with chronic noncancer pain. The onset of analgesia was within 10 minutes with duration of action of up to 60 minutes. There were no reports of auditory or visual hallucinations, phenomena both observed with IV or IM administration.[55] A randomized, prospective placebo-controlled trial of intranasal ketamine (administered through a metered-dose inhaler) demonstrated statistically significant relief of postoperative pain at 10 mg, 30 mg, and 50 mg doses. There were no serious adverse events including hallucinations or psychotomimetic effects.[56]

Compared to intramuscular morphine, intranasal ketamine offers several potential advantages. It maintains normal heart and respiratory rate and blood pressure. The onset of analgesia is within 10 minutes. It does not cause drowsiness or confusion. The drug is administered noninvasively. Finally, intranasal ketamine appears to have a wide margin of safety. There is little, if any, literature on the use of intranasal ketamine in austere settings. However, there are anecdotal reports this new modality is presently being used in combat situations.[57]

## Other Medications

There are other medications used for analgesia that need to be considered; however, they have less acceptability in the mass casualty/disaster setting and these would include:

Alpha-2 receptor agonists such as clonidine, amitryptyline, and anticonvulsants such as gabapentin. In addition to the IM, IV, or PO methods of drug delivery mentioned earlier, there are also epidural infusions, local anesthesia by infiltration or infusion, nerve sheath catheters, and so forth. Although these may not be contraindicated medically in a battlefield situation, it becomes increasingly difficult to dedicate the time and provide the aseptic technique required for some of these. They are generally not recommended in the field and, if used at all, might first be applicable in the field hospital situation. At a receiving hospital level, the choice as to whether to use these procedures, considering that they are both equipment and human resource consumptive, will depend on the infrastructure available to the hospital. As mentioned earlier, the contraindications to these are not medical but operational.

## Summary

This review demonstrated that although various agents have been assessed for their risks and benefits on individual cases, there is no good evidence for generalized use of any specific analgesic agent over any other in MCIs.

The present practice of using morphine for all significant field analgesia in MCI situations has not been proven to be either the best or the safest practice, and further research into other agents is warranted.

This chapter focused on the medications required for analgesia but not the delivery process. Delegating the administration of analgesia to RNs or EMTs or equivalent can hasten delivery of the medication. The process of defining the delegated act will depend on local legislation and facility bylaws.

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Chapter 11

# Infectious Diseases Following Disasters

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# Preface

Infectious diseases following natural disasters tend to emerge as a result of the prolonged secondary effects of the disaster, mostly when there is an interruption of public health measures resulting from destruction of the local infrastructure. This chapter will review infectious risks that occur as a result of natural disasters, reviewing the basic principles of post-disaster infectious diseases, diseases associated with specific types of disasters, and the public health interventions that should be considered.

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# Infectious Diseases Following Disasters

Infectious diseases following natural disasters emerge as a result of the prolonged secondary effects of the disaster, mostly when there is an interruption of public health measures resulting from destruction of the local infrastructure. Infectious disease outbreaks following disasters are rare if there is little or no displacement of the population. Outbreaks more commonly occur post disasters if there has been population displacement, particularly if the displacement is prolonged and associated with comorbidities such as malnutrition. It is crucial that post-disaster risk assessment take into account infectious issues for the potential risk and impact that they represent. As evidenced from prior disasters, the precise impact of infrastructure destruction is variable and contingent on the pre-disaster baseline, for example, if the preexisting level of sanitation is very poor, then a disaster may have little impact on baseline rates of infectious disease. The converse is also true, in that a highly developed infrastructure with a low baseline disease rate can offer a significant reserve capacity that can lessen the perceived impact of the disaster.[1] Thus, it is difficult to predict the risk of infectious disease outbreaks following a disaster simply based on the magnitude of the event itself.

There are 3 overlapping concerns that have synergistic effects and are helpful in predicting the risk of post-disaster infectious diseases:

1. new pathogens introduced into a community without preexisting immunity;
2. a change in the susceptibility of the population; and
3. an increase in the potential for transmission of local pathogens.

These will be discussed in turn, followed by examples of specific types of disasters and their associated infectious risks and the principles of risk assessment in response to a disaster.

# Principles of Post- Disaster Infectious Diseases

## New Pathogens

As many historical examples illustrate, the introduction of new pathogens into a population increases the risk of infectious outbreaks. Disasters commonly provide the means for the introduction of these new pathogens, thereby bringing low-incidence endemic diseases to the forefront. The postflood environment, for example, is a prime breeding ground for fungi and mold. Freshly flooded homes and buildings pose infectious risks.[2] The aeration and spread of soil and particulate matters have the potential to introduce new earth-borne organisms into the environment, specifically fungi such as histoplasmosis and coccidioides.[3] Collapsing wood and chaotic debris increases the risk of tetanus exposures. New mosquito habitats are created in the post-disaster flotsam, thereby increasing the risk of mosquito-borne illnesses such as malaria, West Nile virus (WNV), or dengue. Waterborne pathogens have been

documented to cause wound infection in the post-flood situation, notably during the post-Katrina response.[4]

The infectious risks posed by dead bodies have been greatly examined, and there are no data to suggest that the body of a person killed in a disaster who is free of infection at the time of death will pose any risk of infection to others, despite common misconceptions.[5,6] Appropriate public education is vital to disseminate knowledge of World Health Organization (WHO) guidelines stating that every effort should be made to identify and bury or cremate the corpse, all the while respecting appropriate customs and laws.[7] Typical universal precautions for body fluids should be observed. Concern about dead bodies will persist among workers and evacuees,[8,9] and reassurance should be given by the disaster services provider.

## Altered Susceptibilities

Populations in movement or stress are more susceptible than normal to infectious diseases. This vulnerability comes from mechanical factors such as the compromise of personal hygiene and the presence of disaster-related wounds,[10] and biological factors such as a potentially compromised immune response due to the stress, hypothermia, or malnutrition associated with the post-disaster environment. Interruption of vaccination and other public health programs (e.g., tuberculosis [TB] treatment, HIV therapy) may lead to populations with susceptibility to vaccine-preventable and other infectious diseases.

## Increased Potential for Transmission

Although not specific to any one type of disaster, populations displaced from their homes, clustered in close proximity and spending time in closed spaces are at an increased risk for infections, especially respiratory and gastrointestinal illnesses. The enteric viruses, such as norovirus or rotavirus, have been implicated in outbreaks of gastroenteritis in the post-disaster setting.[11–14] The risk of TB transmission is increased with close contact living and should be anticipated particularly in areas with high endemic rates of TB whether or not access to medications is interrupted. Transmission of acute respiratory viruses has been well documented in the close conditions of the post-disaster setting.[15] Airborne outbreaks of pathogens, especially measles, are also significant risks that need to be considered and have been associated with higher rates of pneumonia and death in displaced populations.

In all of these situations, an increase in the basic reproductive number ($R_0$) of previously low-incident diseases is primarily attributed to an increased population density and closed conditions in the post-disaster setting. Therefore, the threshold vaccination rate required to achieve herd immunity is increased, so that if previously it stood at 85%, it may rise to 95% in the post-disaster setting[16] (see Figure 11-1). This increased potential for disease transmission must be taken into account when discussing any program implementation, including shelter, sanitation, food distribution, and health care.

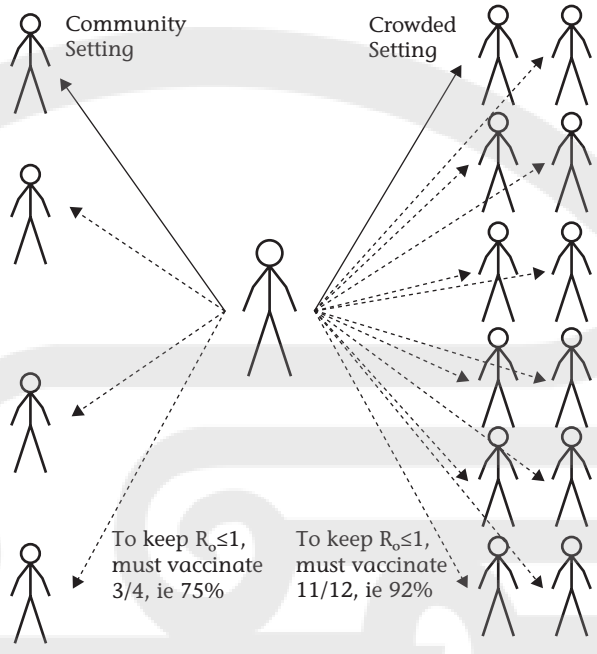


**Figure 11-1: Increased potential for transmission in the post-disaster setting causing an increased threshold of herd immunity required to stem outbreaks of infectious diseases.**

# Specific Types of Disasters

## Floods and Tsunamis

Floods are one of the most frequent of all natural disasters. Drinking water contamination is the most frequent concern from an infectious diseases perspective, with numerous historical epidemics of post-flooding gastrointestinal illness.[17–20] There are also examples, however, where significant flooding and subsequent water system damage occurred without any documented outbreaks.[21–23] When outbreaks have occurred, they have typically been associated with previously endemic organisms, such as Shigella[19] and Giardia,[17] although most cases have no etiologic agent identified.

A study of water quality that was ongoing when a major flood of the Mississippi River occurred provides an interesting insight into this situation.[20] Source drinking water concentrations of both *Giardia* and coliform species significantly increased (330% and 270%, respectively) postflood. The two major factors that increased an individual's risk of diarrhea were whether the individual's house or yard was flooded and whether they assisted with clean-up efforts. The availability of safe potable water from active water purifying devices had no discernible effect. This suggests that infection actually occurred through a route other than the consumption of contaminated drinking water in this case, and that source water purification may not play a significant role in attenuating outbreaks. Similarly, following the 1998 Bangladesh floods factors such as crowding, lack of latrine use, lidless water storage containers, and the use of small storage containers for water were all associated with increased rates of diarrheal illness.[1,18] This again illustrates that factors beyond simply a supply of clean source water are important to prevent disease, and that educational

interventions regarding appropriate hygiene and infection prevention are crucial. Common causes of diarrheal and other infectious illnesses post-disaster are listed in Appendix C.

In addition to contaminated drinking water, flooding also raises the theoretical specter of increased vector-borne illnesses due to increased mosquito populations.[1,22] Following the 1993 Iowa floods, a significant increase in the number of mosquitoes was documented, although without an accompanying increase in the endemic, but sufficiently rare, Western Equine Encephalitis (WEE).[21] Fifty-five human cases of WEE and 12 cases of St Louis encephalitis (SLE) were reported after flooding in North Dakota and Minnesota in 1975. After Hurricane Katrina, statewide surveillance in Louisiana and Mississippi did not show an increase in either WNV or SLE; however, local surveillance revealed a dramatic increase in WNV neuroinvasive disease in hurricane-affected areas when compared with areas in the states that were not affected by the hurricane.[53] Relief workers aiding the recovery efforts following Hurricane Georges in Puerto Rico did not contract the mosquito-borne dengue fever, despite being in the midst of an epidemic of dengue fever.[23] Although vector-borne disease outbreaks are rare in North America and other areas where adequate mosquito abatement programs exist, there have been large outbreaks of malaria recorded after flooding in other countries including Mozambique in 2000, Sudan in 1985, and Bangladesh in 1989–1991.[54] The increased morbidity and mortality in these disasters are likely from combinations of an increase in vectors, poor environmental conditions, interruption of mosquito control programs, increased populations exposed to the vectors while living outside, lack of access to health care, and increased vulnerability due to malnutrition. Arthropod-borne infections pose a risk after flooding and other water-related events that is dependent on the endemic risk in the affected area. Therefore, education and preventive measures against such infections should be part of a disaster response plan.

Another specific risk posed by floods is mold growth due to water damage. After Katrina and Rita in New Orleans, household levels of fungal by-products were significantly higher in severely flooded homes, specifically the fungi *Aspergillus Niger*, *Penicillium* spp, *Trichoderma*, and *Paecilomyces*, all of which cause human disease. There was no significant human outbreak of these illnesses post-Katrina, although a theoretical risk exists in future disasters.[2,24]

Wound infections, dermatitis, conjunctivitis, and ear and throat infections have all been recorded after flooding and, in particular, in the aftermath of the 2004 tsunami in Southeast Asia. Most infections are the result of direct skin or mucous membrane contact with contaminated fresh or salt water. The most commonly isolated microorganisms are *Staphylococcus* and *Streptococcus*; however, outbreaks of leptospirosis have been reported after flooding in Hawaii, Nicaragua, Puerto Rico, India, and Bangladesh. Skin infections with waterborne organisms like *Aeromonas* spp, *Vibrio* spp, and other gram-negative rods have been recorded. In particular, 18 cases of *Vibrio* wound infections were reported after flooding following hurricane Katrina. Of the identified species, 14 were caused by *Vibrio vulnificus* (with 5 deaths) and 3 were caused by *Vibrio parahaemolyticus* (with 2 deaths).[27] After the tsunami, a report on skin and soft tissue infections from Thailand found over 70% were polymicrobial with 2 organisms recovered from 41% of specimens and 3 different organisms isolated from 24%. *Burkholderia pseudomallei* caused infections ranging from skin and soft tissue infections to sepsis, pneumonia, and secondary abscesses was reported following the tsunami in both locals and in returning travelers to several countries where *B. pseudomallei* is not endemic.[55] Other travelers who

survived the tsunami reported unusual skin and wound infections from a variety of bacteria and fungi including *Aeromonas hydrophila*, *Apophysomyces elegans*, *Pseudomonas aeruginosa*, and *Mycobacterium abscessus* and *M. chelonae* most not normally endemic in their home countries. Rapid response to these infections and active surveillance to determine common causes are essential parts to these kinds of disaster response and recovery efforts.

## Hurricanes, Cyclones, Tornadoes, and Typhoons

Hurricanes, cyclones, and typhoons share a great deal in common with floods in terms of their post-disaster impact. The storm surge itself is responsible for most of the death and injury, and the post-disaster issues are similar to flooding.[25] In one example, a very large outbreak of diarrhea occurred with 97,934 cases following a cyclone in India.[8] Molecular analysis confirmed that this outbreak was due to endemic strains of *Vibrio cholera*, *Escherichia coli*, and *Shigella*, although with a much lower case fatality rate compared with pre-disaster baseline.

Tornadoes share the ferocious powers of the wind with hurricanes, but they lack the storm surge and flooding that accompany hurricanes. They occur with greater frequency and tend to affect inland areas more than hurricanes, at times spawning from remnants of hurricanes. Although tornadoes themselves have not been reported to directly result in infectious disease outbreaks, wound infections due to traumatic injuries contaminated with soil or water incurred during a tornado have been reported and risk of tetanus exists in people who have not had a primary series or recent tetanus booster.[26]

## Earthquakes

Earthquakes are one of the most dramatic, rapid, and destructive natural disasters that occur. The loss of life and injuries can be numerous following an earthquake, although the risks of infectious outbreaks are relatively low.[9,27,28] In fact, nearly 95% of injuries and deaths due to earthquakes occur within minutes of the quake.[27,28] Even in a situation where significant damage has been sustained to public infrastructure and thousands of people are homeless, outbreaks have rarely occurred immediately following earthquakes.[9,29]

When outbreaks of illness do occur following an earthquake, they are typically the result of an increased incidence of endemic pathogens. Following the Northridge earthquake in California in 1994, Ventura County experienced an outbreak of 203 cases of Coccidioidomycosis, including 72 deaths, as a result of dust clouds created during landslides.[3,27] Following an earthquake in Turkey, a large but brief outbreak of diarrhea was noted,[30] although with no significant change in the baseline rates of isolation of endemic pathogens, prompting the authors to speculate that either emotional stress and/or a sudden change in the diet of displaced persons was to account for the illnesses documented.

A unique property of earthquakes is their ability to cause tsunamis. Tsunamis combine both powerful destructive forces along with flooding, resulting in a very unique disaster. Aside from drowning, the most common serious injuries reported following the Southeast Asian tsunami in 2004 were large flap lacerations.[31,32] As described earlier, there were several reports that wounds were grossly contaminated with seawater, coral, or soil, causing infections by often drug-resistant organisms such as *Acinetobacter*, *Pseudomonas*, *Stenotrophomonas*, *E. coli*, *Aeromonas*, and *Mucor*. Transmission of infectious disease can occur only

if the organism is endemic in the area where the disaster occurs and this is reflected in many unusual infections seen after the tsunami in Southeast Asia. These infections can show up, however, in other countries as also seen after the tsunami when many victims and relief workers returned to their home countries with infections acquired in the tsunami zone.

## Displaced Populations

A unifying feature of the post-disaster environment is the presence of displaced population. As was widely publicized during hurricane Katrina, those evacuated to emergency shelters often faced crowded living conditions creating situations vulnerable to communicable disease outbreaks. Outbreaks of Methicillin Resistant *Staphylococcus aureus* (MRSA) skin infections and gastrointestinal illnesses were common in post-Katrina evacuation centers.[4] People sheltered in buildings with one large room, such as churches or community centers, were at significantly higher risk of contracting an influenza-like illness than those in shelters with several smaller rooms, such as schools.[15] Following two hurricanes striking the Dominican Republic in 1979, community outbreaks of hepatitis, gastroenteritis, and measles occurred,[33] and disease rates significantly peaking from already elevated baseline rates *5 months after* the hurricanes.

When populations become displaced for long period of time, natural disasters can spawn complex emergencies that can prompt outbreaks of diseases such as malaria, meningitis, pneumonia, TB, and HIV.[34–39] Post-disaster crowding itself is a complex enterprise with all three of the above concerns including new pathogens, altered susceptibilities, and increased potential for transmission of infections synergistically resulting in a significantly increased risk of a diverse spectrum of infectious diseases.

# Public Health Interventions to Prevent and Control Infectious Disease

Prevention and control of infectious diseases is a key public health intervention post-disasters, regardless of type. The initial risk assessment for infectious disease after a disaster should include assessment of the endemic and epidemic diseases that are present both in the affected area and the area to which people may have been displaced, the living conditions in the disaster area and areas for displaced people, the availability of safe water and adequate sanitation facilities, the underlying nutritional status and immunization rates of the population affected, and the availability and access to healthcare services for management of cases of infectious illness. The main functions that need to be put in place rapidly are assessment, establishing of water, sanitation, and other environmental systems that prevent disease, surveillance to detect infections early, protocols for rapid outbreak response and implementation of control measures, and individual case management of specific infectious diseases to prevent spread.

## Immediate Infectious Disease Risks

The immediate issues that may need to be addressed following a disaster include management of wounds, injuries, and burns that could lead to tetanus, wound infections, and gangrene. This will usually involve the establishment of acute

health assessment and care centers where both infectious and noninfectious health care is provided. One key measure in response to populations with low immunization rates and high numbers of traumatic wounds is the provision of tetanus immunization to individuals at risk.

## Water, Sanitation, Hygiene-Related, and Food-Borne Disease

Contamination of water by damaged sewage systems and disruption of usual drinking water sources may lead to use of unsafe drinking water. Infectious concerns include common enteric organisms such as *E. coli*, *Salmonella*, and *Shigella*, as well as Hepatitis A and potentially E. Depending on the prevalence in some countries, *Salmonella typhi* (typhoid fever) and cholera may be important concerns as well. Finally, contact with urine from infected rodents can lead to outbreaks of leptospirosis. Ensuring the provision of safe drinking water may be the most important preventive measure in decreasing the risk of waterborne disease outbreaks and a safe water source for hygiene will prevent skin and wound infections. Establishment of latrines and designated defecation areas is another key measure to prevent the transmission of infection.

## Infectious Diseases Associated with Displaced Persons

Addressing of diseases associated with crowding or which have increased morbidity and mortality in settings where there are large numbers of displaced persons is another key public health measure that will mitigate the risk of infectious disease outbreaks. Determination of the baseline immunization rates in the population (both those left in the community and people displaced by the disaster) is a key factor in the potential for outbreaks of measles, diphtheria, pertussis, and meningitis. Measles and meningitis, in particular, can have very high mortality in displaced persons (10%–30%) particularly in a setting of underlying malnutrition, diarrhea, or acute respiratory infections.

Surveillance should be established for rapid detection of these outbreak prone conditions and processes established for rapid delivery of vaccinations upon disease detection. Acute respiratory infections are also a concern in displaced population and surveillance to monitor for and use of standard treatment protocols should be rapidly established. Gastrointestinal illness caused by viruses such as norovirus can cause significant morbidity in displaced population and again systems should be established to detect illness rapidly so that control measures can be implemented immediately. TB may be a concern if there is a high prevalence in the community. People may not have access to their anti-TB drugs after a disaster and crowded conditions may lead to enhanced transmission. Poor nutrition over prolonged periods may trigger reactivation of latent TB and surveillance for new cough and fever should be established. The same concerns of access to antiretroviral medications may also be an issue for people with HIV and should be considered in a response to a disaster.

## Vector-Borne Disease and Zoonoses

Dengue, malaria, yellow fever, and WNV have all been associated with outbreaks following disasters; routine response planning needs to include measures to reduce mosquito breeding sites and protocols for vector control and yellow fever immunization in specific countries.

Rabies can be a concern in some countries with high endemic rates in dogs that may be foraging and displaced as well during the disaster. In some areas, leptospirosis can also be a concern and measure should be implemented to prevent contact with urine of infected animals.

## Vaccine-Preventable Disease and Routine Immunizations

Many vaccine-preventable diseases have an increased outbreak potential in displaced populations particularly when underlying immunization coverage rates are low and crowding is common. Particular concerns in post-disaster settings are measles, polio, diphtheria, and pertussis. Consideration should be given to proactive immunization with MMR vaccine (either as measles-rubella or measles-mumps-rubella) for all persons aged 6 months to 35 years who are displaced and living in crowded conditions; vaccine should be offered as soon as they enter a camp regardless of immune status (from previous immunization or history of measles). Surveillance programs should be established to monitor for meningococcal meningitis, yellow fever, and hepatitis A and plans put in place to initiate vaccination as an outbreak control measure should illness be detected. In general, population immunization with tetanus toxoid is not recommended but tetanus vaccination should be a routine part of wound management.

When the situation stabilizes, routine immunization programs should be set up as soon as possible. The routine vaccinations provided by the national immunization program should be made available to all infants, pregnant women, and others as part of provision of basic emergency healthcare services following a disaster. As a minimum, the immunizations given as part of the WHO expanded program on immunization (EPI) should be included. These include tetanus, diphtheria, polio, measles, and TB and in some countries, hepatitis B. Although immunization programs are well established in most EPI countries, the disaster may lead to disruption of public health programs leaving large number of people, especially children susceptible to vaccine-preventable diseases.

Emergency responders and relief workers should ensure that their own immunizations are up-to-date before deployment. As a minimum, this should include protection for hepatitis B, diphtheria, pertussis, tetanus, polio, measles, mumps, and rubella and in addition, depending on the situation and the country involved, immunization for typhoid, rabies, Hepatitis A, yellow fever, and meningitis may be recommended.

## Other Public Health Considerations

Individuals handling human remains may have a small risk through contact with blood, secretions and feces of hepatitis B and diarrheal illness, and a theoretical risk of hepatitis C or HIV. Anybody handling human remains should be instructed

on the basic hygiene measures to protect themselves; this includes wearing gloves and boots, washing hands with soap and water or alcohol-based hand rubs before eating and after their shift is over, avoiding touching their mouth, eyes, or face with their hands, and washing all equipment, clothes, and vehicles used for transporting of bodies.

Malnutrition can be a serious underlying issue in displaced populations and may lead to an increased vulnerability to infections particularly acute respiratory infections and diarrheal illness. HIV prevention, treatment, and care may be an important component of a disaster response and sexually transmitted infections may be an important cause of morbidity in displaced persons camps. This has been an issue in some displaced persons camps particularly if stays in the camps are prolonged. Issues of food security, domestic violence, lack of clean needles, blood supply disruption, and lack of availability of condoms may lead to increases of sexually transmitted infections and HIV. Infestations such as scabies and lice may also become a concern in crowded conditions with poor access to water and other hygiene measures.

## Rapid Needs Assessment and Surveillance for Infectious Disease Outbreaks

Rapid needs assessment can be accomplished using standard simple tools such as questionnaires[68] that can be administered to a random cluster sample in a displaced person camp or in the community. This methodology has been used post-disaster to assess needs in several situations[68,69] including post hurricanes in the United States and after the devastating earthquake in Pakistan in 2006. These assessments can not only be used initially to determine the health response needs but can also be used as a surveillance tool for understanding baseline rates of illness and immunization.

Early establishment of surveillance systems to detect outbreaks and monitor for epidemic prone illnesses is key to a rapid and lifesaving response. Priority conditions to put under surveillance include the following:

- Acute watery diarrhea
- Acute bloody diarrhea
- Measles
- Acute respiratory infection
- Dengue
- Malaria
- Jaundice syndromes (Hepatitis A, E, and B)
- Meningitis
- Tetanus
- Unexplained fevers
- Unusual or unexpected public health events (e.g., clusters of illness, unexplained disease)

In particular, alert systems should be established for bloody diarrhea, measles, and dengue hemorrhagic fever; and standard treatment protocols should be established for these epidemic prone diseases as well as cholera, dysentery,

shigellosis, typhoid, hepatitis, malaria, influenza, STIs, and any other endemic infectious disease of concern.

A detailed outbreak response plan should be developed early to allow timely action to be taken to control outbreaks. This response plan should build on existing structures as much as possible and should identify key laboratory support.

## Interventions

Many of the interventions should be centered on anticipatory prevention, given the risks of a significant infectious outbreak. Vital to these interventions is surveillance, both immediately post-disaster and in the subsequent weeks as the disaster response continues. The ability to detect greater-than-baseline incidences of diarrhea, respiratory illness, or fevers with rash is the cornerstone of any outbreak response.

Implementing appropriate universal- and transmission-based precautions at all times is vital for health worker safety and outbreak control. The availability of hand-washing stations, ensuring frequent and thorough hand cleansing, is the most cost-effective intervention to stem disease spread. Maintaining a focus on hygiene through ensuring clean food preparation and eating areas, appropriately placed lavatories, and containment of soiled areas is vital to prevent an infectious outbreak.[14,40] Post-disaster sheltering in many small rooms is preferable to few, large roomed housing, if feasible.

The typical historical response to a natural disaster has been to conduct mass vaccination or chemoprophylaxis campaigns.[1,9,41] Unfortunately, these campaigns have been poorly organized and characterized by the administration of incomplete batteries of vaccine and inadequate record keeping. Each situation is unique, requiring providers to weigh the merits of vaccinating post-disaster evacuees who should be examined on a case-by-case basis.[42] In regions such as parts of Canada[43] or the UK[44] with rates of measles immunization of <90%, there may be a need to introduce measles mass-vaccination campaigns to achieve the new, higher threshold of herd immunity in the post-disaster crowding. Similarly, in developing world settings, the lower baseline vaccination rate, coupled with increases in $R_0$, makes preventive measles vaccination a priority in all children up to 14 years.[45,46]

The Centers for Disease Control and Prevention (CDC) in the United States have routinely updated guidelines regarding immunizations in the post-disaster setting, encouraging updating tetanus, meningococcal, and pneumococcal series for those not up-to-date.[47] Varicella, influenza, and MMR vaccines should be considered in individuals living in crowded group settings, with targeted vaccinations for other at-risk population used to control outbreaks. Crucial to all of the above vaccination recommendations is adequate documentation of any intervention.[47]

The chemoprophylaxis and vaccination needs of responders to a disaster, ideally organized well before departure, should include provisions for HIV post-exposure prophylaxis following percutaneous exposures. Post-exposure chemoprophylaxis for documented cases of meningitis or rabies should be performed on an as-necessary basis. In addition, people affected by the disaster may have chronic infectious issues, namely HIV, where access to medications will be a likely concern.[48] It was estimated that up to 40% of people affected by Katrina lived with a chronic illness,[49] thereby making chronic disease exacerbations a concern.

Having a health center where there is limited exposure to other community members and easy access to medical personnel is a crucial component of infection control and triage for people with a suspected or documented infection.[50] Anticipatory preparation of these health and evacuation centers for the expected outbreaks, especially of diarrheal illness, should be performed. The creation of appropriate diagnostic centers with rudimentary laboratory facilities is a reasonable step for prolonged post-disaster conditions.[51,52]

The distribution of antimicrobials should be on a patient-by-patient basis by appropriately trained professionals. Appendix D lists the antibiotic-related contents of the most recent WHO emergency kit, which can be used as a guide in deciding on appropriate medications for the setting. Appendix E lists some considerations to take into account for those who wish to alter the antibiotic formulary for a specific setting. Once again, due to rapidly changing epidemiology, drug formulary selection should be performed on a situational basis, using the criteria listed below, with the emergency kit simply used as a backbone. Regional resistance rates to antibiotic (and antiparasitic, i.e., malaria) agents, if known, can be taken into consideration by relief agencies deploying healthcare resources to disasters.

## Conclusions

Disasters, whether natural or manmade, have the potential to lead to outbreaks of infectious diseases. Despite common perceptions, outbreaks following a disaster are infrequent. Outbreaks are most commonly caused by endemic organisms when they do occur. The peer-reviewed literature discussing post-disaster infectious disease is limited. The main tools in prevention and treatment remain as follows:

1. infection control,
2. surveillance,
3. epidemiologic analysis, and
4. laboratory diagnostics.

By considering the type of disaster, endemic organisms, public health infrastructure, and baseline population characteristics, one should be able to predict with reasonable certainty what infectious agents may pose a threat following a disaster, therefore initiating a tailored response. Finally, there is a critical need to begin to include research into disaster responses so that future responses can be evidence based thereby allowing resources to be directed appropriately.[25]

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# Appendix A – Health Sector Priorities

| |
|---|
| Provision of sufficient and safe water |
| Access to surgical, medical, and emergency care, particularly for trauma, obstetric cases, wounds, and burns |
| Priority immunizations, including mass vaccination campaign for measles/rubella, and tetanus immunization as part of wound care |
| Communicable disease surveillance and response, including preparedness for epidemic-prone diseases |
| Support for appropriate infant and young child feeding and malnutrition management |
| Continuity of care for chronic diseases (e.g., HIV, TB, hypertension, etc.) |
| Public health communication |
| Non-health sector priorities impacting health |
| Shelter and site planning |

# Appendix B – Sequence of Public Health Interventions

| | |
|---|---|
| Rapid Assessment | Identify the infectious disease threats and define the health status of the population. |
| Prevention | Prevent communicable disease by fostering a healthy physical environment and good general living conditions. |
| Surveillance | Set up an early warning mechanism to ensure the early reporting of cases of specific infectious diseases, to monitor disease trends. |
| Outbreak Control | Ensure rapid response by confirmation, investigation, and implementation of control measures. |
| Disease Management | Diagnose and treat individual cases of infectious disease promptly with trained staff using effective treatment and standard protocols at all health facilities. |

Adapted from WHO.[47]

# Appendix C – Selected Pathogens Implicated in Post-Disaster Infectious Diseases

| Transmission | Disease/Agent | Clinical Features | Incubation Period | Diagnosis | Treatment | Prevention/ Control |
|---|---|---|---|---|---|---|
| **Fecal/Oral** | *Cholera Vibrio cholerae* | Profuse watery diarrhea, vomiting | 2 h to 5 d | Microscopic observation of organism in stool | Intensive rehydration therapy; antimicrobials based on sensitivity testing | Hand washing, proper handling of water/food, and sewage disposal |
| | Bacillary dysentery *Shigella* spp | Malaise, fever, vomiting, blood and mucous in stool | 12–96 h | Isolation of organism from stool | Nalidixic acid, ampicillin; hospitalization of seriously ill or malnourished; rehydration | Hand washing, proper handling of water/food and sewage disposal |
| | Viral Hepatitis Hepatitis A, E virus | Jaundice, abdominal pain, nausea, diarrhea, fever, fatigue, and loss of appetite | 15–50 d | Serologic assay detecting anti-HAV/HEV antibodies | Supportive care | Hand washing, proper handling of water/food, and sewage disposal; Hepatitis A vaccine |

*(continued)*

| Transmission | Disease/Agent | Clinical Features | Incubation Period | Diagnosis | Treatment | Prevention/ Control |
|---|---|---|---|---|---|---|
| | Typhoid fever *Salmonella typhi* | Sustained fever, headache, constipation | 3–14 d | Culture from blood, bone marrow, bowel fluids; rapid antibody tests | Ampicillin, trimethoprim-sulfamethoxazole, ciprofloxacin | Hand washing, proper handling of water/food, and sewage disposal; vaccination in some settings |
| | Viral Gastroenteritis Many, including rotavirus and norovirus | Diarrhea | 3–7 d | Clinical, isolation of virus in stool | Supportive, hydration | Hand-washing, hygiene; environmental cleaning |
| **Air-Borne** | Measles Measles virus | Fever, conjunctivitis, cough, diffuse rash | 10–14 d | Clinical, serology | Supportive | Vaccination, hygiene |
| | Respiratory viruses | Cold-type symptoms | 3–7 d | Clinical | Supportive | Hygiene, hand-washing |
| | Meningitis *Neisseria Meningitis* | Fever, headache, stiff neck | 2–10 d | Isolation of organism in CSF | Antibiotics | Post-exposure antibiotic prophylaxis, vaccination |
| **Vector-Borne** | Malaria *Plasmodium* spp | Fever | Varies by species, 9–40 d | Visualization of organism in blood, rapid test | Anti-malarial, depending on species | Mosquito control, |
| | Dengue fever | Fever, headaches, muscle pain | 3–14 d | Clinical, serology | Supportive | Mosquito control |

# Appendix D – Infectious Disease-Related Contents of WHO Emergency Kit

| | |
|---|---|
| Basic Kit | Benzyl benzoate, lotion 25%<br>Chlorhexidine (5%)<br>Chloroquine, tab 150 mg<br>Gentian violet, powder<br>Mebendazole, tab 100 mg<br>Oral rehydration salts<br>Sulfamethoxazole + trimethoprim, tab 400 mg + 80 mg<br>Tetracycline eye ointment 1% |
| Supplemental Kit[a] | Amoxicillin, tab 250 mg<br>Ampicillin, inj 500 mg/vial<br>Benzathine benzylpenicillin, inj 2.4 million IU/vial<br>Benzylpenicillin, inj 5 million IU /vial<br>Chloramphenicol, caps 250 mg<br>Chloramphenicol, inj 1 g/vial<br>Doxycycline, tab 100 mg<br>Metronidazole, tab 250 mg<br>Nystatin, non-coated tab 100 000 IU/tab<br>Nystatin vaginal tab 100,000 IU/tab<br>Procaine benzylpenicillin, inj 3–4 million IU/vial<br>Quinine, inj 300 mg/ml 2 ml/ampoule<br>Quinine, sulfate, tab 300 mg tab<br>Sulfadoxine + pyrimethamine, tab 500 mg + 25 mg |

*(continued)*

| | |
|---|---|
| The Kit Does Not Contain | Vaccines |
| | Drugs for tuberculosis |
| | Drugs for leprosy |
| | Drugs for specific resistant malaria strains |
| | Drugs for sexually transmitted infections |

[a]Includes all contents of basic kit as well.

# Appendix E – Considerations When Selecting Antimicrobials for Disaster Relief

| |
|---|
| The endemic organisms in the disaster area |
| Resistance patterns of these organisms |
| Ease of administration in the field (oral preferred over intramuscular preferred over intravenous) |
| Storage requirements (avoid drugs that require refrigeration or are damaged by freezing) |
| Expiration dates for drugs should not be less than 4 yr |
| Vaccines and Chemoprophlyactic agents |
| Constantly recall that providers are potential patients |

Chapter 12

# Managing Chemical, Biological, Radiological, and Nuclear Disasters in a Healthcare Facility

By Carl Jarvis, MSc, MD, CCFP(EM)

# Preface

This chapter is intended to provide practical advice for managing disasters involving chemical, biological, radiological, and nuclear (CBRN)* contamination by first receivers at healthcare facilities. The term "first receivers" refers to Emergency Department (ED) staff who receive the casualties brought in by first responders (paramedics and fire), and the term "healthcare facility," as used in this chapter, refers to acute care hospitals. These represent a broad spectrum, from the level 1 trauma centre in a big city to a rural hospital with family physicians providing after-hours on-call coverage for outpatients. Within most local and regional healthcare centers, the ED will be the primary site of the response to a CBRN incident. However, the ED is really just the front door into the hospital during a disaster. Thus, staff throughout the healthcare facility must be equally prepared, and the ED disaster plans must be fully integrated into the broader plan for disaster preparedness for the healthcare facility as a whole.

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*CBRN refers to Chemical, Biological, Radiation, and Nuclear disasters. The term "explosive" (referring to the explosions with which CBRN events are sometimes associated) is sometimes appended to the acronym, giving CBRNE.

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## Common Issues in CBRN Disasters

On July 13, 2006, just after midnight, a Canadian Forces CH-149 Cormorant helicopter was involved in a "hoist exercise" with the Canadian Coast Guard and a local fishing vessel on a foggy night in the Atlantic Ocean off Canso, Nova Scotia. Something went wrong and the aircraft plunged into the ocean.[1] The fishing vessel pulled 4 injured airmen out of the icy water: 3 others died and were later recovered from the partially sunk fuselage. On arrival dockside, the 4 survivors, saturated with jet fuel, were transported to the local hospital prior to any on-scene decon.[2] The receiving hospital had no equipment or plan for managing contaminated casualties and they were brought into the ED. Because it was unprepared, the hospital's role in providing the necessary medical care for the contaminated casualties while remaining open for the usual heartburn and heart attacks that continued coming in was compromised. This event prompted a reevaluation of the preparedness for CBRN incidents in Nova Scotia, which led to improvements in the ED Disaster Plans, the purchase of advanced capability personal protective equipment (PPE) for some EDs, and exercises focused on chemical decontamination.[3]

In another incident, on January 6, 2005, a train with 42 tanker cars containing chlorine derailed at 2:40 AM in the town of Graniteville, South Carolina, releasing a toxic cloud of the gas that killed 9 and injured scores of others.[4,5] After receiving an initial phone call from a local resident, "the poison center promptly called the local ED and found on duty a single emergency physician, who was already overwhelmed with 1 critically ill patient, 6 patients who had pulmonary edema, and 100 patients in the waiting room."[6]

Auf der Heide[7] refers to "the paper plan syndrome," which he describes as the "illusion of preparedness based on the completion of a written document." Some efforts at improving disaster preparedness have focused on improving infrastructure and buying supplies (protective suits, safe breathing apparatus, and collapsible decon tents). However, there is no evidence that big capital

projects translate directly into improved disaster preparedness on the long term. Thus, adequate ED preparedness for contaminated casualties requires the following:

- Basic knowledge about specific CBRN threats, how to identify and manage the medical issues, and how to mitigate the risks to themselves, their patients, and their ED
- An Emergency Department Disaster Plan that is both accessible and comprehensive, familiar to those who will be called on to use it with very little advance notice, and is fully integrated with the rest of the hospital and with outside stakeholders.
- Equipment for detecting contamination and performing subsequent decontamination, and staff who are trained in the use of that equipment and those facilities, as well as appropriate PPE.
- Practice with the use of the Disaster Plan, the decontamination equipment, and the PPE.

There is ample evidence that healthcare facilities appear to be poorly prepared to manage CBRN disasters.[8–12] One of the contributing factors to this perception is the difficulty in defining "preparedness." Should all EDs be prepared for a CBRN disaster on the scale of the 1995 Sarin attack on the Tokyo subway[13,14] or is any deliberate preparedness a waste of resources better spent on managing daily overcrowding?[15] The Centre for Excellence in Emergency Preparedness has published a checklist for assessing preparedness for CBRNE incidents,[16] which could be used as a starting point.

This chapter takes the view that some preparedness for CBRN casualties constitutes "due diligence," and that with education, training, and minimal (if any) additional resources, every ED can provide essential care in a safe and cost-effective manner in all but the most exceptional circumstances.

The goal of this chapter and the skill set it describes is not to create the expectation that ED staff have to be experts in managing CBRN disasters. As skilled as ED's might aspire to being at managing contaminated casualties, they will never have the skills or resources of professional CBRN specialists. Thus, one of the first telephone calls made from the ED when facing a CBRN disaster should be to Emergency Services Dispatch to request assistance from the fire department Hazmat team.

## Identifying a CBRN Disaster

Shortly after a CBRN incident occurs, the first responders (fire, police, and emergency medical services) arrive at the scene. Some supervisory, special operations, and Hazmat vehicles are equipped with chemical sniffers and γ (gamma) detectors, and arriving first responders may rapidly learn of the existence of a hazard. Otherwise, they may have prior intelligence or recognize signs at the scene that are suggestive of a CBRNE hazard. It typically falls to EMS to notify the EDs of area hospitals. Despite this infrastructure, however, first receivers may learn about contamination at a disaster scene prior to official

notification, when casualties arrive on foot or by personal vehicle[6,17]. The Centers for Disease Control and Prevention (CDC) have published preparedness and response recommendations for hospitals.[14]

In some cases, recognition of the disaster is overt, when it is obvious that there has been a disaster involving contamination even in the absence of formal notification. At one end of the scale, workers may come from the site of an accident anxious that they may be contaminated with a known agent that they were working with or transporting. They may have triggered a portal monitor (e.g., at a nuclear power facility, research, or industrial site). Patients may come in from their homes near the scene of a train derailment complaining of a "fog" descending on their homes and subsequent respiratory symptoms[6] (note that both you and they may initially be unaware that there has been a train derailment several miles away). At the other end of the scale, there may have been an explosion at a nearby nuclear power plant or fire at a petroleum refinery that could already have been reported in the local media.

In other cases, the occurrence of a CBRNE disaster may be covert. For disasters with a drawn-out timeline (i.e., days to weeks), syndromic surveillance may provide some warning that there is something extraordinary going on. This surveillance can happen at a variety of levels, from search terms used in public internet searches (e.g., Google FluTrends[18]) to symptom clusters (i.e., clusters of diarrhea and vomiting with mass food poisoning or neurological dysfunction and respiratory distress with mass botulism poisoning) either called in to EMS or presenting to ED's equipped with electronic patient tracking. In many cases, syndromic surveillance will consist simply of recognition that patients presenting to the ED are suddenly sharing common symptoms. ED staff should always consider the possibility that this cluster of cases may be due to a mass chemical or biological event and not just that "there must be a Norovirus going around the nursing home…"

Portable monitors are available for certain types of chemical and radiological contaminants. Some monitors are handheld, for example, Geiger counters (for γ (beta) and γ (gamma) radiation) and certain chemical "sniffers." Others are portal monitors, the same as the metal detectors that passengers walk through going through security at the airport. It makes sense to have monitors relevant to the setting of the hospital, so that, for example, any ED within 50 miles of a nuclear facility should have a Geiger counter. Staff need to know where their monitors are stored and how to use them. Most use simple batteries that require scheduled replacement.

# The Disaster Plan

## Why the ED Needs Its Own CBRN Disaster Plan

The role of a functional CBRN Disaster Plan is to provide a means of moving forward when confronted with an extraordinary challenge that is unfamiliar to most staff. The format is important. A fully digital format will allow the plan to be stored on the hospital server and therefore accessible from any terminal in the ED. This type of access also allows staff beyond the ED (e.g., in inpatient

and administrative areas of the hospital) the means of seeing what is going on in the ED during a CBRN disaster response. Finally, it also facilitates ongoing maintenance and improvements. However, it is also essential to have a small number of up-to-date paper copies of the plan placed at strategic locations in the hospital for the inevitable power outage.

Although each type of CBRN disaster has its own specific features, there are many issues that are common to all CBRN events. These issues include the following:

- Safety of staff and other patients
- Maintaining the ongoing function of the ED
- Initial uncertainty regarding the specific contaminants involved, followed by a lack of knowledge about those contaminants once they are identified
- Disproportionate levels of fear and anxiety among staff, patients, and members of the public peripherally affected by the CBRN disaster[19]

The Disaster Plan needs to include specific answers to the following questions:

- What are the risks posed by common CBRN agents?
- What constitutes appropriate PPE when the specific contaminant is unknown?
- What are the key aspects of triaging casualties from a CBRN disaster?
- Decontamination: when, where, who, and how?
- When, if ever, is it safe to bring contaminated casualties into the ED, the diagnostic imaging facilities or the OR?
- How to proceed if the ED does not have the level of PPE required for casualties arriving who are contaminated.
- What resources are available in hospital? Labs, housekeeping, and site engineering all use toxic chemicals and are required to have spill kits and other safety supplies.
- How to manage the disproportionate numbers of psychological casualties in a CBRN disaster.
- Business continuity: how to keep providing care for patients not involved in the CBRN incident, and how to clean up afterwards so that contaminated areas can be put back into general service as soon as possible.

The Disaster Plan should specify an approach to patients from across the spectrum of triage acuities, including high acuity (especially those who require life and limb-saving interventions prior to being decontaminated), low acuity, walk-ins, and psychological casualties. Note that this last group is likely to outnumber the injured and contaminated by a ratio of 10:1 in any CBRN mass casualty incident.[17,19]

## Disaster Codes

Broader protocols that are part of the overall hospital disaster plan should be used when appropriate during a CBRN disaster. Specific "code" colors are not universal. Thus, a chemical spill may be a "Code Brown" at one hospital and a "Code Green" at another.

"Code Orange" is frequently used for mass casualty reception when the number of affected casualties exceeds the capacity of available resources. Thus, a "Code Orange" should probably be declared for any CBRN disaster that has more than a limited number of casualties, when the contamination requires a large commitment of resources, and when there is a significant proportion of concomitant trauma. Some hospitals also have other "Codes" that should be considered.

"Code Brown" is a hazardous substance spill. Calling this Code will engage resources that the ED may not even be aware of in their own hospital, for example, the hazardous chemical spill kits in hospital laboratories as well as technical experts and equipment. "Code Brown" can be used if a chemical or radioactive agent from a disaster outside the hospital has contaminated the entrance to the hospital, including areas designated for triage and decon.

Finally, a "Code Grey" should be called if chemical fumes, smoke, or a radioactive plume is contaminating the air outside a hospital; it shuts down the intake of ambient air by the hospital heating, ventilation, and air conditioning systems.

## Patient Flow

Patient flow describes how arriving casualties flow through the physical space while they go through the stages of care, and who will provide that care for each type and scale of CBRN incident. These stages of care include the following:

- Triage (including initial assessment for contamination)
- Registration (keeping track of arriving casualties)
- Decontamination
- Evaluation and management of injuries and medical problems related to contamination
- Disposition (the location to which the patient is eventually discharged)

Patient flow through the ED follows a similar pattern regardless of the specific incident (see Figure 12-1). Casualties are met by the Triage Team at the outer edge of the "Warm Zone" where they are evaluated and assessed for contamination. Stable patients who are contaminated can be grouped together to wait for decon. Their priority should be based on their triage acuity and their risk of ongoing health effects due to the contamination (e.g., contaminated wounds or ingestion or inhalation of contaminant). Patients who are ambulatory are directed into the ambulatory decon shower. Once they have showered, they

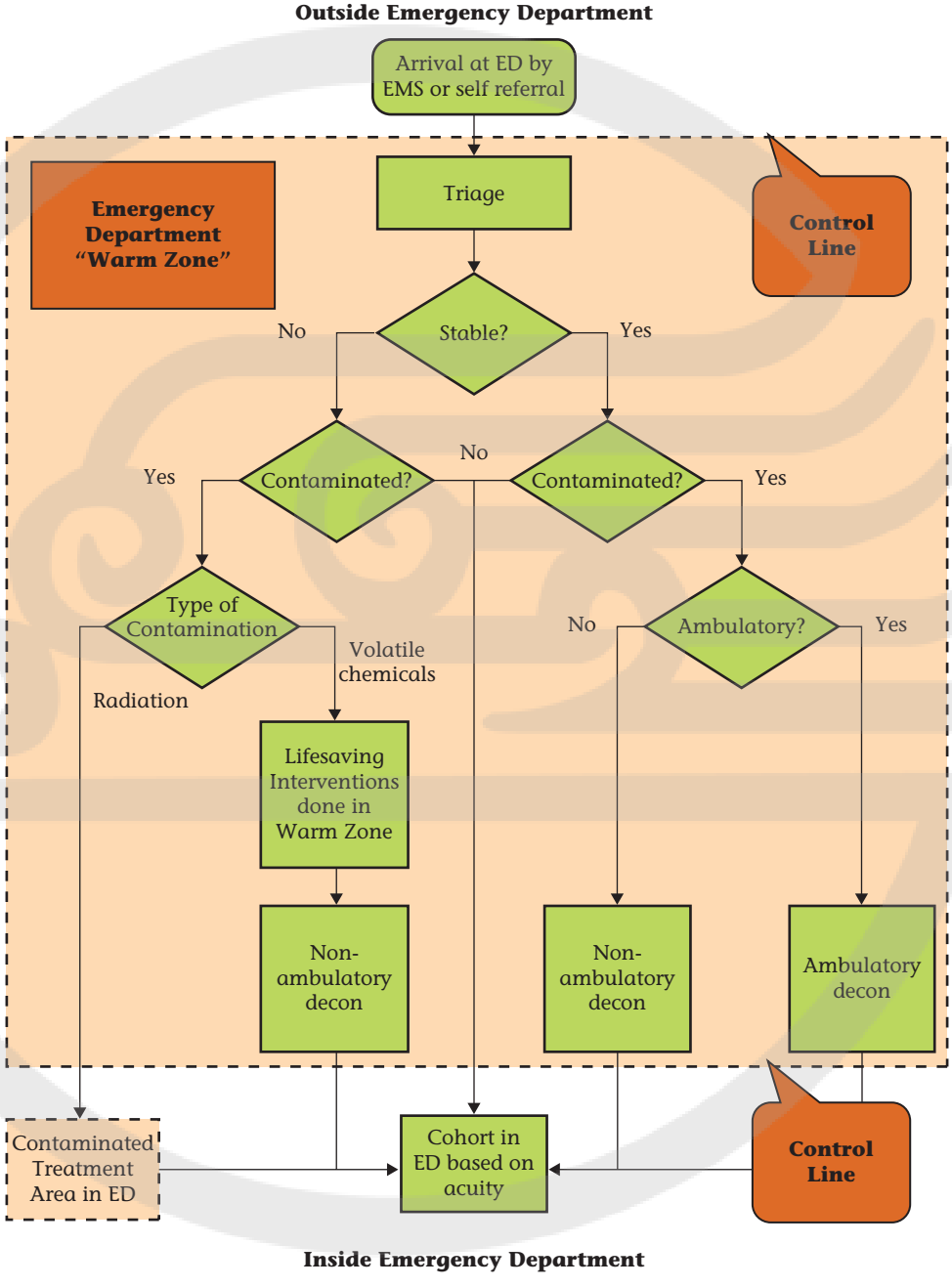


**Figure 12-1: Algorithm for patient flow through the ED during a CBRN disaster.**

should be reassessed for contamination. When successfully decontaminated, they are allowed to enter the post-decon area where they dry off with towels and put on clean dry clothing. Then they are brought into clean areas of the ED when a bed is available for their evaluation and management. Those who are nonambulatory go through a similar process but are decontaminated on a stretcher.

Once decontaminated and ready to enter the ED for their full evaluation and management, it is certainly an option to mix these patients with other patients from the disaster who were not contaminated in the first place or with those patients in the ED for reasons unrelated to the disaster. The only reason to continue to cohort decontaminated patients might be in the case of patients with internal contamination, where specific sampling and treatment procedures (e.g., screening urine, emesis, and stool for radiation) might best be done by a group of ED staff prepared for those specific issues.

There are two options for managing unstable patients. First, if they do not pose any significant contamination risk to the staff, other patients, or the facility (e.g., with radiation contamination), they should be brought into an isolated area within the ED (called the "Contaminated Treatment Area"). Otherwise, they should receive whatever interventions are possible in the Warm Zone.

## Cohorting Patients

When potentially contaminated casualties present to the ED, one way to manage them is to group them based on key parameters that affect where (and how rapidly) they are decontaminated and receive their medical evaluation and management. These parameters include the following:

- *contamination status* (contaminated, not contaminated, or unknown)
- *acuity* (stable—those patients who can wait until after being decontaminated to receive complete medical evaluation and management, and unstable—those patients who require immediate evaluation and/or emergent management)
- *ambulatory status* (ambulatory versus nonambulatory)

Taken together, these parameters define the cohort to which the patient belongs. The key cohorts include the following:

1. Stable, contaminated, and ambulatory
2. Stable, contaminated, and nonambulatory
3. Unstable, contaminated, can be decontaminated immediately and then brought into ED for evaluation and management
4. Unstable, contaminated, requires live or limb-saving intervention prior to being decontaminated
5. Not contaminated
6. Psychological casualties

As mentioned earlier, with the exception of patients with internal contamination, after being decontaminated, patients could be mixed with other patients from the disaster who were not contaminated in the first place or with those patients in the ED for reasons unrelated to the disaster.

## Personal Protection Equipment

The risk of working with contaminated patients is that the healthcare worker will become contaminated themselves. This is not a problem provided they are protected from the negative consequences of contamination.

Proper PPE leaves the healthcare worker free to get surface contamination on their PPE, while protecting their skin and personal clothing from requiring decon and protecting themselves from any adverse health effects.

When contamination with an unknown agent is suspected, staff should wear the highest level of PPE available to protect themselves from the type of contaminant involved (i.e., chemical, biological, or radiation). Once the exact contaminant is known, it becomes possible to focus the exact type of PPE required to ensure staff safety (e.g., using databases like WISER[20]).

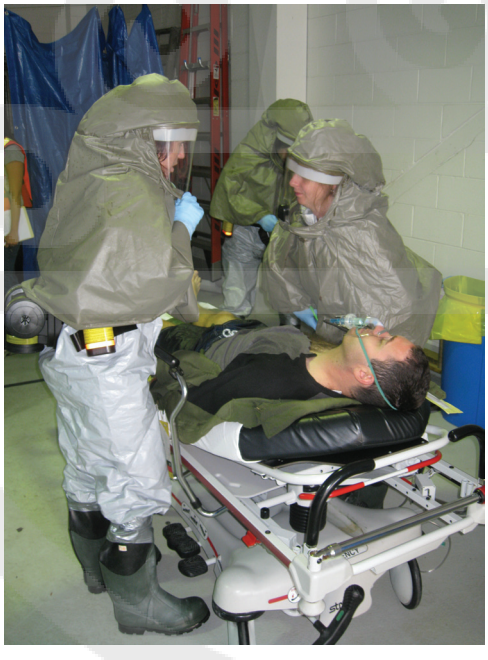

**Figure 12-2: Triage Team wearing Level C PPE for chemical contamination.**

Levels of PPE vary from Level A (maximally protective suits with self-contained breathing apparatus (SCBA), typically used by Hazmat technicians) to Level D (basic universal precautions). The Level A and Level B PPE are impractical for assessing patients and providing any interventions and are only used in the field by specialists whose role it is to carry casualties from the "Hot Zone" to the "Warm Zone." There, first responders with less restrictive PPE (usually Level C) are able to provide initial medical triage and treatment. Resuscitation in the Warm Zone consists of limited procedures such as BVM ventilation, needle thoracostomy, providing intravenous access, immobilizing possible C-spine fractures or straightening angulated fractures with absent distal pulses. The minimal safe level of PPE for first receivers depends on the contaminant.

The types of PPE accessible for most EDs include Levels C and D. Full Level C PPE includes hooded chemical-resistant clothing, a NIOSH-approved full or half facemask powered air purifying respirator (PAPR), as well as chemical-resistant gloves and rubber boots (see Figure 12-2). Level D PPE is essentially the same PPE used in EDs for contact precautions and is protective against radiation contamination (see Figure 12-3). Note that a Tyvek suit will provide more protection of the first receiver's personal clothing than just a gown and is quite affordable.

For EDs equipped with Level C protection, a practical approach is to have a core of staff fully trained in its use, acting as leaders and resource people to assist other staff in the correct procedure. It also helps to have demonstration

media (posters, slides, or video) of appropriate PPE for each specific type of CBRN contamination and how to use it. The specific tasks for the use of different types of PPE include donning (i.e., putting it on), use while working, and doffing (i.e., taking it off). For ED's without any special PPE, it is important to know what is feasible to do with Level D PPE and also what should not be attempted. The sections in this chapter dealing with each specific type of CBRN contamination will address that question.

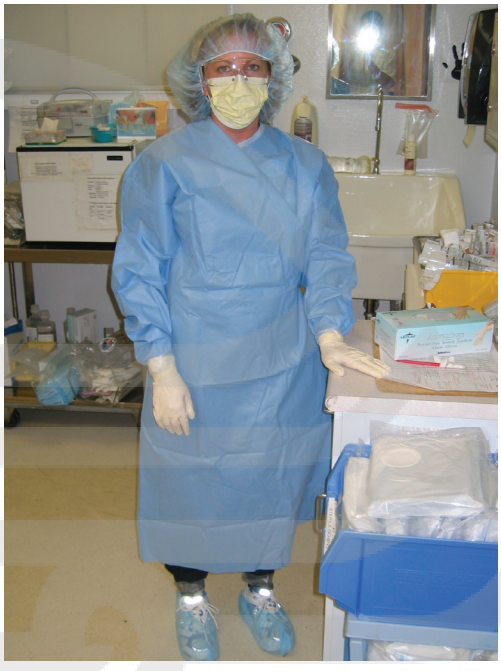

**Figure 12-3: Level D PPE for radiation contamination.**

From a practical standpoint, it is a good idea to use the bathroom before donning PPE and to wear light clothing underneath because it can get hot in a gown or suit and opening the zipper to ventilate is not an option. It can be very difficult once a healthcare workers are wearing the appropriate PPE to recognize each other. Therefore, a strip of masking tape with your name or role, taped on the front and back of the gown or suit, can make it easier to find specific individuals. It may also help to use color-coded strategies (e.g., colored tape) to identify key roles as follows: ED leaders, staff qualified to intubate ("intubators"), and so forth. It is important to keep in mind that it is very difficult to hear and to be heard while wearing a full face mask and hood. There needs to be a backup strategy for communication, something as cheap as a dry erase marking board or as expensive as a wireless Bluetooth communications system with individual microphones and ear buds. Finally, there is also a finite period of time that any person can wear PPE in terms of tolerance and filter efficiency.

A thorough discussion of PPE and general decontamination procedures from a first receiver occupational health perspective is available in the OSHA (the US Occupational Safety and Health Administration) 2005 report "Best Practices for Hospital-Based First Receivers of Victims from Mass Casualty Incidents Involving the Release of Hazardous Substances."[21]

## Preparing the ED for Contaminated Casualties

When the decision is made to prepare the ED for receiving contaminated casualties, the same basic approach applies for most types of contamination. This includes setting up a "Warm Zone" adjacent to the ED and, in the case of radiation casualties, a "Contaminated Treatment Area" inside the ED. A schematic representation of this basic approach is shown in Figure 12-4. Although clinical staff are preparing to triage and decontaminate patients, security should be preparing for the arrival of the casualties by ambulance, private vehicle, and on foot.

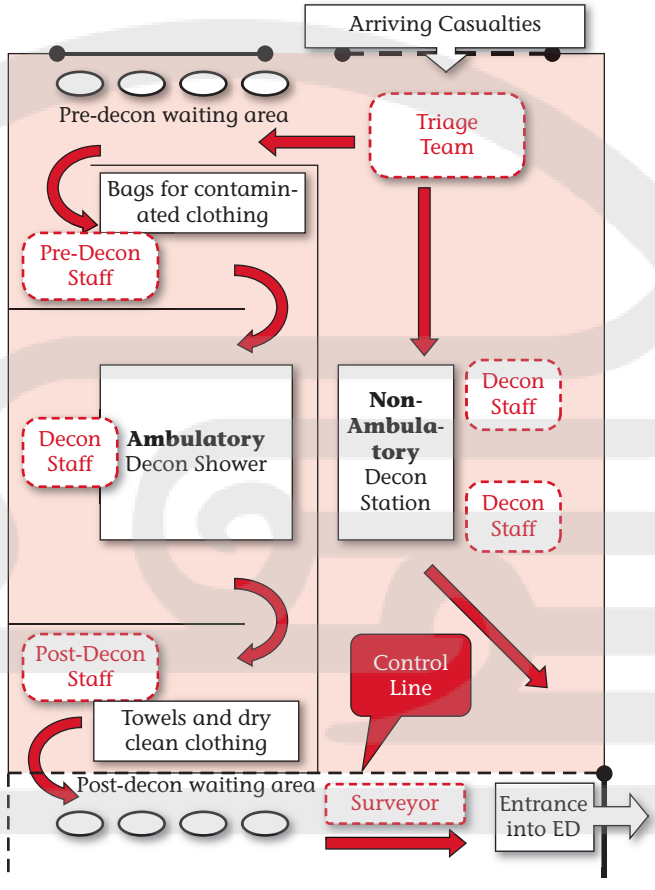


**Figure 12-4: Typical layout of 2-truck ambulance bay with ambulatory and nonambulatory decon lines. The heavy red arrows depict patient flow through the Warm Zone. Staff positions are shown as well.**

## The "Warm Zone"

Managing casualties from a CBRN disaster typically conjures up images of extensively trained and equipped hazmat technicians wearing space suits, speaking in muffled voices through full face masks as clouds of deadly mist swirl around them. That may actually be the reality in the "Hot Zone" at the site of the disaster. However, the reality in the ED is typically less hostile. Several factors serve to mitigate the risk to first receivers (as opposed to first responders) as follows:

1. The contaminant is typically diluted by the time the casualty arrives at the ED: the ambient concentration of contaminant is highest at the point source of its release, as typically it is stored or transported in a pure or concentrated form prior to the disaster.
2. Casualties with the greatest burden of contaminant may in fact be either dead, or triaged as "expectant" at the site, and may not even be transported to the ED.
3. Most toxic chemicals are fairly volatile. This means that unless the disaster occurs immediately adjacent to the ED, much of the contaminating

chemical would have evaporated by the time they reach the ED. This is called "off gassing," and poses a risk primarily to paramedics transporting contaminated casualties.

4. Casualties arriving by EMS may have been decontaminated prior to arrival at the ED. In fact, many EMS organizations have policies prohibiting the transport of contaminated casualties until after they have been decontaminated in the field. Note that this does not apply to ambulatory casualties who will have self-extracted from the scene and will likely arrive prior to the EMS patients.
5. Up to 90% of the contamination on casualties will be on their clothing. By simply removing their clothing and keeping it outside the ED (and away from any hospital air intakes!), most of the contamination will be kept outside the ED decon area.

Thus, the space adjacent to the ED where contaminated casualties are triaged and decontaminated can be referred to more as a "Warm Zone" than a "Hot Zone." The "Warm Zone" may be on the periphery of the ED (e.g., in an exterior ambulance bay) or can be near the ED (e.g., part of a parkade across from the ED or an adjacent building that does not house patients or essential services). Triage and decontamination functions may be set up at different physical locations, with patients walked from the Triage area to a nearby decon site. When the "Warm Zone" is inside the building that houses the ED, it is essential that dangerous fumes are not allowed to enter the building; most ambulance bays are designed so that there is a flow of air out of the building (i.e., from the inside, through the ambulance bay to the outside), because vehicle exhaust fumes are another type of chemical toxin.

The entry into and exit out of the "Warm Zone" must be clearly identifiable with painted lines or tape on the floor and possibly pylons or other physical barriers. Also, the movement of casualties through the "Warm Zone" into the main ED must be ideally controlled by a surveyor, whose role is to ensure that no staff or patients carry contamination into the ED, recontaminate themselves, or expose themselves to contamination without appropriate PPE.

Consideration should be given to special population who might require more guidance or support such as the blind, the mobility impaired, the mentally handicapped, and patients with psychiatric illness and specifically how to manage children in such a frightening situation (i.e., to keep with relatives, etc.).

## The Contaminated Treatment Area

Generally speaking, contaminated casualties should not be brought straight into the ED until they have been decontaminated. One exception to this rule is with unstable patients contaminated with radiation. Although radiation can pose an exposure risk to first responders close to a point source for a sufficient duration of time, this level of exposure would not be expected in the ED setting. This room (or contiguous rooms, in the case of multiple contaminated and unstable patients) is referred to as the "Contaminated Treatment Area." When patients are brought into the Contaminated Treatment Area, they should (if possible) have their clothing removed and be transferred to a clean stretcher, or at the very least

wrapped in a clean sheet to contain loose contamination prior to being wheeled into the ED.

If a contamination risk becomes apparent only after a patient has been brought into the ED, a Contaminated Treatment Area can be set up as soon as that risk is noted, with the control lines put in place to control the spread of contamination into other parts of the ED.

Be mindful that this task and others outlined in this chapter may take longer than expected, even up to a few hours in large facilities, particularly after hours when staffing is decreased.

## Additional Preparations

*Security* staff are critical to the ongoing ED function during a CBRN disaster. They should begin by initiating a facility-wide lockdown. Note that this may take a longer time than expected and involve more staff than is usually available on site. It is worthwhile reviewing the process ahead of time with the Chief of Security and perhaps prioritizing the lockdown of specific areas initially so as to save time.

After locking down, their tasks then include the crowd and traffic control issues present with an MCI. In addition, they may be needed to assist the surveyor in enforcing the control lines around the "Warm Zone" and the Contaminated Treatment Area. Security must take responsibility for the bags of contaminated personal belongings (including wallets, watches, cell phones, and jewelry). They may also be responsible for preserving forensic evidence and may be required to work with law enforcement agencies in that regard.

*Signage* will need to be posted designating the various marshalling areas, including the predecontamination undressing and post-decontamination dressing areas on either side of the decon shower, as well as the storage site for bags of contaminated clothing and waste. These signs should be prepared in advance and ideally deployed (such as painted arrows on floors or walls).

Many EDs set up their decon facilities in their Ambulance Bay. In these setups, there is often a *positive pressure air flow* out the inside (ED entry) doors, across the "Warm Zone," and out the bay doors. There may be a switch to start the fans. In the event that there is an air intake (e.g., for air conditioning systems) in a contaminated area, it may need to be shut down to prevent the spread of contaminants.

Ideally, EDs should try to *control contaminated effluent*. Small numbers of casualties can be decontaminated standing in wading pools (which will then have to be drained). Newer sites sometimes have "skimmer" tanks installed in their ambulance bays that store hundreds or thousands of gallons of effluent. These are usually designed to collect oil-based solvents that float on the water used for decontamination. If the contaminant is aqueous, then it is more difficult to control. In any case, the relatively small amount of contaminant (once the casualties clothing has been removed) is likely to be extremely dilute by the time the effluent enters the municipal water treatment system. Furthermore, environmental remediation is always available as an option of last resort, once the casualties have been attended to.

When there are *fatalities* in the "Warm Zone," they are likely to be the most heavily contaminated casualties. They will need to be decontaminated prior to being brought into an indoor morgue. However, they are also likely to be of

interest from a forensic and biodosimetry point of view. Therefore, any bodies will likely need to be stored in or near the ED until these requirements have been met and the Medical Examiner's office is ready to take them. In the case of an MCI, a temporary disaster morgue can be set up in a refrigerated trailer, which can be arranged by the Hospital Emergency Operations Center (EOC).

## Organizing Staff in the ED

The 2 basic functions carried out in the "Warm Zone" of the ED are *triaging* arriving casualties and *decontamination*. Unless it is known that the arrival of the first casualties will be delayed, the staff designated for the Triage Team should begin donning their PPE right away, so that there will be someone to receive them. Security should establish their security perimeters and work out the flow of traffic and arriving self-referred and EMS casualties. The remainder of the available staff (including those on the Decon Teams, the surveyor, and other staff who will not be working in the Warm Zone but are available to help set it up) should break out the CBRN supplies and set up the decon facilities, waiting areas, Contaminated Treatment Area, and control lines. The positioning of staff in the Warm Zone is depicted in Figure 12-4.

There are additional roles that support the 2 basic functions. These include casualty registration and identification, enforcing the control lines, monitoring staff for PPE and casualties for decontamination, and staffing a Contaminated Treatment Area within the ED for unstable casualties of a radiation disaster. Finally, life-saving medical procedures within the "Warm Zone" can be performed by staff from either the Triage or Decon teams or by dedicated medical staff. Table 1 lists the basic staff roles and responsibilities in the "Warm Zone." Note that the Contaminated Treatment Area (set up during radiation disasters) should be considered as an extension of the "Warm Zone" inside the ED and should be staffed with at least 1 physician, 1 nurse, and a surveyor with a Geiger counter.

Any time remaining after the ED is set up and before the arrival of the first casualty should be spent clarifying roles and reviewing patient flow with the assembled Triage and Decon Team members.

### Table 12-1: Summary of Staff Roles and Responsibilities in the "Warm Zone"

| Role | Minimum Number | Responsibilities |
|---|---|---|
| Security | 2 | *Security* to control entry into the Warm Zone for assessment by the Triage Team and ensure that movement across the control line between the Warm Zone and the ED is supervised by the surveyor. Ensure that potentially contaminated patients do not bypass the Warm Zone. |

## Table 12-1 *(continued)*

| Role | Minimum Number | Responsibilities |
|---|---|---|
| Triage Team | 3 | *MD* and *RN* assess arriving casualties for stability and contamination; decide which cohort patients belong to; *Registration Clerk* ensures that patient name is recorded, patient is given ID bracelet, and a second bracelet identifying them as contaminated (or not); may provide life-saving medical interventions as required and as time and conditions permit; with radiation, should also include a *surveyor*. An alternate model would be to have a more extensive registration after decontamination with only an initial ID number being given to patients in the Warm Zone so as to match them with their belongings. This ID is then integrated into their registration chart (for more details, please see the chapter on Hospital Emergency Surge Capacity). |
| Decon Team (per "line") | 3 | 1 staff to prepare patients for decon and collect/label contaminated clothing and personal items (pre-decon staff); 1 staff to assist with showering and to ensure that showering is adequate (decon staff); 1 to assist patients with getting dried off and clothed in dry clothing (post-decon staff). Note that only 2 decon staff are required for a nonambulatory decon line. |
| Surveyor(s) | 1 | *Surveyor* to ensure that no contamination is brought across control lines into the inside of the ED by either patients or staff (may be equipped with Geiger counter or other contamination meters as available). |
| Contaminated Treatment Area Team | 3 | For use during radiation disasters; *MD* and *RN* to provide medical care for unstable patients referred from disaster Triage, then to carry out decontamination; surveyor to assist with identification of residual contamination. |

## Arrival of Casualties at the ED

The policy of many EMS organizations is to not transport casualties who are contaminated; to protect their paramedics and their other assets, they require that the casualty be decontaminated in the field prior to putting them in an ambulance. For stable casualties when field decon is being set up in a timely manner, this policy makes good sense. However, there may be instances where a contaminated casualty does get transported by EMS. First, the paramedics involved may be unaware of the policy.[2] Second, they may feel that the patient is so unstable that they cannot wait for a decon process that is not yet operational. Third, they may recognize (in the case of radiation contamination) that there is minimal personal and operational risk in transporting contaminated casualties who are too unstable to wait for decontamination in the field.

In any case, the large majority of casualties arriving at the ED during a CBRN disaster are likely to arrive outside of the official prehospital systems, usually by private car, public transport, or on foot.[6,22] In general, arriving casualties should be directed to a single point of triage. This need not be (and in some situations should not be) the entrance to the ED. With mass casualties, bullhorn triage can be used to separate arriving patients who can follow verbal instructions from those who cannot when commanded to assemble "over there"; those who do not follow the command are either nonambulatory or cognitively impaired, and thus should be the first to be triaged.

If there are large numbers of contaminated casualties who are low acuity, transporting them to a predesignated nonclinical site, such as a local high school or health club where there are a lot of showers, may be the best strategy.

## Triage

During a CBRN disaster, triage should occur at a limited number of sites. The usual triage site may be kept open to assess arriving patients with problems unrelated to the CBRN incident. However, it would be efficient to direct arriving casualties from the disaster to the disaster Triage Team site. In mass casualty CBRN events, this may mean implementing a "pre-triage" process using a bullhorn to direct disaster casualties around the building to the ambulance bay, where they are again provided direction.

# Triage Team

The Triage Team must be dressed in the appropriate PPE. They should be prepared to receive unstable casualties from the field as both walk-ins and EHS transports. Then the formal triage process can focus on the highest acuity patients first. The goal should be to identify the appropriate cohort for the patient and those unstable patients who require a life or limb-saving procedure.

The Triage Team has 2 decisions to make about each arriving casualty as follows:

1. *What is their acuity?* Assigning a triage acuity score can be done using either a familiar ED system (e.g., CTAS) or a mass casualty system such as START. In addition, the Triage Team should identify arriving casualties who need a life or limb-saving intervention.

2. *Are they contaminated?* This can be determined with certainty in the case of radiation (using a Geiger counter), but is often less clear with chemical or biological contamination (especially while wearing Level C PPE). In these cases, the likelihood of contamination is determined by subjective means: a history of exposure and proximity to the contaminant, as well as suggestive physical signs and symptoms.

If the patient is contaminated and requires an emergent life or limb-saving intervention (e.g., CPR, BVM ventilation, needle decompression of the chest, or administration of a chemical antidote) prior to full decontamination, they have several options. First, they can identify an MD or other clinical staff from one of the Decon Teams to deal with it inside the Warm Zone. Second, they can do it themselves, provided that there are no other casualties waiting to be triaged. Third, in a mass casualty situation, they may decide to triage the casualty as "expectant," in other words, to receive comfort care only prior to their death. Finally, they may decide that the contamination poses little risk to the staff, other patients, and space inside the ED (e.g., with radiation) and direct the patient be taken to the Contaminated Treatment Area.

The final function during triage is to keep track of arriving casualties. If there is sufficient time between arrivals, this can be done using the usual registration procedures. If, however, the casualties are arriving at very short intervals, someone should be assigned to keep a record of the names of arriving casualties on a large dry erase board, assign an identification number, and if possible list where they are being taken. Finally, each casualty should get 2 wristbands: 1 identifying them and the other color coded with their contamination status (i.e., brown = contaminated and green = decontaminated).

## Decontamination

There are some excellent reviews on how an ED should manage chemical contamination.[6,23,24] These strategies apply generally to all CBRN responses. The goals are to remove the toxic material from contact with the patient; to prevent further (secondary) contamination of the patient, other patients, or staff; and to prevent contamination of the ED such that it is unable to continue to carry on "business as usual." Every ED has the capability to carry out some decontamination depending on what level of protection is offered by the available PPE.

# Scale of Decontamination Facility

Decontamination can be carried out on a variety of scales. At the smallest scale, a casualty who is identified by a surveyor as having a small area of radiological contaminant on 1 hand just needs to have that hand rinsed under water. At the other end of the scale, a group of refinery workers all sprayed with hydrocarbon solvents would benefit from mass decon in multiple showers (see Table 12-2).

The level to which a given healthcare facility decides to provide decon depends on a variety of factors, including size of the facility (smaller facilities have less space, smaller budgets, fewer staff to provide ongoing staffing and maintenance, and perhaps a lower expectation of providing mass

## Table 12-2: Types of Available Decontamination Facilities

| Scale of Decon | Type | Pros and Cons | Cost[a] | Ease of Retrofitting |
|---|---|---|---|---|
| Small | Individual shower | Requires minimal infrastructure once installed<br>Can be used for other functions when not being used for decon<br>Available in portable format that can be assembled when needed, then disassembled for storage<br>Processes one casualty at a time | $ | Easy (if adding portable shower) |
| Small | handheld spray nozzle | Useful for spot decontamination<br>Can be built into an existing sink | $ | Easy |
| Medium | Multiple showerheads | Requires adequate drainage, privacy barriers | $$ | Difficult |
| Large | Specialized decon tent | Flow-through processing model (efficient)<br>Requires significant ongoing support (equipment, staff, training, and practice)<br>Can be owned and operated by healthcare facility or provided by municipal fire service (based on mutual agreement) or provided (with or without staff) by a third-party private contractor | $$$ initially and $$ annually | Easy (provided space available and infrastructure in place) |

**Table 12-2** *(continued)*

| Scale of Decon | Type | Pros and Cons | Cost[a] | Ease of Retrofitting |
|---|---|---|---|---|
| Large | Fire hose | Cheap, easy to set up, generally effective for water soluble contaminants on ambulatory patients<br>Socially less desirable, ineffective for spot decontamination | $ | Easy (requires access to fire hydrant if an existing hose is not available) |
| Large | Local high school, gym, or health club | Suitable for mass casualties, can be distributed widely throughout affected communities<br>Would likely require orders of government to enable | N/A | N/A |

[a]Estimated cost is relative. "$" could be $500–$2000, "$$"could be $5000–$10,000, and "$$$" > $40,000 (including supplies).

decontamination during a disaster), the specific risks identified in a community risk hazard analysis, and a variety of other site-specific factors.

Many ED's have rooms off their ambulance bays for showering patients who are unhygienic or for hosing down soiled equipment (see Figure 12-5). Note that a decon shower that must be accessed by walking through the hospital cannot be used by casualties contaminated with volatile chemicals, which will compromise the ambient air. Another solution is a collapsible shower system that can be stored in a duffle bag when not in use, but rapidly assembled for use when needed (see Figure 12-6). After assembly (10–15 minutes), a garden hose is run from a temperature-controlled faucet in the ED to

**Figure 12-5: Individual decontamination shower off ambulance bay. Halifax Infirmary, QEII HSC.**

the showerhead. The effluent can be collected in a plastic wading pool as required. These structures are appropriate when there are a relatively small number of stable casualties to decontaminate. Patient flow through one of these portable showers is shown in Figure 12-4.

When casualties are stable enough to wait for decontamination, they can generally be taken through the shower one at a time. A handheld shower nozzle can speed up the overall decon process for casualties who, for example, have only touched a contaminated object with their hands. This type of individualized approach works best when the contaminant is readily detectable (e.g., radioactive contamination).

As soon as the number of contaminated casualties increases, or if medical issues require a more rapid decon process, a single shower will not suffice. Some ED's have multiple shower heads that can be used for the simultaneous decon of multiple contaminated casualties (see Figure 12-7). This capacity greatly expands the ability of the ED to decon larger number of patients without relying on assistance from outside agencies that may be preoccupied at the field site. Any such mass decon areas should be fitted with privacy barriers that can be installed quickly and easily so that casualties who are showering have some privacy from each other and from staff and patients outside the decon area. When privacy barriers are missing or will take too much time to set up, modesty becomes a secondary concern to the removal of a potentially toxic contaminant.

**Figure 12-6: Portable decon shower assembled with garden hose supplying warm water to shower head.**

**Figure 12-7: Multiple individual decontamination showers along the wall inside an ambulance bay at the Halifax Infirmary. Note drain channel along the floor, which drains into the a skimmer tank. Note also the lack of privacy curtains isolating casualties being decontaminated.**

Another option is a commercially available decon tent. These are sometimes purchased for regional and provincial trauma centers and are used extensively by professional Hazmat teams and the military. Many hospitals are unprepared to make the up-front or long-term financial commitment to purchase their own mass decon capability and maintaining the skills of the staff involved, so they rely instead on their municipal fire service and its Hazmat team. For hospitals choosing this route, it is important to have memoranda of understanding (MOUs) ahead of time with the fire service outlining details around deploying

their decon capability: How does the hospital request it? What if it is being used on scene by the fire service? Where will it go? What are the infrastructure requirements (i.e., electricity, water, drainage, signage, security, and access for EMS)?

## The Decontamination Team

EDs should consider organizing decontamination "Teams" consisting of staff of all types (MDs, RNs, paramedics, registration clerks, maintenance and housekeeping staff, and administrators) who are trained in the use of the PPE and to perform decon. During a disaster, the basic Decontamination Team includes the following:

- One person to control patients entering the decon process: patients can wait in chairs pending their decon; when it is their turn, they remove their clothing and belongings and put them in a bag that is labeled with the patients ID and marked as "contaminated;" then they enter the decon shower as it becomes available.
- One or more persons to perform the actual decon: patients may require assistance.
- One person to control patients leaving the decon process (to make sure that they do not recontaminate themselves); the person controlling which patient gets put in which room (i.e., the charge nurse) should be told that the patient has been decontaminated, so that they can begin the process of moving that patient into a room for their evaluation and management.

## How to Decontaminate

For all types of contamination, decontamination begins with removing the patients clothing. This step alone typically removes ~70%–90% of the contaminant. Ambulatory patients can remove their own clothing, being careful not to further contaminate themselves in the process. Nonambulatory patients should have their clothing cut off. This is done with them lying supine on a flat stretcher or board. Cuts are made lengthwise down their front and along all 4 extremities. The clothing is then carefully rolled away from the cut edge so that loose contamination is contained inside the rolled-up clothing. The clothing is then put in a bag, labeled with the patients ID sticker, and another sticker to indicate that it is contaminated. Finally, the bag is taken outside the building and stored away from air currents that might draw toxic fumes back into the building.

There is no clear consensus on how long a patient should be showered. With radiation, it is a simple matter of resurveying the patients, then sending them back into the shower if there is any residual contamination. For chemical contamination, the OSHA report[21] reviews some of the available studies and concludes that 5 minutes (1 minute rinsing the entire body, followed by 4–5 minutes of focused washing) should generally be adequate. Soap should be used in some cases, but in most it does not matter.

Specific recommendations for decontamination are included in the individual sections on specific CBRN issues.

## Patient Flow During Decontamination

Patient flow during decontamination follows the large red arrows shown in Figure 12-4. In each ED, there should be a flow chart or diagram to show how existing resources and spaces are integrated into the decontamination effort. Figure 12-8 shows the layout for the ED at the Halifax Infirmary for decontaminating arriving casualties.

Patients who are ambulatory are directed into the ambulatory decon showers. Once they have undressed and showered, they should be reassessed for contamination. If successfully decontaminated, they are allowed to enter the post-decon area where they dry off with towels and put on clean dry clothing. Then they are brought into clean areas of the ED as beds become available.

Nonambulatory patients are decontaminated on their stretcher using a spray wand. They should be put on a backboard while being decontaminated, because it is hard and can be decontaminated itself by logrolling the patient to either side.

The most challenging casualties are those that are unstable. A reasonable approach for contaminated patients who require limb- or life-saving procedures that cannot wait until they are fully decontaminated is to don the maximum available PPE, perform brief focused decontamination (e.g., remove the patients clothing and rinse contaminated skin with warm soapy water), then provide the required critical care interventions until the patient can be properly and

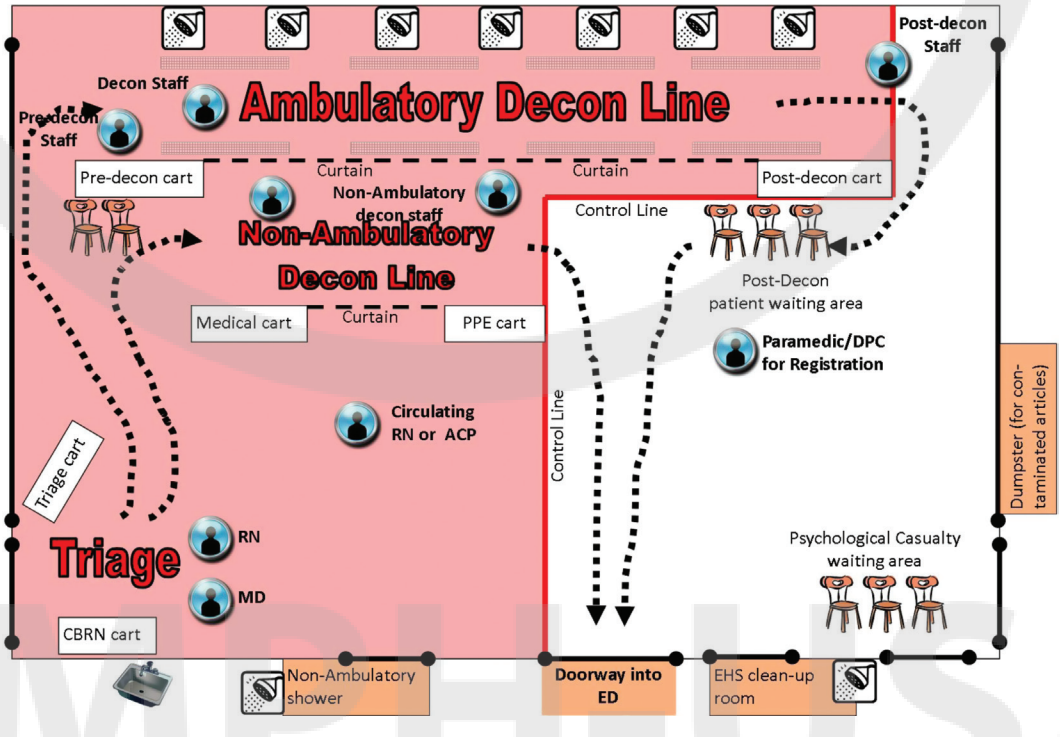


**Figure 12-8: Layout for decontamination (taken from Halifax Infirmary ED Disaster Plan).**

completely decontaminated. It is possible to perform key resuscitating maneuvers prior to decontamination and some authorities would endorse intubating patients while still contaminated. This requires trained and equipped staff.

## What To Do with Minimal Resources

If the ED or Outpatient Department at your hospital does not have an enclosed area (like an attached ambulance bay) to set up the triage and decon sites, you will have to identify a nearby room or building that is not directly attached to the patient care site. An alternative is a tent or a parking garage. These are both problematic; they may not have accessible water, electricity, or drainage and will require heat in the winter.

## Cleanup of Contaminated Materials and Space

The cleanup after a CBRN can generate massive amount of contaminated garbage and debris. Housekeeping and commercial industrial cleaners can assist with the cleanup after a chemical disaster. The waste can usually be incinerated. Radiation contamination is easier to remove (it is "visible" to Geiger counters and is not volatile) but impossible to ultimately destroy. The widespread cesium 137 contamination in Goiania, Brazil, in 1987 resulted in 275 truckloads of contaminated waste, which is stored on a special field to this day.[25]

Personal effects (including clothes, purses and wallets, cell phones, laptops, and any other contaminated items) should be in individually labeled bags at the end of the response. Ultimately, they represent contaminated waste and must be disposed of by a certified contractor. However, prior to disposal, there are a number of potential steps that must be taken. First, these items could be required as part of the ongoing analysis of contaminants (both qualitatively and quantitatively). Second, they may be part of the forensic evidence for a terrorism investigation. Finally, it may be possible to obtain critical data from cell phones and laptops using a wireless router before they are destroyed.

Contamination is more likely to be contained when control lines are enforced and when patients have been cohorted. Contaminated areas should be identified and marked. Typically site decontamination is done with the usual cleaning agents (soaps) and water. In some cases where the contamination is ground into the floor or other permanent structure, it may be necessary to remove the structure (e.g., flooring or other surfaces) and replace them.

## Antidotes

The health effects caused by many CBRN contaminants are managed symptomatically. However, there are some toxins for which there are antidotes that should be used to reduce the health effects. Antibiotics are used in treating and prophylaxing against infections caused by biological agents. These antidotes accomplish this following a variety of strategies, including the following:

- Reducing uptake of the toxin
- Competitively blocking the action of the toxin on its target
- Enhancing the metabolism or elimination of the toxin
- Converting the toxin to a less toxic compound

Specific antidotes are reviewed in each of the sections on chemical and radiologic/nuclear disasters.

## Supplies

The usual supplies for mass casualty incidents should be available. In addition, supplies specific to CBRN disasters are typically stored on a separate cart that can be rolled out of storage when needed. These supplies include the following:

- Tools for detecting contaminants (sniffers and Geiger counters, if available)
- PPE (various levels, including all sizes)
- Decon supplies (shears for cutting off contaminated clothes, bags to put them in, labels for the bags, soap and shampoo, towels, and clean dry clothing)
- Bracelets for identifying patients' contamination status (i.e., brown for contaminated and green for not contaminated or recontaminated. In some scenarios, it may be simpler to assume all patients are contaminated and not use brown bracelets, only green)
- Blank pre-numbered charts and ID bracelets (for use when the usual registration is not operational—see chapter 6 on Hospital Emergency Surge Capacity for details)
- Specialized clinical forms and templates for managing specific types of CBRN disasters (e.g., Radiation Casualty Assessment Tool)

## Safety Manager

Many hospitals have an official Safety Manager and this position is part of the incident management system (see Chapter 4 on IMS and Communications for details). This person is usually responsible for maintaining the mass casualty and CBRN preparedness at the hospital. This person also sets up and operates the hospital emergency operations centre (HEOC) during an actual response. The Safety Manager usually knows what specialized hazardous materials spill kits and other equipment is available in the hospital and where it is kept.

## HEOC

The HEOC in larger hospitals consists of all senior executives (and their EAs) representing physicians, nurses, other clinical staff, materials management, facilities, food services, and the other operational branches of the hospital. They have the authority (and the resources) to develop contingency plans and mobilize the required resources on short notice. The HEOC is an essential resource during any disaster, particularly a CBRN disaster for procuring assistance with crowd control, decontamination, and making inpatient beds available to admitted patients from the ED (see Chapter 4 on IMS and Communications for details).

## Resources

Facility support varies with the size and role of the facility. Large teaching hospitals and regional centers have more resources and bigger budgets for

providing support for disaster preparedness as well as during an actual response. Smaller rural or community hospitals probably have a lot less. All the same, there are frequently more resources available within both the institution and the broader community at large than might at first appear.

## Poison Control

They can offer advice on appropriate use of antidotes.[26] Their contact number should be posted prominently in the ED.

## Other Hospitals

Hospitals within a specific region can share resources and capabilities. For example, a portable decon unit shared by 2 or 3 small hospitals that can be transported to the required site on short notice. Other benefits can come from being strategic about which hospitals emphasize the various types of preparedness. For example, if 1 hospital in a city is located beside a refinery, the healthcare region should probably pick that ED as the site for an enhanced preparedness for a chemical disaster; there should be a supply of PAPRs and other chemical protective PPE at that site, which can also function as a training site for the other less well-equipped EDs in the city.

## Municipal Hazmat Teams

Hazmat Teams are generally staffed by firefighters with specialized training and equipment. They have portable chemical sniffers, Geiger counters, and decon equipments that can help during a CBRN disaster. The "Catch 22" is that these same fire departments are usually unwilling to promise mutual aid during a CBRN disaster because that is just exactly when they are most likely to need those resources themselves while attending to their own priorities. It is important for hospital disaster planners to meet with fire departments ahead of time to discuss CBRN support: where their portable decon tent might be placed, what resources it would require (electricity? a water source? drainage?), and so on.

## Provincial Departments of Health

Provincial departments of health often have stockpiles of disaster supplies (particularly following the preparations for the H1N1 pandemic in 2009). These may include not only basic medical supplies (dressings, syringes, sutures, etc.) but also items like transport ventilators that may be at a premium during some CBRN disasters (e.g., mass botulism poisoning).

## Federal Government

Health Canada

- http://www.hc-sc.gc.ca/hc-ps/ed-ud/event-incident/index-eng.php

Public Health Agency of Canada (PHAC)

- Extensive and relevant links to a variety of CBRN resources
- http://www.phac-aspc.gc.ca/cepr-cmiu/ophs-bssp/ctchin8-eng.php

## The Military

In some communities, Canadian Forces presence can be a significant resource. Military bases, including naval and air bases, are required to have (and to exercise) various Emergency Response Teams (ERT). Military hospitals and clinics also may have much larger supplies of antidotes, antibiotics, and decorporating agents than a hospital could ever hope to carry. Again, meeting with the chief medical officers before a CBRN disaster occurs can clarify what resources are available and the circumstances under which they might be shared.

## Industry

Industry has a great interest in mitigating the effects of any accident involving the release of toxic agents into the community. Thus, they have safety committees and ERTs and should be highly motivated to team with the local EDs to mitigate the health effects on the community. They have a lot of knowledge to offer, may have stockpiles of relevant material, and should be approached in the planning stage to provide input into hospital CBRN disaster preparedness.

## The Centre for Excellence in Emergency Preparedness

A general portal with extensive links and publications to assist with management of CBRN related issues; accessed at www.ceep.ca.

## Software and Web-Based Resources

There are a number of software applications that can assist with solving problems related to specific CBRN disasters. These will be covered in the specific appendices dealing with each type of CBRN disaster later in this chapter. They should be loaded onto a terminal in the ED and made operational prior to a disaster and should also be backed up on some form of safe external storage (e.g., USB memory devices).

CDC

- Portal for a vast array of online information, videos, and "Just-in-Time" educational materials.
- http://www.bt.cdc.gov/

ATSDR (Agency for Toxic Substances and Disease Registry)

- Developed by the CDC.
- A series of extremely comprehensive reviews of specific toxins.
- http://www.atsdr.cdc.gov/csem/csem.html

AHQR (Agency for Healthcare Quality and Research)

- Real-time online modeling to provide estimates of casualty numbers and hospital resources needed to treat casualties resulting from a variety of specific CBRN disasters.
- http://www.ahrq.gov/prep/hospsurgemodel/

EMCAPS[27]

- Modeling software that predicts the number and severity of expected casualties with a trauma or CBRNE MCI based on estimated population density and size of explosion.
- Provides an initial estimate of the number and severity of expected casualties.
- http://www.hopkins-cepar.org/EMCAPS/EMCAPS.html (can be downloaded and installed on local storage device).

## Maintenance of Proficiency

For EDs new to enhanced CBRN preparedness, the essential skills and equipment can be challenging to acquire and maintain. Knowledge about the basics of CBRN issues learned through courses and focused educational sessions degrades fairly quickly. Staff forget how to assemble portable equipment. Chemical resistant suits cannot just be folded up and left on a shelf for years on end; they will develop leaks in the fabric around creases, and rubber gaskets can dry and crack over time.

Members of the Triage and Decon Teams must practice regularly to maintain proficiency at donning and doffing the PPE and in performing triage and decon procedures. OSHA recommends that 2-hour training modules be given quarterly and that donning and doffing be practiced twice yearly.

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# [28]Appendix A – Chemical Disasters

## Basics of Chemical Disasters

Chemicals are ubiquitous in our modern world. They are being produced, shipped, stored, processed and disposed of in vast quantities just about everywhere; thus, the potential for disasters (accidental or otherwise) is always just around the corner.

In a review of effective strategies for the medical response to a mass chemical exposure, Kirk and Deaton[6] identify a series of "myths" that can erode the effectiveness of the response, and the realities that they reflect are as follows:

1. Medical personnel must often operate in the blind during the early stages of an event.
2. The offending chemical may not be identified for hours, or even days.
3. Emergency response personnel seldom have adequate tools or resources to effectively triage, decontaminate, and treat the large number of victims of a large-scale chemical exposure.
4. The first victims arriving at the hospital often arrive under their own power without direct involvement from emergency response personnel on the scene.
5. The public can behave in ways that significantly erode the effectiveness of the emergency medical response.

Although much of the literature deals with the potential for bioterrorism and mass chemical casualties, the same principles apply, for example, to managing a crew of field workers who have been mistakenly sprayed with pesticide by a crop duster, or any other accidental exposure to these agents.

## Types of Chemicals

The principal types of chemical toxins are listed below. This list is by no means complete. There are other more novel and unique chemical toxins that are not discussed.[29]

## Nerve Agents

Organophosphate (OPs), Carbamates

- Pesticides (2,4-D and 2,4,5,-T)

Chemical Weapons

- GA (Tabun), GB (Sarin),GD (Soman), GF, VX

OP pesticides are not only used extensively in agriculture, but also in suicide attempts; in one review, OP ingestion was identified as causing 175,000 suicides per year in China.[30] There were 12 deaths and about 3,000 injuries as a result of the Sarin attack on the Tokyo subway in 1995.[17,31]The characteristic smell

of these liquids is actually due to the hydrocarbon solvent and not the OP itself. Although chemical weapons may seem like an unlikely contaminant to encounter, there are stockpiles of these weapons in most countries that are at risk of misappropriation and misuse.

These agents are almost all cholinesterase inhibitors, and thus produce a cholinergic toxidrome. The bond between the nerve agent and cholinesterase is initially amenable to reversal, but it "ages" over time, becoming irreversible. One mnemonic for remembering the symptoms of the cholinergic toxidrome is SLUDGEM (salivation, lacrimation, urination, defecation, gastrointestinal upset, emesis, and miosis). There are also copious bronchial secretions that can lead to respiratory distress. Finally, CNS symptoms can be significant, including confusion and seizures.

## Intracellular Toxins

- Systemic asphyxiants
  - Carbon monoxide
- Methemoglobin-forming compounds
  - Nitrites (amyl nitrite, nitroglycerine)
- Cyanides and cyanogens
  - hydrogen cyanide, acetonitrile
- Sulfides
  - hydrogen sulfide
- Azides
  - sodium azide
- Ricin

This group of agents affects oxygen transport (e.g., carbon monoxide and hydrogen sulfide), cellular metabolism (e.g., cyanide), or cellular function (e.g., ricin). Each has its own symptom profile and antidote. Carbon monoxide and concentrated hydrogen sulfide competitively inhibit hemoglobin from carrying oxygen, and thus lead to decreased level of consciousness, nonspecific flu-like symptoms, anaerobic metabolism, and eventually death. Both are treated with oxygen. Cyanide causes oxidative uncoupling and leads to similar symptoms. It does not respond to hyperbaric oxygen and requires sodium nitrite followed by sodium thiosulfate, or more recently hydroxocobalamin.[32] Finally, ricin is produced from the mash remaining after extracting the oil from castor beans[33] (thus is widely available). When administered in even minute doses (usually by aerosol), it inhibits protein synthesis leading to chest pain, cough, dyspnea, joint and muscle pain, abdominal pain, and vomiting and bloody diarrhea. There is no antidote and treatment is supportive.

## Blistering Agents

Chemical weapons

- Nitrogen and Sulfur mustards
- Lewisite: an organic arsenical compound
- Phosgene oxime

These agents are only seen in the context of war. They extensively damage the skin, eyes, and respiratory tract. As such, they may also function as pulmonary irritants.

## Pulmonary Irritants

This category includes many familiar industrial chemicals. They all act as mucosal and pulmonary irritants. Symptoms initially include eye irritation, sore throat, coryza, and cough. These symptoms can progress to pulmonary edema, hypoxia, and hypotension. Most fatalities are within the first 24 hours and due to respiratory failure. There are no antidotes and treatment is supportive.

- Chlorine gas
  - Chlorine has been released from a variety of sources, including rail tanker cars[4,5,34] and swimming pools.[35]
  - Also a significant irritant to the skin and eye
- Vinyl chloride
- Phosgene
  - Both chlorine and phosgene enter the lungs and then release hydrochloric acid on reaction with water. Both can produce capillary leak with pulmonary edema.
- Methyl isocyanate (MIC)
  - Used to produce a variety of chemicals and was the gas released in the Bhopal disaster of 1984.[36,37]
- Anhydrous ammonia
  - Has been released in a number of separate accidents involving road and rail transportation.[38,39]
- Arsine

## Riot Control Agents

These agents are designed to briefly incapacitate someone by irritating the eyes, nose, mouth, and throat. They generally do not cause systemic symptoms, although they can lead to acute exacerbations of underlying cardiopulmonary problems. The primary treatment is to make sure that the casualty is decontaminated.[40,41]

## Sedatives

In 2002, a hostage taking in a Moscow suburb resulted in a 4-day standoff that ended with security forces gassing of approximately 900 hostages and captors with an unknown agent that was felt to be Fentanyl. Approximately 168 people were killed, many from the effects of the incapacitating agent. Other sedatives (including benzodiazepines) could also cause mass poisoning. Clearly, the key to managing these cases lies in recognizing a toxidrome, if present, using available antidotes (e.g., naloxone or flumazenil) and providing good supportive care.

## Petroleum Products

Chemical exposure to petroleum products can vary from individuals soaked with gasoline, diesel, or jet fuel (98% kerosene) to explosions at refineries. Note

that refineries use many other industrial chemicals, including hydrofluoric acid, hydrogen sulfide, heavy metals, and PCBs. Petroleum products are typically highly volatile; bringing a contaminated casualty into an ED can quickly shut the ED down due to the strong unpleasant odor and resulting in mucosal irritation. Additives to the petroleum product can also cause heavy metal and other types of toxicity. Decontamination may benefit from cleaning solutions containing dioctyl sulfosuccinate, chlorhexidine gluconate, or polyethylene glycol,[42] but in the absence of these agents, warm water and soap can be used.[43]

## Types of Accidents

1. Isolated cases
   - ❑ Casualties may become contaminated with petroleum products at service stations and other sites
   - ❑ Ingestion of OP pesticides; suicide by intentional ingestion of OP pesticides is relatively rare in North America, but is common in other parts of the world. In China, there are an estimated 175,000 deaths each year from the intentional ingestion of pesticides.[30]
2. Industrial accidents
   - ❑ Refinery accident: hydrocarbons and other volatile organic compounds
   - ❑ Other industrial chemicals: hydrogen cyanide, hydrofluoric acid, and other organic acids and bases
3. Transportation accidents
   - ❑ Train car derailment: hydrochloric acid, ammonium, chlorine, and others
   - ❑ Aircraft crash: jet fuel
   - ❑ Tanker truck: hydrocarbons
4. Agricultural accidents
   - ❑ Poisoning with herbicides and pesticides (e.g., aerial crop dusting accidents, storage building fires, and explosions)
5. Chemical weapons
   - ❑ Nerve agent: Tabun (GA), Sarin (GB), VX
   - ❑ Asphyxiant: Hydrogen cyanide, Arsine
   - ❑ Choking agent: Chlorine, Hydrogen chloride, Phosgene
   - ❑ Blistering agent/vesicant: Mustard gas, Nitrogen mustard, Lewisite
   - ❑ Incapacitating/mind altering: Agent 15/BZ
   - ❑ Sedation: Fentanyl

## Identification of Chemical Agents

Chemical identification can be based on known facts from the site (e.g., knowledge about disaster site, first person report, or identifying placards or manifests), by its physical properties (state, smell, etc.), or by its clinical effects (e.g., effect on organ systems or identifiable toxidrome).

Some agents have characteristic smells, which when coupled with the clinical effects of that agent can help to identify the agent (see Table 12-3). Note that caregivers will be unable to smell anything if they are wearing a PAPR, SCBA, or other source of air other than ambient air.

## Table 12-3: Identification of Chemical Contaminant Based on Smell

| Smell | Agent |
|---|---|
| Camphor (i.e., Vicks Vaporub) | Soman (nerve agent GB) |
| Garlic, onions, or mustard | mustard gas, phosphorus |
| Geraniums | Lewisite |
| Fresh mown hay | Phosgene |
| Bitter almonds | cyanides |
| Mild garlic or slightly fishy | Arsine (at high concentration) |
| Bleach | ammonia, bromine |
| Swimming pool | chlorine |
| Sour | hydrogen sulfide (only at low concentrations) |
| Fruity, floral, or sweet | methyl bromide, CN (riot control agent) |
| Pepper | CS (riot control agent) |

The clinical effects of various chemical agents are described in Table 12-4.[44]

## Table 12-4: Clinical Effects of Various Chemical Agents

| Category | Clinical Syndrome | Potential Chemical Etiology* |
|---|---|---|
| Cholinergic crisis | • Salivation, diarrhea, lacrimation, bronchorrhea, diaphoresis, and/or urination<br>• Miosis, fasciculations, weakness, bradycardia or tachycardia, hypotension or hypertension, altered mental status, and/or seizures | • Nicotine[a]<br>• Organophosphate insecticides[a]—decreased acetylcholinesterase activity<br>• Carbamate insecticides<br>• Medicinal carbamates (e.g., physostigmine) |

## Table 12-4 *(continued)*

| Category | Clinical Syndrome | Potential Chemical Etiology* |
|---|---|---|
| Generalized muscle rigidity | • Seizure-like, generalized muscle contractions or painful spasms (neck and limbs) and usually tachycardia and hypertension | • Strychnine—intact sensorium |
| Airway and Breathing | • Lip, mouth, and pharyngeal ulcerations and burning pain<br>• Mucous membrane irritation | • Paraquat[a]—dyspnea and hemoptysis secondary to pulmonary edema or hemorrhage; can progress to pulmonary fibrosis over days to weeks<br>• Chlorine and other irritant gases<br>• Caustics (i.e., acids and alkalis)<br>• Inorganic mercuric salts<br>• Mustards (e.g., sulfur) |
| Cellular hypoxia | • Mild: nausea, vomiting, and headache<br>• Severe: altered mental status, dyspnea, hypotension, seizures, and metabolic acidosis | • Cyanide[a] (e.g., hydrogen cyanide gas or sodium cyanide)—bitter almond odor[b]<br>• Sodium monofluoroacetate (SMFA)[a]—hypocalcemia or hypokalemia<br>• Carbon monoxide<br>• Hydrogen sulfide<br>• Sodium azide<br>• Methemoglobin-causing agents |
| Peripheral neuropathy and/or neurocognitive effects | • Peripheral neuropathy signs and symptoms: muscle weakness and atrophy, "glove and stocking" sensory loss, and depressed or absent deep tendon reflexes | • Mercury (organic)[a]—visual disturbances, paresthesias, and/or ataxia<br>• Arsenic (inorganic)[a]—delirium and/or peripheral neuropathy |

**Table 12-4** *(continued)*

| Category | Clinical Syndrome | Potential Chemical Etiology* |
|---|---|---|
| | • Neurocognitive effects: memory loss, delirium, ataxia, and/or encephalopathy | • Thallium—delirium and/or peripheral neuropathy<br>• Lead—encephalopathy<br>• Acrylamide—encephalopathy and/or peripheral neuropathy |
| Severe gastrointestinal illness,<br>dehydration | • Abdominal pain, vomiting, profuse diarrhea (possibly bloody), and hypotension, possibly followed by multisystem organ failure | • Arsenic[a]<br>• Ricin[a]—inhalation an additional route of exposure; severe respiratory illness possible<br>• Colchicine<br>• Barium—hypokalemia common |

*Not intended as a complete differential diagnosis for each syndrome or a list of all chemicals that might be used in a covert chemical release.

[a]Potential agents for a covert chemical release based on historic use (i.e., intentional or inadvertent use), high toxicity, and/or ease of availability.

[b]Unreliable sign.

## PPE for Chemical Contamination

Deciding what constitutes "appropriate" PPE depends on several factors such as the chemical agent and the concentration. Because, frequently, neither are known when the first casualty arrives, staff exposed to contaminated casualties should wear the highest available level of PPE. OSHA has defined a "minimum" level of PPE that hospitals could use to effectively protect first receivers assisting victims contaminated with unknown substances as equivalent to Level C[21] (see the section on Personal Protection Equipment discussed earlier).

Off-gassing from clothing and direct chemical contact are the primary threats to healthcare workers. Okumura et al.[45] reviewed the PPE requirements in MCI's with chemical contamination. In 2000, 3 ED staff in Georgia developed severe cholinergic symptoms after inhaling fumes from the emesis of a patient who had intentionally consumed 110 g of pesticide concentrate.[46,47] Only 1 of the 3 ED staff actually touched the contaminant, the other 2 were poisoned by off-gassing. In another case in the United Kingdom, a total of 25 healthcare workers (including MDs, RNs, paramedics, and clerical staff) were affected during a similar case of intentional poisoning with a pesticide[48]; only 10 ED staff became symptomatic and no antidote was required for any. In each case, the original patient and all the secondarily contaminated healthcare workers survived. Little and Murray[49] reviewed the published cases of secondary OP poisoning of ED staff and concluded that the risk of adverse health effects is minimal. They suggested

the following basic principles to reduce the risk of healthcare workers becoming secondarily contaminated:

- Resuscitation and further treatment should ideally take place in a well-ventilated area with the regular rotation of staff.
- All staff with direct patient contact should observe universal precautions—gloves, gowns, eye protection.
- Patients should undergo external decontamination as soon as practicable; clothes removed and bagged and body washed with soap and water. This process should not take place to the detriment of timely resuscitation and medical assessment.
- Staff inadvertently coming into direct contact with patient's bodily secretions should immediately and thoroughly wash the affected area.

As with all types of decontamination, undressing the victim will generally remove approximately 90% of the chemical agent. In general, the more symptomatic the patient from the agent, the greater the risk to responding personnel; most patients will be only minimally contaminated or affected. Decontamination, aside from clothing removal, is not necessary for exposure to a vapor (as opposed to liquid on skin) except with nerve agents. In most mass exposure situations, soap and water decontamination is sufficient. Transporting stable patients to a predesignated nonclinical site, such as a local high school or health club, may be the easiest way to decontaminate large number of victims.

## Preparing the ED for Chemical Casualties

Preparations follow the general description (see "Preparing the ED for Contaminated Casualties" discussed earlier). It is unlikely that there would be casualties safe enough to bring in to a Contaminated Treatment Area while still contaminated, given the risk of adverse health effects on staff, patients, and regular ED operations. However, under some circumstances, it may be safe to perform a brief focused decontamination (i.e., remove the patients clothing and rinse contaminated skin with warm soapy water), then provide the required critical care interventions either in the Warm Zone or inside the ED in a Contaminated Treatment Area, until the patient can be properly decontaminated.

If blowers are available to push air out of the ambulance bay to the outside, they should be turned on.

## Decontamination

Decontamination of chemical agents is generally rinsing with copious amount of water. Note that scrubbing the skin can lead to an increase in percutaneous absorption, an effect referred to as the "wash-in" effect.[50] There are a few contaminants for which special decontaminating solutions (such as dilute chlorine bleach), lotions, or "dry decontamination" (using special powders like "Fullers Earth") have been recommended. There are even some contaminants (like elemental sodium) that react violently with water. In all but the most remarkable situations, however, the appropriate solution for decontamination is to use water, and lots of it.[23,24]

Soap may be helpful when the contaminant is oil based. The most effective soaps are those with the greatest surfactant activity, such as dish detergent.[21] Shampoo can also be used, but conditioner should be avoided because it can aggregate heavy metals and prevent them from rinsing off during decontamination.

## What To Do with Minimal Resources

It is a fairly recent phenomenon for EDs to equip themselves with specialized decontamination showers and Level C PPE. The hospital in Canso, Nova Scotia, had none of these resources when they received their 4 airmen soaked in jet fuel. The staff found that N95 masks provided some benefit to the strong fumes. They cut off the casualties clothing and put them outside the ED in plastic bags. They were able to provide the necessary medical care and to decontaminate their patients prior to sending them on to other hospitals. Some of the paramedics reported headaches from the strong fumes inside the ambulance, but there were no reported adverse health effects amongst the hospital staff.[2]

The basic steps that any ED can take include the following:

1. All staff should wear Level D PPE (gowns, gloves, booties, and a facemask (N95) may provide some benefit over regular surgical masks).
2. Undress the patients before bringing them into the ED, leaving bagged clothes outside.
3. Decontamination can be done with soap and warm water within or outside the ED. The effluent (along with contaminated clothing and garbage) can be stored in containers outside the ED.

## Cleanup of Contaminated Materials and Space

Volatile chemicals will become less concentrated over time, and with doors and windows open and fans installed, many contaminants can be cleaned up with warm water and detergents using Level D PPE. Commercial cleaners can be hired to assist with more complicated site recovery. All of these resources (fans and commercial cleaners) can be accessed through the HEOC. Some equipment (e.g., mattresses on ED beds) may have to be replaced.

## Antidotes

General references on the management of chemical toxicities are included.[8,51,52] Minimum stockpiles can be defined in a variety of ways, but variously require adequate amount of the most time-sensitive antidotes (Atropine, 2-PAM, and cyanide kits) on hand to manage 5–50 severely poisoned patients.[53,54] Most ED's do not have adequate stockpiles.[11,12] Some communities may chose to share antidote stockpiles between different hospitals that are geographically close together.

## Nerve Agents

For general reviews, see Rodgers 2010[51,52] and Lawrence 2000.[42]

Atropine

- ❑ Blocks acetylcholine receptor sites
- ❑ Alleviates muscarinic (parasympathetic) effects (salivation, lacrimation, urination, defecation, gastrointestinal upset, emesis, and miosis)
- ❑ Mark 1 autoinjectors contain Atropine (2 mgs in 0.7 mL) and 2-PAM (600 mg in 2 mL)
- ❑ Initial dose: 2 mg for adults (pediatric dose 0.02 mg/kg) IM/IV q5mins prn severe poisoning

- ❑ Recommended stockpile for most hospitals: 45–165 mg[28,54,55]

Pralidoxime

- ❑ Interacts with and breaks the nerve agent–enzyme bond; can reverse effect of nerve agent if given soon enough
- ❑ Alleviates nicotinic symptoms (tachycardia, weakness)
- ❑ Give ASAP with any systemic effects
- ❑ Initial dose: 1 to 2 g diluted in 100 mL normal saline (pediatric dose is 20 to 50 mg/kg up to 2 g) given over 15 to 30 minutes
- ❑ Recommended stockpile for most hospitals: 2–18 g[28,54,55]

Benzodiazepines

- ❑ For preventing and treating seizures related to CNS effects of cholinesterase inhibition

## Intracellular Toxins

Cyanide

Sodium Nitrite

- ❑ Generates methemoglobin, which competitively binds cyanide; rapid onset
- ❑ Dose: 10 mL of 3% solution (300 mg) IV over 2 to 4 minutes (pediatric dose 6–10 mg/kg)

Sodium Thiosulfate

- ❑ Increases the rate of endogenous metabolism; slow onset
- ❑ Dose: 50 mL of 25% solution IV over 10 minutes (provides 12.5 g of sodium thiosulfate; pediatric dose 1.65 mL/kg of the 25% solution)
- ❑ Recommended stockpile for most hospitals: 12.5 g

Hydroxycobalamin

- ❑ Chelates cyanide; can be used in prehospital setting
- ❑ Given as 5 g infusion IV (pediatric dose 70 mg/k, up to 5 g)

## Blistering Agents

**Nitrogen and Sulfur Mustard**

- ❑ For skin effects: consider Thiosulfate, *N*-acetyl-l-cysteine, Amifostine
- ❑ For eye effects: topical NSAIDs (e.g., Voltaren eye gtts 1 gtt ou qid)
- ❑ For respiratory effects: consider steroids and antibiotics, to reduce long-term sequelae

**Lewisite**

- BAL (British anti-Lewisite: dimercaprol or 2,3-dimercaptopropanol)

## Pulmonary Irritants

Humidified oxygen and bronchodilators; positive pressure ventilation as needed; ibuprofen and *N*-acetyl-l-cysteine may be useful with Phosgene toxicity.

## Resources

### Software and Web-Based Resources

WISER

- Downloadable searchable database of 400 + toxic chemicals using key characteristics for identifying unknown chemicals and treating known chemical exposures; provides a wide range of information on identification and clinical management of different chemicals.
- Produced by the National Library of Medicine.
- http://wiser.nlm.nih.gov/ (can be downloaded and installed on local storage device).

MSDS (Materials Safety Data Sheets)

- MSDS for toxic chemicals used in the hospital (including laboratory supplies and cleaning agents) are required to be kept in binders at strategic locations.
- These are the basic source of technical information on all chemical products.
- Available without charge online from chemical producers.
- http://www.ehso.com/msds.php

WHMIS (The Workplace Hazardous Materials Information System)

- Canada's national workplace hazard communication standard.
- http://www.hc-sc.gc.ca/ewh-semt/pubs/occup-travail/ref_man/ref_manual_index-eng.php

ATSDR (Agency for Toxic Substances and Disease Registry)

- Developed by the CDC.
- http://www.atsdr.cdc.gov/csem/csem.html has extensive case studies on selected heavy metals and other toxins.
- http://www.atsdr.cdc.gov/MMG/index.asp

Courses

- Advanced Hazmat Life Support
  - an excellent course focused on clinical toxicology
  - http://www.ahls.org/ahls/ecs/main/ahls_home.html

# Appendix B – Biological Disasters

## Basics of Biological Disasters

In the dusty hills looking down on the Columbia River, a religious cult led by Bhagwan Sri Rajneesh established the community of Rajneeshpuram in 1981 near the Oregon community of The Dalles and began to look out at the surrounding county.[56] The cult was interested in gaining political influence and decided that the quickest way to achieve that would be if local voters (most of whom did not support the cult's chosen candidates) were all sick on election day. Thus began an event that started with the purchase of cultures of *Salmonella typhimurium* from a biological supply house and ended with the intentional infection of 751 people with *Salmonella gastroenteritis* over a 3 week period in 1984.[57] This incident was not recognized as bioterrorism for more than one year afterwards. In another incident, US Postal workers were targeted with anthrax spores during 2001, resulting in 5 deaths.[58,59]

First receivers are unlikely to receive warning that arriving casualties are the victims of bioterrorism or laboratory accident. They will have to recognize the cluster of similar cases or benefit from some other type of syndromic surveillance that herald the onset of a biological disaster. There is evidence that we are not very good at this.[60] Surveillance by the pharmacy may detect the increased use of specific antibiotics. Once a bioterrorism event is suspected, the laboratory must be capable of testing for anthrax, plague, smallpox, brucellosis, botulism, tularemia, SARS, viral hemorrhagic fever, as well as unknown agents. The pharmacy must have an adequate stockpile of antibiotics, antivirals, and antidiarrheals.

As with other types of CBRN disasters, a large biological disaster would generate a huge surge of psychological casualties who would threaten the function of the ED. There are strategies, however, that can reduce the large number of people in the community who have not been exposed from flooding local medical facilities in search of reassurance or unnecessary treatment.[61] These include providing clear information about who should and should not attend hospital; using telephone services to provide more detailed information and initial screening; employing rapid triage at hospital entrances based, where possible, on exposure history and objective signs of illness; and following up by telephone those judged to be at low risk.

There are a number of excellent reviews of bioterrorism and preparedness.[62–65] Epidemics and pandemics (e.g., SARS and H1N1) that arrive with some advance notice and whose cases are spread over a prolonged time present a different type of challenge to the ED and are covered elsewhere.

## Biological Agents

The various biological agents can be divided into different categories based on their potential severity from a public health perspective. These categories and the agents that make them up are summarized in Table 12-5.

## Table 12-5: Categories of Bioterrorism Agents

| Category | Characteristics | Agents |
|---|---|---|
| A | Highest priority agents:<br>• easily disseminated or transmitted from person to person<br>• result in high mortality rates and have the potential for major public health impact<br>• might cause public panic and social disruption<br>• require special action for public health preparedness | • Anthrax (*Bacillus anthracis*)<br>• Botulism (*Clostridium botulinum* toxin)<br>• Plague (*Yersinia pestis*)<br>• Smallpox (variola major)<br>• Tularemia (*Francisella tularensis*)<br>• Viral hemorrhagic fevers (filoviruses [e.g., Ebola, Marburg] and arenaviruses [e.g., Lassa, Machupo]) |
| B | Second highest priority agents:<br>• moderately easy to disseminate<br>• result in moderate morbidity rates and low mortality rates<br>• require specific enhancements of CDC's diagnostic capacity and enhanced disease surveillance | • Brucellosis (*Brucella* species)<br>• Epsilon toxin of *Clostridium perfringens*<br>• Food safety threats (e.g., *Salmonella* species, *Escherichia coli* O157:H7, *Shigella*)<br>• Glanders (*Burkholderia mallei*)<br>• Melioidosis (*Burkholderia pseudomallei*)<br>• Psittacosis (*Chlamydia psittaci*)<br>• Q fever (*Coxiella burnetii*)<br>• Staphylococcal enterotoxin B<br>• Typhus fever (*Rickettsia prowazekii*)<br>• Viral encephalitis (alphaviruses [e.g., Venezuelan equine encephalitis, eastern equine encephalitis, western equine encephalitis])<br>• Water safety threats (e.g., *Vibrio cholerae*, *Cryptosporidium parvum*) |

## Table 12-5 *(continued)*

| Category | Characteristics | Agents |
|---|---|---|
| C | Emerging pathogens that could be engineered for mass dissemination in the future because of:<br>• availability<br>• ease of production and dissemination<br>• potential for high morbidity and mortality rates and major health impact | |

Abbreviation: CDC, Centers for Disease Control and Prevention.

### Identifying a Biological Agent

An excellent algorithm for identifying probable pathogens in a bioterrorism event based on the presenting clinical syndrome has been published elsewhere[66] and is summarized in Table 12-6.

## Table 12-6: Identification of Possible Pathogens Based on Presenting Syndrome

| Syndrome | Pathogen |
|---|---|
| Gastrointestinal illness | Salmonella |
| Febrile respiratory illness | Pneumococcal pneumonia |
| | Pneumonic plague |
| | Tularemia |
| | Brucellosis |
| | Q-fever |
| | Inhalational anthrax |
| Neurological symptoms | Venezuelan encephalitis |
| | Botulism |
| Skin changes | Smallpox |
| | Hemorrhagic fevers |
| | Cutaneous anthrax |
| | Bubonic plague |

## PPE for Chemical Contamination

Biological agents are ubiquitous in the ED. ED staff are already familiar with the different levels of protection, which are summarized in Table 12-7. A key requirement (one that was addressed as a result of the H1N1 pandemic) is for an adequate supply of N95 masks and staff who have been fit tested. In addition, basic measures like frequent hand washing and not eating in patient care areas of the ED are common sense, but essential.

### Table 12-7: Levels of PPE for Different Biological Hazards

| PPE Level | Method of Transmission | Precautions Required to Prevent Transmission |
|---|---|---|
| Standard | Basic level of risk from direct or indirect contact with a patient with an unknown level of contamination<br>Examples:<br>• regular patient interactions<br>• anthrax, botulism, plague | • Hand washing pre and postcontact<br>• Using gloves when coming into contact with any secretions, blood, or other body fluids |
| Contact | Transmission can be direct (e.g., body-to-body contact with patient) or indirect (e.g., touching a contaminated object, such as dressing or bedrail)<br>Examples:<br>• MRSA carrier, acute gastroenteritis<br>• Intentional food poisoning of unknown etiology | • All standard precautions<br>• Gloves should always be used<br>• Gowns should be worn if:<br>❑ body-to-body contact, or<br>❑ patient has diarrhea, an ostomy, or excessive drainage from a wound |
| Droplet | Produced when patient talks, coughs, or sneezes. Droplets do NOT remain suspended in air; risk of transmission is high with procedures like suctioning, PPV, aerosols, and bronchoscopy<br>Examples:<br>• H1N1 | • All contact precautions<br>• Put mask on patient if sneezing or coughing<br>• Place patient in private room (if not possible, then keep 2 m from other patients or place curtain around patient)<br>• Minimize patient transport, make sure patient has mask on when being transported |

## Table 12-7 *(continued)*

| PPE Level | Method of Transmission | Precautions Required to Prevent Transmission |
|---|---|---|
| Airborne | Airborne microorganisms or contaminated dust particles that remain suspended in air for long period of time<br>Examples:<br>• Tuberculosis, SARS<br>• Smallpox, viral hemorrhagic fever | • All droplet precautions<br>• Place patients in negative pressure rooms<br>• Use of N95 masks at all times in patient care room<br>• Use PAPR if available |

Abbreviation: PPE, personal protective equipment; MRSA, methicillin-resistant *Staphylococcus aureus*; PAPR, powered air purifying respirator.

## Preparing the ED for Biological Casualties

The planned layout of the ED at the Halifax Infirmary is shown in Figure 12-9 (taken from the ED Disaster Plan).

## Negative Pressure Rooms

Health Canada recommends that every ED in Canada have at least 1 negative pressure room,[67] with a recommended minimum of 9 air changes per hour and with air exhausted outside the building.[68] Of interest, testing of negative pressure rooms often reveals less negative pressure than was believed.[69] Also note that some rooms (e.g., trauma rooms) are deliberately kept under positive

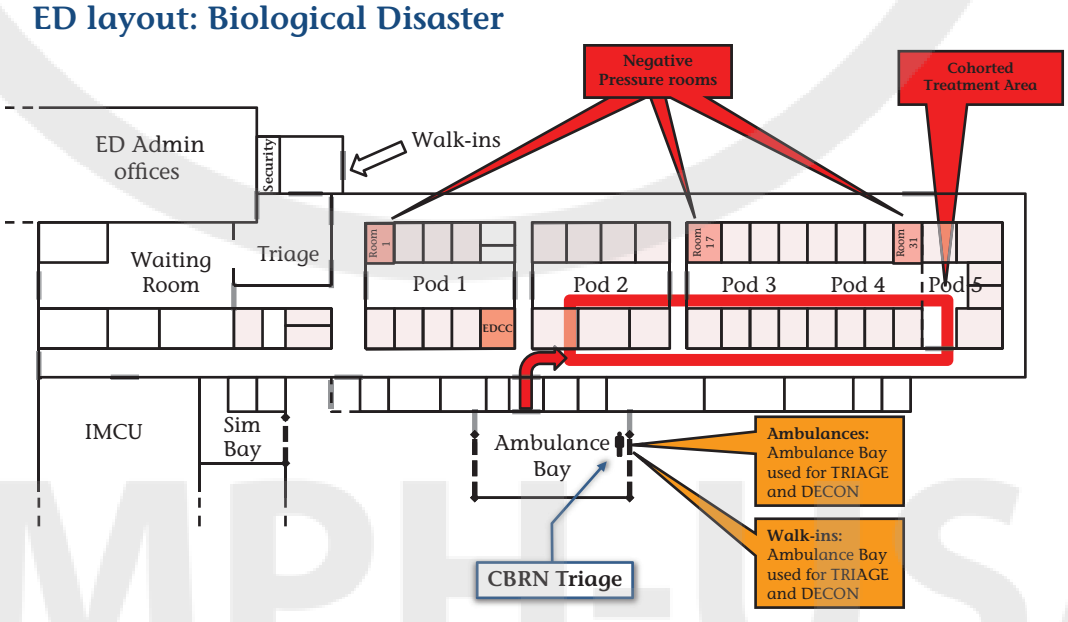



**Figure 12-9: ED setup for a biological disaster.**

pressure to reduce the risk of exposing open wounds to airborne pathogens and would be very efficient at distributing airborne pathogens throughout the rest of the ED.

Many EDs and smaller Outpatient Departments do not have any negative pressure rooms. The reality in these institutions is that casualties will have to be managed in regular rooms. Fans can be used to attempt to direct air through the ED in a predictable manner, although these can distribute airborne hazards in less helpful ways.

## Cohorting Patients

Most guidelines recommend that patients suspected of infection during an epidemic, pandemic, or bioterrorism event be cohorted inside the ED. The cohorted area can be any series of adjacent rooms that have been identified and labeled as being contaminated. This strategy was used during the H1N1 pandemic at the Halifax Infirmary to facilitate patient management and speed up turnover of rooms between patients; when a series of patients are all infected with the same pathogen, the room does not necessarily need to be completely cleaned between patients. Also, the medical staff may be more likely to follow protocols consistently when they are seeing consecutive patients with the same infection-control requirements.

Consideration should be given to the site of a morgue for bodies that are a risk for further transmission of the disease.

## Decontamination

Decontamination of casualties or patients is generally not necessary with biological agents. The only patients who require decontamination are those who have been sprayed or come into physical contact with the infectious agent. They would not be symptomatic with the infection at that point, but could have traumatic injuries in the case of an improvised explosive device (IED) with an associated biological contaminant. Undressing the victim will remove approximately 90% of the biological agent. Decontamination, aside from clothing removal, should be done with soap and water. If the patient is unstable and there is no time to further decontaminate them, they should be unclothed and have a clean sheet placed over them before being brought into the ED.

## Managing a "White Powder" Incident

The following steps are for managing incidents in which an envelope containing suspicious powder is found in the ED and is felt to represent a potential threat (modified from the CDC Guidelines):[58]

- Do not shake or empty the contents of a suspicious package or envelope.
- Do not carry the package or envelope, show it to others, or allow others to examine it.
- Put the package or envelope on a stable surface; do not sniff, touch, taste, or look closely at it or any contents that may have spilled.
- If possible, cover the powder with a concave object (bowl or hat), being careful not to touch or spread powder in the process.

- Alert others in the area about the suspicious package or envelope. Leave the area, close any doors, and take actions to prevent others from entering the area. If possible, shut off the ventilation system.
- Wash hands with soap and water to prevent spreading potentially infectious material to face or skin. Seek additional instructions for exposed or potentially exposed persons.
- If at work, notify a supervisor, a security officer, or a law enforcement official. If at home, contact the local law enforcement agency.
- If possible, create a list of persons who were in the room or area when this suspicious letter or package was recognized and a list of persons who also may have handled this package or letter. Give the list to both the local public health authorities and law enforcement officials.

## Cleanup of Contaminated Materials and Spaces

Cleanup of rooms between consecutive cohorted patients does not require a complete decontamination; linens should be changed and any personal effects (e.g., used Kleenex, water cups, and medical supplies) discarded. However, if a room is being used for patients unrelated to the biological disaster after having been used for infectious patients, then it will require a complete cleaning (bed, chairs, medical equipment, surfaces, floors, and in the case of droplet and aerosol transmission, curtains as well).

## Antibiotics and Other Treatments

Other than the PPE, there are no special supplies for a biological disaster. Additional antibiotics may be requested from the pharmacy. Antibiotics that should be stockpiled for bioterrorism events include Doxycycline, Tetracycline, Ciprofloxacin, Levofloxacin, Oseltamivir, Zanamivir, and Penicillin. For further information on this issue, refer to the chapter on Readiness Assessment/CBRNE.

## Resources

### Laboratory

Laboratory testing (including serology and cultures) is essential to arriving at a diagnosis. The laboratory should work together with the ED, the consulting Infectious Disease service, and Public Health to identify and screen for the pathogen.

### Infection Control

For any disaster involving a biohazard, call Locating and have them page the Infection Control nurse on call.

### Public Health

Public Health provides essential guidance to the ED on the epidemiology and expected course of the disaster. They also follow up with recommendations regarding prophylaxis for ED staff and arranging immunization programs, essential components of both the medium- and long-term response. The contact number for Public Health should be posted in the ED.

## Provincial Department of Health

The provincial departments of health usually have stockpiles of specific antibiotics for managing events like outbreaks and bioterrorism. They could be accessed through the HEOC or through Public Health.

## Software and Web-Based Resources

CDC Bioterrorism site

- http://www.bt.cdc.gov/bioterrorism/
- http://www.bt.cdc.gov/agent/agentlist-category.asp#a

PHAC

- http://www.phac-aspc.gc.ca/id-mi/index-eng.php

# Appendix C – Radiation Disasters

## Basics of Radiation Disasters

Healthcare workers are usually the most anxious about radiation. They perceive a significant threat from a contaminant that they cannot see, smell, or feel, but one that they know can cause acute injuries, cancer, and death. Yet, if one looks at Chernobyl (presumably a worst-case scenario), there were no documented attributable health effects to any of the frontline ED staff who cared for the contaminated casualties.[70,71] Nor do there appear to have been any other documented cases of significant exposure to healthcare workers in any of the other accidents involving radiation around the world,[41] including the mass contamination in Goiania, Brazil, in 1987.[25,72]

Radiation comes from energized isotopes of the same elements that are used as building blocks of the compounds that make up all matter. An isotope is a nuclide of an element having the same number of protons but a different number of neutrons. These isotopes give off high energy particles ($\gamma$ [alpha] and $\gamma$ [beta] particles or neutrons) or waves ($\gamma$ [gamma] or x-rays) that can damage or kill cells. The isotopes behave biochemically exactly the same as their stable cousins. For example, $H^3$ (tritium) forms tritiated (heavy) water that follows the exact same metabolic pathways and distribution as regular water molecules. Thyroid receptors cannot distinguish $iodine^{131}$ (released following nuclear explosions and reactor core breaches) from stable iodine and it is rapidly absorbed by the thyroid gland. The half-lives of different isotopes (the time it takes for half of the quantity of radioisotope to decay) vary from 6 hours for technetium ($Tn^{99m}$, used in nuclear medicine) to $7.1 \times 10^8$ years for uranium ($U^{235}$, used in reactors and nuclear weapons).

The health effects of radiation include several distinct syndromes. Acute Radiation Syndrome (ARS) refers to the acute effects of whole-body exposure to radiation. The types of cells that are most sensitive to radiation include those that are most rapidly dividing and the most undifferentiated: bone marrow, lymphocytes, mucosal, and reproductive cells. Thus, the initial symptoms include GI effects (nausea, vomiting, and diarrhea), and the earliest laboratory changes include a drop in the Absolute Lymphocyte Count (ALC). If the radiation exposure is primarily to a defined area of skin, the effect may be a local radiation injury (erythema, hair loss, and eventual necrosis) without ARS. This is referred to as the Cutaneous Syndrome.

Radioactive contamination does not travel through the ED by diffusion and on air currents in the way that strong chemical odors and airborne biological agents are carried. The only theoretical risk to ED staff is if the patient has a point source of radiation on them (e.g., on their clothing) or in them (e.g., ingestion or radioactive shrapnel). These sources are easily identified with a Geiger counter and removed before the source has a chance to expose first receivers to any significant amount of radiation. Thus, there is no good reason to deny the radiation-contaminated patient who requires life-saving interventions a place inside the ED, provided that their treatment area is kept within control lines that are scrupulously enforced and the staff are wearing appropriate PPE.[72]

## Exposure versus Contamination

A key concept in managing disasters involving radioactive material is to understand the difference between exposure and contamination.

The term "exposure" refers to patients who have been close to a source of radiation and as a result have been exposed to ionizing particles or waves rays. As an example, sunbathers are exposed to UV light (and might have an associated injury, i.e., sunburn), but are NOT contaminated. Exposure above a certain threshold can cause the Cutaneous Syndrome, ARS, or death.

The term "contamination" refers to traces of radioactive material on or inside casualties or objects. Contamination can be external (on their clothing, hair, or skin) or internal (entering through the nose, mouth, lungs, GI tract, or open wounds). The treatment for external contamination is decontamination and for internal contamination is the use of decorporating agents and the medical treatment of the concomitant exposure.

Although most patients who have been contaminated have not received a significant exposure, the two problems are by no means mutually exclusive.

## Measuring Radiation Contamination

There are several properties of radioisotopes that actually make them easier to deal with in the ED than with chemical or biological contaminants. The first concept is that radiation, unlike either chemical or biological contaminants, is easy to detect. *Geiger counters* are relatively cheap and easy to use and reliably detect even traces of $\gamma$ particles and $\gamma$ rays. They do have their limitations, though they do not reliably detect $\gamma$ particles and do not detect neutrons at all. There are other types of portable contamination meters as well as a variety of nuclear medicine imaging devices (e.g., scintillation counters and whole-body scanners) that can be used to quantitatively assess the presence of a variety of particles with a variety of energy levels.

A key role during the ED response to a disaster involving radiation is that of the "surveyor": a trained healthcare worker equipped with a functioning contamination meter. These surveyors identify patients, staff, and objects that are contaminated (and those that are not) and control the movement of patients out of contaminated areas into the remaining uncontaminated areas of the ED.

Given that radiation contamination is easily detected and has never caused known health effects in hospital-based healthcare workers, it is entirely feasible to bring contaminated casualties with limb- or life-threatening injuries into the ED. Thus, contamination within the ED (which should be limited to controlled areas and only for those highest acuity patients) is not a health hazard to ED staff and other patients, but rather a housekeeping problem.

Finally, any hospital with a nuclear medicine department has the tools on hand to identify contamination with a pure $\gamma$ emitter, to identify most isotopes, and to semi-quantitatively assess partial or whole-body internal contamination with $\gamma$ emitters. Taken together, these features make radiation a lot easier to work with than the invisible and often more dangerous chemical and biological agents.

## Measuring Radiation Exposure

Workers who work with radiation wear personal dosimeters and dose rate meters. Dosimeters measure the cumulative dose and include the film badges traditionally worn by radiologists and radiology technicians. They provide a retrospective estimate of the amount of exposure to the healthcare worker.

Dose rate meters, on the other hand, provide an ongoing estimate of the rate of radiation (measured as milliSieverts per hour, mSv/hr). To give a sense of scale for different doses, some estimated doses (including the allowable exposure limits in Canada[73,74]) are as follows:

| Exposure Dose | Dose (in mSv[a]) |
|---|---|
| Average annual dose received by Canadians | 2.6 |
| Maximum dose received by healthcare workers in Goiania accident[25] | 5 |
| Computed Tomography (CT) scan | 10 |
| Annual nuclear energy worker dose limit | 50 |
| Dose limit during an emergency | 500 |
| Minimum dose at which acute health effects observed | 0.5–1 |
| LD50–60 (dose at which 60-day mortality for optimally treated casualties is 50%) | 4.0–4.5 |

[a]In this context, 1 Sievert (the equivalent dose) is equal to 100 rems and equivalent to 1 Gray (the absorbed dose equal to 100 rads)

The dose rate meters worn by specialized technicians and first responders include alarms that warn of high dose rates, and are called Personal Alarming Dosimeters (PADs) and are the size of a small cell phone. Most healthcare workers will not have access to personal dosimeters. During a radiation disaster response, however, it is likely that some of the specialists who will arrive to assist will be equipped with PADs, and their exposure dose rate will be similar to that of the healthcare workers they are supporting.

Biodosimetry refers to estimating the exposure dose based on the patients signs and symptoms as well as laboratory investigations. An initial rough estimate of a patient's exposure dose can be based on 2 readily observed features. First, how soon after the exposure did the patient begin to vomit? Casualties receiving a significant dose of radiation will generally have started to vomit as a symptom of ARS within 6 hours of their exposure. The second is the rate of decline of the ALC as measured in a CBC. Interpretation of these clues is included in the Radiation Casualty Assessment Tool (see Appendix D) and the Radiation Emergency Medical Management (REMM) Tool.

The most accurate means of quantifying a significant exposure dose is to perform cytogenetic biodosimetry. This involves counting the genetic changes in lymphocytes. For this reason, patients suspected of having received a significant radiation exposure should have 2 blood tubes drawn with their initial laboratories. Cytogenetic biodosimetry is done in only a few specialized laboratories across Canada and takes about 50 hours to perform, and it is used to support ongoing medical decision making.

## Types of Accidents

### Medical

Radioisotopes as point sources of radiation are used widely throughout larger hospitals. The types of accidents that can occur include the following:

- Displacement of brachytherapy device or high-dose local radiation source in a cancer patient

- Malfunction or error in use of diagnostic imaging modalities
- Accidental exposure to staff while handling source materials

Common isotopes involved include cobalt-60, cesium-137, and Iridium-192

### Industrial

There are over 1 million sources of radiation in the United States that are routinely monitored; each year more than 500 of these sources are lost.[72]

- Radiation gauges, gamma cameras, food and equipment sterilization, either on site or during transportation
- Activation of radiation portal monitors at industrial sites (e.g., airport, landfill, and ports)
- Common isotopes: cobalt-60, strontium-90, cesium-137, and iridium-192

## Research

Radioisotopes have a wide range of research applications. Common isotopes include hydrogen-3 (tritium), carbon-14, phosphorus-32, cobalt-60, iodine-125, iodine-131, and californium-252.

## Criticality Accidents and Loss of Containment in Reactors

Criticality happens when fissionable isotopes are present in sufficient concentration and configuration that a chain reaction starts. This is the basic operating principle of nuclear reactors, but can also happen unintentionally in laboratories that deal with sufficiently enriched solutions of fissionable materials. A key distinguishing feature is whether containment (i.e., the integrity of the reactor or container holding the fissioning material) is preserved or not. When there is no loss of containment, the issue is only exposure (albeit extremely high). During the criticality accident in Tokaimura, Japan, in 2003,[75] workers were mixing a solution in a vat of about 100 L, which went critical. There was a flash of blue light and the casualties were exposed to massive doses of $\gamma$ and X-ray radiation as well as neutrons. They were not directly contaminated; the solution remained in the vat the whole time. In contrast, accidents with loss of containment (e.g., Chernobyl) cause widespread contamination with the isotopes listed below, in addition to the exposure to $\gamma$ and $\gamma$ particles, $\gamma$ and X-ray radiation, and neutrons.

The setting of accidents includes the following:

- Laboratories involved in the production, processing, or disposal of fissionable material
- Commercial nuclear power plants and research reactors
- Reactor accident aboard nuclear powered vessels (NPV). Note that accidents involving nuclear weapons (e.g., the crash of a nuclear capable aircraft or vessel) in which there is no detonation is not a criticality accident, rather it is one with contamination and exposure to the plutonium-239 and other isotopes found in the weapon.

Common isotopes found in criticality accidents with loss of containment include strontium-90, iodine-131, cesium-137, and uranium-235, plutonium-239, americium-241.

## Terrorism

The use of IEDs to spread radioactive contamination (referred to as a Radiation Dispersion Device [RDD]) or "dirty bomb") is a real threat that will almost certainly occur.[76] This type of event would contaminate some casualties and property at some future point, certainly create mass panic, but would lead to few significant radiation exposures. The isotopes most likely to be employed in an RDD (i.e., "dirty bomb") would include cobalt-60, cesium-137, and iridium-192. There is also the possibility of a low-yield improvised nuclear explosive device being detonated.

## Identification of Isotope

The exact isotope is unlikely to be known when contaminated casualties begin arriving during a radiation disaster. Because the type of accident will likely be known, it may be possible to narrow down the range of possibilities (see "Types of Accidents" discussed earlier). For example, if casualties are arriving from a criticality accident with loss of containment, then contaminants may include strontium-90, iodine-131, cesium-137, uranium-235, plutonium-239, and americium-241. Because there is really no difference in preparing the ED or in PPE requirements (unlike with chemical or biological disasters), the only difference is in choosing decorporating agents. The exact identification of the isotope will be provided by technical experts in the hours after the response begins.

The Geiger counter can be used to provide a rough estimate of the type of radiation being emitted. Alpha particles are generally only detectable when the source is less than 3–5 cm from the membrane (and not at all if it is in solution). Beta particles travel further, but can be stopped by several pieces of paper or tin foil. Gamma rays, on the other hand, require several centimeters of lead to stop them. Some Geiger counters have a thickness of lead on the back of the tube: activity that is not stopped by holding tin foil between the source and the tube, but is stopped by flipping the tube over so that it is shielded by the lead is likely coming from a $\gamma$ emitter. In fact, most isotopes emit more than one type of radiation. Thus, by experimenting with the amount of distance and shielding between the contaminated surface and the Geiger counter tube, a contaminant can be identified as emitting $\gamma$, $\gamma$, or $\gamma$ radiation. $\gamma$ particles are primarily a risk for internal contamination, $\gamma$ particles for skin burns, and $\gamma$ radiation for ARS.

## PPE for Radiation

Proper PPE for managing patients contaminated with radiation is readily available in all EDs. It is equivalent to Level D, or droplet precautions, and includes the following:

- A gown or Tyvek suit
- Booties, with the leg cuffs taped outside the booties
- A mask (N95 if readily available, but regular surgical mask will suffice)
- Goggles and face shield (especially if involved in patient decontamination, which potentially involves splashes of contaminated water hitting the face)
- Cap

- Gloves, with the wrist cuffs taped outside the gloves; a second untaped pair of gloves should be worn outside the first and changed frequently (e.g., when grossly contaminated and between patients)

If personal dosimeters or dose rate meters are available, they should be worn under the outer layer of PPE, on the surface of the underclothing.

Care must be taken removing PPE. It needs to be done with a surveyor present with a Geiger counter. The outer layers are gradually removed, with the booties and inner pair of gloves left to the last. Then, after the surveyor has given the all clear, the healthcare workers step across the control line and remove their booties one at a time, putting first one clean foot, then the other, on the clean side of the line. At any time, if the surveyor comes across a localized area of contamination, that area must be either covered up or decontaminated before the healthcare worker can resume their duties.

## Preparing the ED for Radiation Casualties

The same basic preparations are taken for radiation contamination as for other CBRN disasters. With radiation disasters, however, surveyors play a key role. During a radiation disaster in which unstable patients who are contaminated are a possibility, a Contaminated Treatment Area should be set up. At the Halifax Infirmary ED, both triage and decontamination are carried out in the ambulance bay (where the showers are located), while the Contaminated Treatment Area is a contiguous group of ED beds including both regular rooms and several trauma rooms (see Figure 12-10).

The only difference in staffing is the addition of surveyors equipped with Geiger counters, who will gradually appear in the ED as the broader disaster response rolls out. They should be deployed to those points in the Patient

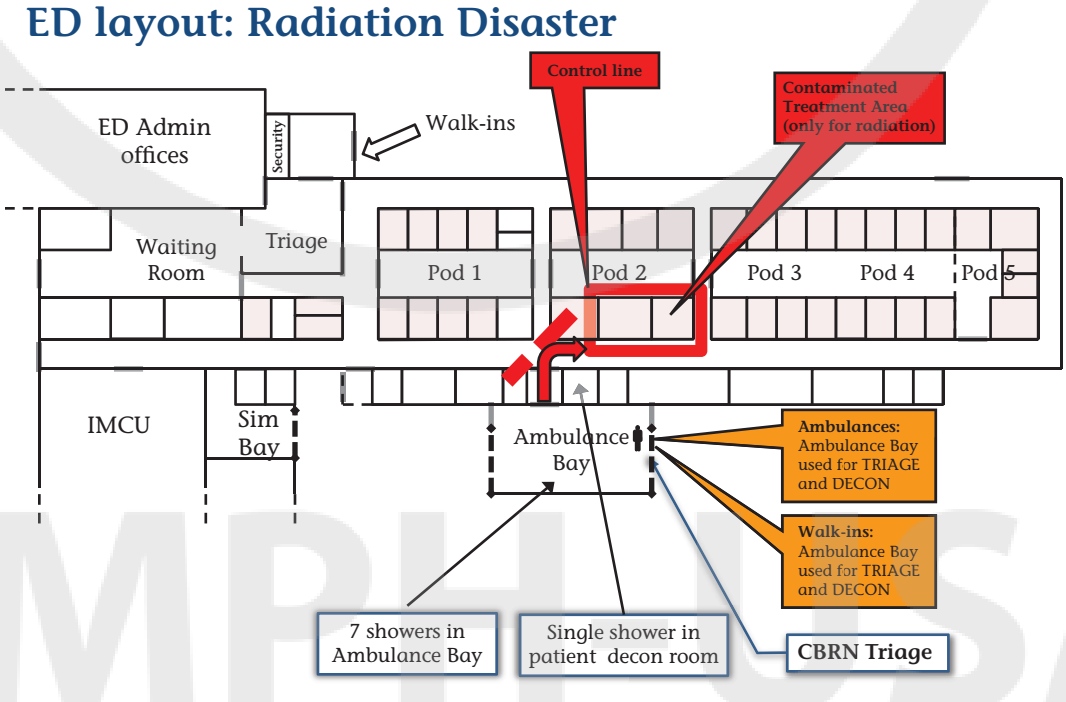



**Figure 12-10: Set-up for managing radiation contaminated casualties at the Halifax Infirmary ED.**

Flow algorithm where decisions are made based on whether the patient is contaminated or whether they have been successfully decontaminated. These include the Triage Team, the Decon Team (at post-decon station), the control line at the back of the "Warm Zone" into the ED, and as part of the Contaminated Treatment Area Team (to survey the patient for contamination and departing staff crossing the control lines). For radiation mass casualty incidents, portal monitors are the most efficient and should be set up some distance from the triage area to allow an appropriate staging area.

The Contaminated Treatment Area should be established right away, so that it will be ready when the first casualty arrives (in case they are unstable).

## Triage

In addition to triaging arriving casualties, a Radiation Surveyor should quickly identify patients who are contaminated. The triage survey does not need to be detailed. Casualties who are contaminated with radiation and so unstable that there is no time to remove the contaminated clothing and thoroughly decontaminate them prior to receiving interventions for life or limb-threatening injuries should be taken immediately to the Contaminated Treatment Area. If there is no Geiger counter available yet, and the available information indicates any possibility of contamination, they should be treated as if they are contaminated and sent to the Contaminated Treatment Area. The risk of spreading contamination can be minimized by wrapping the casualty in a clean sheet prior to bringing them into the ED.

The Registration Clerk should register the patients in some way, put bracelets on patient to identify them and to indicate contaminated (brown) versus noncontaminated (green). Finally, he/she should put a copy of the Radiation Casualty Assessment Tool (or other clinical template) on each patient's chart to assist with the ongoing patient evaluation and management.

## Decontamination Team

Prior to decontamination, the patient should be surveyed by a surveyor with a Geiger counter and the degree of contamination (measured in "counts per minute") should be recorded on a diagram. Note that the Decon Teams should also swab patient's nostrils and mouth if the presentation is suggestive of internal contamination (i.e., swallowed or inhaled dust that is suspected).

Those who are stable and ambulatory should be directed to the Ambulatory Decon shower to remove contamination. Patients who are nonambulatory must be decontaminated on stretchers. If they are also unstable, this will be done in the Contaminated Treatment Area. The clothing must be removed as described earlier (see "How to Decontaminate" in the first section). The surveyor should be recording the location and amount of contaminant (measured in "counts per minute," which are read off the gauge on the counter) ahead of the staff performing decontamination. Decontamination efforts should begin with the mouth and nose, then open contaminated wounds, and finally intact skin and hair. Focal areas of solid contamination should be removed with baby wipes, moist 4 × 4's, or makeup removal pads. For more widespread areas of contamination, use saline; control the effluent with waterproof drapes that drain into garbage buckets lines with plastic bags and keep as contaminated waste.

Decontamination is considered complete when residual contamination is less than twice the background level or consecutive attempts fail to reduce it further. If areas of significant contamination remain (including open wounds), they can be covered with a bio-occlusive dressing (e.g., Op-Site) and labeled with a permanent marker; this will contain the contamination until further measures can be taken (such as surgical debridement).

Contaminated samples (i.e., vomit, urine, or stool) should be put into sealed labeled specimen containers or plastic bags and surveyed as soon as possible. These can then be put in a labeled red hazardous waste bag.

The Decontamination Team Surveyor should survey patients with a Geiger counter after they emerge from the decon shower. If they are still contaminated, then they are sent back to the pre-decon staff to have further decon done; if they are no longer contaminated, then they are told to dry off and to put on available clean dry clothing.

## Contaminated Treatment Area

The Contaminated Treatment Area includes contiguous treatment rooms that are used for treating patients who arrive unstable and require emergent treatment prior to being decontaminated. The room(s) are set up as follows:

- Brown paper taped to floor (optional)
- Designated entrance (contaminated) and exit (transition to clean area)
- Mark perimeters of Contaminated Treatment Area (i.e., control lines) with masking tape and surveyor to control in the movements of staff and patients across the control lines
- Plastic covering to block off shelving and supplies not likely to be needed (to facilitate cleanup afterwards)
- Decon supplies (baby wipes, bottles of saline, drapes, bags for contaminated waste, Ziplock bags, and gloves)

The staff who make up the Contaminated Treatment Area Team include the following:

- MD and RN(s): carry out evaluation and management of contaminated casualties brought into the of Contaminated Treatment Area (using Radiation Casualty Assessment Tool or other clinical management templates); decontaminate patients once they have been medically stabilized.
- Radiation Surveyor: identify patients who are contaminated. The triage survey does not need to be detailed.

Consultant and service staff as well as portable equipment (e.g., ECG machine, portable X-ray, and ventilators) can enter and leave the contaminated treatment areas, but they must leave across the control line under the supervision of the surveyor. Once a piece of portable equipment is contaminated with radiation, it can continue to be used within the Contaminated Treatment Area until it is ultimately cleaned.

Decontamination carried out in the Contaminated Treatment Area follows proceeds the same as in the nonambulatory decon area.

## What To Do with Minimal Resources

If there is only 1 Geiger counter, it should initially be used by the surveyor stationed with the Triage Team.

## Cleanup of Contaminated Materials and Space

There are no real special requirements in site remediation after radiation contamination; it proceeds similarly to the cleanup after a chemical disaster. A Geiger counter is used to identify the contamination, then basic cleaning to remove it. Wax strippers may be required for floors. In some cases, floor tiles and other durable pieces of infrastructure may have to be removed, treated as contaminated waste, and replaced. Extensive or complicated site remediation requires professional contractors.

## Decorporating Agents

There are several comprehensive reviews of the medical management of radiation casualties.[77] Decorporating agents are used for treating internal contamination. They are most effective when used early. Some decorporating agents are commonly available in most EDs. These include sodium bicarbonate (used for uranium-235), calcium gluconate (used for strontium-90 and radium-226), Dimercaprol (also called BAL or British Anti-Lewisite; used for heavy metals, including isotopes of mercury, lead, arsenic, gold, and strontium-210), sodium alginate (used for strontium-90 and radium226), antacids (aluminum phosphate and aluminum hydroxide), and water (used for tritium). Others are less commonly available. Basic information on these specific decorporating agents is given below. More specific information (including dosing, precautions, contraindications, and alternate therapies) is available from a variety of resources (including the REMM application) and should be sought prior to actual use.

Prussian blue (Radiogardase)

- Used for cesium-137 and thallium-201
- Exchanges ions with isotopes, removing them from enterohepatic circulation, resulting in excretion in stools
- Not approved by Health Canada; available only under Special Access Program; stockpiled at Health Canada and specific military dispensaries

Potassium iodide

- Used for iodine-131
- Competitively binds iodine receptors in thyroid; allows unbound iodine to be excreted prior to being incorporated; most effective when used within the first 1–2 hours after ingestion and should be used prophylactically with any reactor accidents in which there is external contamination (as a proxy for loss of containment)

Calcium and Zinc DPTA

- Used for plutonium-239, americium-241, curium-244, californium-252, thorium-232, and yttrium-90

- Chelating agent: binds isotope, allows excretion prior to being incorporated
- Use Ca-DPTA for first dose (more effective), then switch to Zn-DPTA for subsequent doses (less toxic); best within 1 hour, should administer within 6 hours

Table 12-8 summarizes the decorporating agents for use when the isotope is known. It is taken from a REMM supporting document.[78] If the isotope is unknown, some experts recommend covering the range of expected isotopes based on the type of incident (see "Types of Accidents" discussed earlier). Others recommend waiting several hours until there is some information about the isotope. The most time-urgent isotopes requiring decorporating agents are iodine-131 and uranium-235.

## Table 12-8: Summary of Decorporating Agents for Use with Known Isotope

| Radioisotope | Decorporating Agent |
|---|---|
| Americium | parenteral Ca-DTPA, Zn-DTPA |
| Cesium | oral Prussian blue |
| Cobalt | nothing too good, but oral penicillamine worth trying |
| Iodine | KI *within about first 4 hours*. Consider PTU = propylthiouracil |
| Iridium | unknown; try oral penicillamine |
| Palladium | unknown; try oral penicillamine |
| Phosphorus | oral Na phosphate or K phosphate |
| Plutonium | parenteral Ca-DTPA, Zn-DTPA |
| Radium | oral calcium to reduce gastrointestinal absorption and increase urinary excretion. Alginates are also useful to reduce gastrointestinal absorption |
| Strontium | intravenous calcium gluconate, oral ammonium chloride for acidification. Alginates are useful to reduce gastrointestinal absorption |
| Tritium | force water to promote diuresis |
| Uranium | Ca-DTPA and Zn-DTPA within *4 hours only*. Na bicarbonate to alkalinize urine |
| Yttrium | parenteral Ca-DTPA, Zn-DTPA |

## Supplies

Supplies specific to managing radiation disasters in the ED include the following:

- Geiger counter (or other contamination meter)
- Personal dose meters and dose rate meters (if available)

- Copies of Radiation Casualty Assessment Tool (or any other clinical template used)
- Patient bracelets to apply after being surveyed, to indicate "Contaminated" (i.e., brown) or "Not Contaminated" (i.e., green)
- Equipment for preparing Contaminated Treatment Area
  - ❑ Kraft paper for floor (and masking tape to hold it in place)
  - ❑ Plastic sheets (to cover equipment that is not needed, to protect it from becoming contaminated)
- Equipment for marking control lines
  - ❑ Masking tape and black felt tipped markers
  - ❑ Signage
  - ❑ Yellow barrier tape (i.e., with "caution" printed to augment tape on floor)
- PPE
  - ❑ Tyvek suits (or equivalent, with full legs and sleeves)
  - ❑ Gloves (2 colors if possible, e.g., blue for permanent layer against skin, regular color for second pair of gloves over first)
  - ❑ Masks, booties, caps, and goggles
  - ❑ Masking tape and black felt tipped markers
- Equipment for ambulatory decontamination
  - ❑ Privacy barriers
  - ❑ Portable decon shower (if applicable)
  - ❑ Large plastic bags (for contaminated clothes and personal belongings)
  - ❑ Labels for bags (patient ID and contamination status) or black felt tipped pen to mark same information
  - ❑ Op-Site (or other bio-occlusive dressing) in variety of sizes to place over open wounds prior to general decontamination
  - ❑ Towels and facecloths
  - ❑ Liquid soap and shampoo (without conditioner)
- Equipment for nonambulatory decontamination (including in Contaminated Treatment Area)
  - ❑ Baby wipes, bottles of saline, drapes, bags for contaminated waste, Ziplock bags, and gloves
  - ❑ Long-handled forceps (for picking radiation sources out of wounds) and a lead container (also called a "pig") into which to place them
- Supplies of decorporating agents

## Resources

### Hospitals

Hospitals with Nuclear Medicine or Radiation Oncology departments always have a Radiation Safety Officer (RSO) on call. In the event of a radiation accident, the RSO on call should be contacted immediately through Central Locating. The RSO can be either a Radiation/Radiology/Nuclear Medicine technologist or a Health Physicist. There is also usually a Nuclear Medicine physician on call. They can help to identify the isotope and provide access to Geiger counters.

### Local Industry

There may be local industries that have Geiger counters or other contamination meters and PADs or other dosimeters. Where there are Geiger counters, there are often personnel with special skills and training. The HEOC or municipal EOC can assist in identifying those resources.

### Federal Government

Health Canada

- Responsible for providing support to civilian physicians managing radiation cases. They have an on-call system for radiobiologists to be available to answer questions about biodosimetry
- Phone (613) 954-6647, 24/7/365

Canadian Nuclear Safety Commission (CNSC)

- Regulatory body to oversee safety and security of nuclear materials in Canada
- http://www.nuclearsafety.gc.ca/eng/

METER course

- A course in "Medical Evaluation and Treatment for Exposure to Radiation" sponsored by CRTI[79]
- Focuses on using the Radiation Casualty Assessment Tool to provide clinical guidance during evaluation and management of radiation casualties

### Radiation Trauma Unit (University Health Network in Toronto)

- A network of Emergency Physicians available on call to help answer clinical questions regarding the management of patients from a radiation accident
- Phone (416) 603-5800 (extension 5098), 24/7/365

### Radiation Emergency Assistance Center/Training Site (REAC/TS)

- REAC/TS (located in Oak Ridge, TN) is a WHO funded global Center of Excellence in Radiation Medicine. It is mandated to provide assistance to any member country (including Canada).

- Include algorithms showing the appropriate evaluation and management of casualties arriving from the scene of a radiation disaster
- Phone (865) 576-1005, 24/7/365
- http://orise.orau.gov/reacts/resources/guide/index.htm

### Radiation Casualty Assessment Tool

- Multipage clinical evaluation and management template[80]
- Developed for METER course (funded by CBRNE Research and Technology Initiative [CRTI])[79]
- http://www.ceep.ca/publications/tools/METER-Tool.pdf

### Software and web-based resources

REMM

- Developed by the US Department of Health and Human Services
- Comprehensive package of linked .pdf and .avi files that cover a broad array of topics relevant to the clinical management of patients from a radiation disaster
- Downloadable as standalone application for Windows and Apple platforms, BlackBerry, Palm, or iPhone/iPod
- http://www.remm.nlm.gov/ (can be downloaded and installed on local storage device)

Biodosimetry Assessment Tool (BAT)

- Developed by the US Armed Forces Radiobiology Research Institute (USAFRRI)
- Designed primarily for tracking large numbers of casualties during a radiation MCI
- http://www.afrri.usuhs.mil/outreach/biodostools.htm (can be downloaded and installed on local storage device; requires a password [readily granted] from AFRRI to log onto the download site)

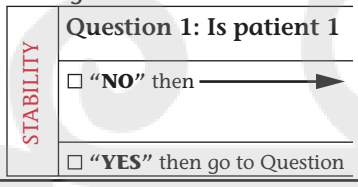
# Appendix D – Radiation Casualty Assessment Tool

## Instructions on use of RADIATION CASUALTY ASSESSMENT TOOL

*METER Course, v2.4 (5/09)*

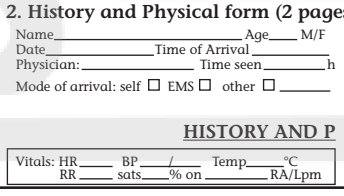
This information packet ('tool') is designed to help with the assessment and management of casualties of an incident involving radiation. Use one packet per casualty, labelling each page. It should become part of the permanent record for that casualty. You do not have to use those parts of the tool that do not apply to that casualty.

**1. Triage Guide**



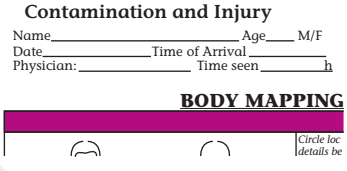

– filled out by triage MD or RN
– used to establish initial priority (i.e. immediate treatment vs. immediate decontamination vs delayed treatment and/or decontamination)
– designed to look and function like the SARS screening tool

**2. History and Physical form (2 pages)**



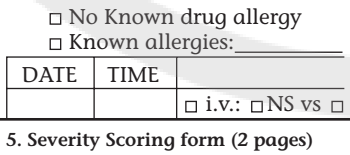

– filled out by treating MD
– used to record findings on history and physical
– prompts physician to obtain specifics relevent to treatment and disposition decisions unique to radiation exposure and/or contamination
– includes biodosimetry estimates using three clinical measures

**3. Body Mapping form for Skin Contamination and Injury**



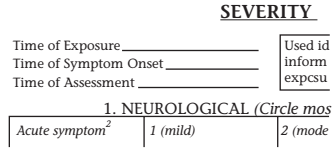

– filled out by treating MD or RN
– used to facilitate recording location of skin contamination
– contaminated areas are recorded (with initial count and description) as they are discovered by person performing survey. All contaminated areas must be decontaminated, with final counts recorded as well
– also used to record location of injuries

**4. Standing Orders**




– filled out by treating MD
– prompts physician to order specific labs, specimens, and medications relevant to treatment of radiation exposure and/or contamination

**5. Severity Scoring form (2 pages)**




– reference material for treating MD
– allows physician to estimate severity of injury due to radiation exposure when the exposure dose has not been determined. This may help with disposition decision
– lists some decorporating agents for internal contamination, table of 'time of onset of vomiting' as biodosimetry marker

**RADIATION CASUALTY ASSESSMENT TOOL**

PLACE ID STICKER HERE

**Name**_____**Age**____**M/F**
**Date** _____ **Time of Arrival** _____**h**
**Triaged by:**_____ **Time seen** _____**h**
**Mode of arrival: self** □ **EMS** □ **ambulatory** □ **stretcher** □

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# TRIAGE

**STABILITY**

**Question 1: Is patient medically stable?**

| | |
|---|---|
| □ **"NO"** then → | 1. Cover with sheet, assume contaminated<br>2. Move immediately to Contaminated Treatment Area |
| □ **"YES"** then go to Question 2 | |

**CONTAMINATION**

**Question 2: Does patient have measurable skin contamination during 2 minute survey with Geiger Counter in triage?**

| | |
|---|---|
| □ **"YES"** then → | 1. Identify as contaminated (*i.e.* red bracelet)<br>2. Record sites/activity of contamination (p 5)<br>3. Prioritise for decon, move patient to decon site, then integrate into cohorted stream of uncontaminated ED patients<br>4. Further assess for Exposure ASAP |
| □ **"NO"** then → | 1. Identify patient as uncontaminated (*i.e.* green bracelet)<br>2. go to Question 3 |

**EXPOSURE**

**Question 3: Does patient have history, signs and symptoms of possible exposure to radiation?**

| | |
|---|---|
| □ **"YES"** | □ New onset of nausea, vomiting, diarrhea or skin changes?<br>□ New onset of weakness, confusion, unexplained low BP? |
| □ **"NO"** | 1. Prioritise for treatment<br>2. integrate into cohorted stream of uncontaminated ED patients |

**RADIATION CASUALTY ASSESSMENT TOOL**

**Name** _____ **Age**____ **M/F**
**Date** _____ **Time of Arrival**_____**h**
**Physician:**_____ **Time seen** _____**h**

*PLACE ID STICKER HERE*

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# HISTORY AND PHYSICAL Form

**Vitals:** HR_____ BP____/____ Temp_____°C
RR_____ sats____% on_____RA/Lpm

**Chief complaint:**_____
**HPI:**_____

**Review of Systems** (selected)

**Neuro:** Confusion □ Fatigue □
Changes in: speech □ vision □ dizzy □ headache □

Vomiting: yes □ or no □ # of times:_____
(began at_____h, =_____h after exposure)

Motor/sensory deficits?_____
Cognitive deficits?_____

**Blood:** Active bleeding? □ _____
Bruising □ Petechiae □

**Derm:** Redness or Rash □ (Time of onset:_____h)
Swelling □ Blisters □ Ulcers □
Desquamation □ Hair loss □ Onycholysis □
Dysaesthesia/pruritis □

**GI:** Nausea □ (severity: ____/10) Anorexia □
Abdominal pain □ Blood □/mucus □ in stool
Diarrhea □ (began at_____h; # of times: _____)

if female: LMP_____, Pregnant: yes/no/?

**Details of radiation contamination/exposure:**_____

**Isotope** Known:_____ unknown □
Type of particle: α □ β □ γ □ X-rays □ neutrons □
State: solid/powder □ liquid □ gas/steam □

**Contamination** see diagram □
**External contamination:** yes □ no □ unknown □
Extent of contamination (see diagram):
localised (skin/hair) □ Wound □ Generalised □
Internal contamination: yes □ no □ unknown □

**Decontamination**
Location: in field □ at ED □ , done by_____

**Exposure** yes □ no □ unknown □
Time of exposure:_____h, Duration:___h___min
Whole body □ Parts of Body □_____

**Past Medical History** Immunosuppression □
Cancer □ (radiation □ chemo □, when?_____)
Previous fluoroscopy/Nuc Med testing/occupational exposure?_____
Other:_____

**Medications** (include dose & freq if known):_____

**Allergies to meds:** NKDA/_____

**Social history:** _____

## RADIATION CASUALTY ASSESSMENT TOOL

PLACE ID STICKER HERE

**Name** _____ **Age**____ **M/F**
**Date** _____ **Time of Arrival**_____**h**
**Physician:**_____ **Time seen**_____**h**

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**Physical exam:**

**Labs & Investigations:**

**Blood samples**

- ☐ **CBC**: WBC_____$\times 10^3$.
  Abs Lymphoocytes_____Abs Neutrophils_____.
  Hgb_____mg/dL, Plt_____$\times 10^3$
- ☐ **Chem 7**: Na_____Cl_____K_____CO2_____.
  BUN____Creat____Glc____.
- ☐ **Pregnancy test** (all females): neg/pos
- ☐ **Thyroid**: TSH, T3, free T4
- ☐ **Cytogenetics** (green-top tube; keep at room temp; send ASAP) if exposure potentially > 0.5 Gray
- ☐ **HLA typing** (green-top tube; hold if potential for requiring bone marrow transplant))

Specimens
(scan with Geiger Counter, then label & save)

- ☐ **Nasal swabs** (labeled L&R): activity: yes/no
- ☐ **Mouth Swab:** activity yes/no
- ☐ **Urine sample:** activity yes/no
- ☐ **Stool sample:** activity yes/no
- ☐ **Emesis sample:** activity yes/no

ECG:_____

**imaging studies:** _____

**BIODOSIMETRY** using different methods of estimating severity of exposure; use REMM Tool or tables p7–8 to calculate estimated dose (in Grays)

**1. Time of onset of vomiting** (see Table on page 8)
- Interval between exposure & onset vomiting:_____h
- Estimated dose: _____Gray

**2. Absolute Lymphocyte depletion rate** (use REMM)
- single ALC_____$\times 10^3$, _____hrs post-exposure
- serial ALC's: 2nd_____$\times 10^3$, _____hrs post-exposure
- Estimated dose: _____Gray

**3. Response Category:**

| | | | | |
|---|---|---|---|---|
| **Neurological:** | **1** | **2** | **3** | **4** |
| **Hematologic:** | **1** | **2** | **3** | **4** |
| **Dermatological:** | **1** | **2** | **3** | **4** |
| **Gastrointestinal:** | **1** | **2** | **3** | **4** |
| **OVERALL RESPONSE CATEGORY:** | **1** | **2** | **3** | **4** |

*(Select highest value from 4 individual categories above)*

*Consistent biodosimetry estimate using all 3 methods is suggestive of radiation exposure at the indicated dose*

(*Source: REMM* ☐*, other:*_____)

**Resources** (available 24/7 throughout Canada):
☐ Health Canada: (613) 954-6647
☐ Radiation Trauma Unit (UHN in Toronto):
(416) 603-5800 ext 5098
☐ REAC/TS: (865) 576-3131, ☐ www.remm.nlm.gov

**Course in ED:** _____

**Reassessed:** Time_____h:_____

Diagnosis: 1)_____
2) _____3)_____

**Decorporating agent** considered: Yes ☐ No ☐

**Disposition:** home☐, transfer ☐(to: _____), admit ☐
Follow-up: RTED if: _____
FP/ED in _____days (pt aware ☐)
outpt lables ☐_____

Prescriptions _____

see RADIATION STANDING ORDERS ☐

**Signature:** _____time_____h

see continuation sheet ☐

**RADIATION CASUALTY ASSESSMENT TOOL**

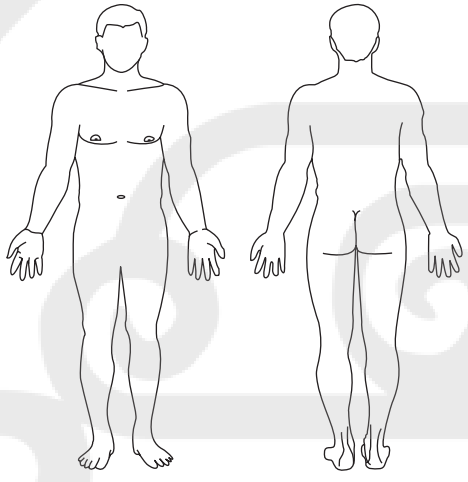
Name _____ Age____ M/F
Date _____ Time of Arrival_____ h
Physician:_____ Time seen _____ h

PLACE ID STICKER HERE

*METER Course, v2.4 (5/09)*

## BODY MAPPING Form

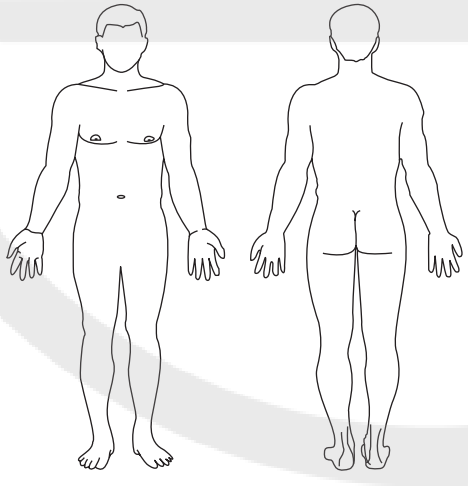
**Injuries, burns, or skin changes**



*Circle location of injuries, number consecutively, list details*

| Site # | Details of Injury |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

**Contamination** Initial survey done by ___ at ___ h Final survey done by ___ at ___ h
Instrument: Background counts per minute:



*Circle location of contamination, then number consecutively. List details below. Be sure to survey nose, mouth, hands & feet. Readings should be in 'counts per minute' (CPM)*

| Site # | Description | Counts/min (initial) | Counts/min (final) |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

**RADIATION CASUALTY ASSESSMENT TOOL**

**Name** _____ **Age** ____ **M/F**
**Date** _____ **Time of Arrival** _____**h**
**Physician:** _____ **Time seen** _____**h**

*PLACE ID STICKER HERE*

*METER Course, v2.4 (5/09)*

# SEVERITY SCORING Form

Time of Exposure _____
Time of Symptom Onset _____
Time of Assessment _____

Based on Waselenko JK *et al.* Ann Internal Med 2004;140(12):1037–1051, also Fliedner TM et al. Oxford: British Institute of Radiology; 2001: 64pp
also refer to REMM website (www.remm.nhs.gov)

**1. NEUROLOGICAL** *(Circle most appropriate description for each symptom)*

| *Acute Symptom*[2] | *1 (mild)* | *2 (moderate)* | *3 (severe)* | *4 (most severe)* |
|---|---|---|---|---|
| *Nausea* | Mild | Moderate | Severe | Unbearable |
| *Vomiting* | ~ 1 per day | ~ 2–5 per day | ~ 6–10 per day | >10 per day |
| *Anorexia* | Mildly decreased appetite | Moderate decreased appetite | Severely decreased appetite | Unable to eat |
| *Fatique Syndrome* | No functional impairment | Moderate functional impairment | Severe functional impairment | Unable to function |
| *Fever* | 37.5–38 °C | 38.1–40 °C | > 40 °C for < 24h | > 40 °C for > 24h |
| *Headache* | Mild | Moderate | Severe | Unbearable |
| *Hypotension* | HR > 100, BP > 100/70 | BP < 100/70 | BP < 90/60 (transient) | BP < 80/60 (persistent) |
| *Neurological deficits* | Minor deficit, no functional impairment | Moderate deficit: moderate functional impairment | Marked deficit: marked functional impairment | Severe deficit: loss of consciousness |
| *Cognitive deficits* | Mild cognitive impairment | Moderate cognitive impairment | Severe cognitive impairment | Profound cognitive impairment |

**2. HEMATOLOGIC** *(Circle most appropriate description for each symptom)*

| *Acute Symptom*[2] | *1 (mild)* | *2 (moderate)* | *3 (severe)* | *4 (most severe)* |
|---|---|---|---|---|
| *Abs Lymphocyte* | ≥ 1.5 × $10^9$/l | 1.0–1.5 × $10^9$/l | 0.5–1.0 × $10^9$/l | < 0.5 × $10^9$/l |
| *Abs Granulocyte* | ≥ 2.0 × $10^9$/l | 1.0–2.0 × $10^9$/l | 0.5–1.0 × $10^9$/l | < 0.5 × $10^9$/l |
| *Abs Platelet count* | ≥ 100 × $10^9$/l | 50–100 × $10^9$/l | 20–50 × $10^9$/l | < 20 × $10^9$/l |
| *Infection*[3] | Local; no antibiotics required | Local; topical or oral antibiotics | Systemic; oral antibiotics | Sepsis; i.v. antibiotics |
| *Bleeding*[3] | Petechiae; easy bruising; normal Hgb | Mild blood loss; <10% decrease in Hgb | Gross blood loss; 10–20% decrease in Hgb | Spontaneous bleeding; > 20% decrease in Hgb |

**Approximate equivalent exposure doses** corresponding to different overall Response Categories:
1~ 1–2 Gy, 2~ 3–4 Gy, 3~ 6–7 Gy, and 4~ > 8–10 Gy (note: high individual variability)

[2] Acute symptoms are those that began after the radiation exposure, and not thought to be attributable to another acute cause
[3] Only present subacutely

## RADIATION CASUALTY ASSESSMENT TOOL

**Name** _____ **Age** ____**M/F**
**Date** _____ **Time of Arrival**_____h
**Physician:**_____ **Time seen** _____h

*PLACE ID STICKER HERE*

*METER Course, v2.4 (5/09)*

**3. CUTANEOUS** *(Circle most appropriate description for each symptom)*

| *Acute Symptom*[2] | *1 (mild)* | *2 (moderate)* | *3 (severe)* | *4 (most severe)* |
|---|---|---|---|---|
| *Erythema* | Minimal, transient | Moderate; isolated patches < 10cm2; < 10% of body surface area (BSA) | Marked; isolated patches or confluent; 10–40% BSA | Severe; isolated patches or confluent, erythroderma; >40% BSA |
| *Sensation/itching* | Occasional pruritis | Slight, intermittent pain | Moderate; persistent pain | Severe; persistent pain |
| *Swelling/Edema* | Mild; asymptomatic | Moderate; symptomatic | Severe; symptomatic | Compartment syndrome |
| *Blistering* | Vesicles, with sterile fluid | Vesicles, with haemorrhage | Bullae, with sterile fluid | Bullae, with haemorrhage |
| *Desquamation* | Mild | Patchy, dry | Patchy, moist | Confluent, moist |
| *Ulcer/necrosis* | Epidermal only | Dermal | Subcutaneous | Muscle/bone involvement |
| *Hair loss*[3] | Thinning, not striking | Patchy, visible | Extensive | Complete and most likely irreversible |
| *Onycholysis*[3] | Minimal | Moderate | Severe | Complete |

**4. GASTROINTESTINAL** *(Circle most appropriate description for each symptom)*

| *Acute Symptom*[2] | *1 (mild)* | *2 (moderate)* | *3 (severe)* | *4 (most severe)* |
|---|---|---|---|---|
| *Stool frequency* | 2–3 stools per day | 4–6 stools per day | 7–9 stools per day | > 10 stools per day; intractable diarrhea |
| *Mucosal loss with diarrhea* | Rare | Intermittent, with moderate patches | Persistent, with larger patches | Continuous, with large patches |
| *Bleeding with diarrhea* | Occult | Intermittent | Persistent | Gross hemorrhage |
| *Abdominal cramping & pain* | Minimal | Tolerable | Intense | Excruciating |

**Decorporating agents (for use with internal contamination)[4]:**

**Cesium** → **Prussian Blue** (1g in 200mL of water tid × 2–3 days)
**Iodine** → **KI** (note: dose of KI is age dependent; 50–130mg given po)
**Plutonium, Americium** → **DTPA** (given as Ca-DTPA initially, then Zn-DTPA)
**Uranium** → **Sodium bicarbonate** (250mL of 1.4% $NaHCO_3$)
**Tritium** → **water** (> 6 litres/day)
**Radium** → **Ca-gluconate** (10mL of 20% solution bid)
**Strontium** → **Barium sulphate** (300g po single dose), **Ca-gluconate**
Other decorporating agents: **Deferoxamine**, **Dimercaprol (BAL)**, and **Penicillamine**

| Dose (Grays) | Onset of vomiting (hours after exposure) | duration |
|---|---|---|
| 0.5 – 2.0 | >6, or absent | < 24 hours |
| 2.0 – 3.5 | 2 – 6 | 12 – 24 |
| 3.5 – 5.5 | 1 – 2 | 24 |
| > 5.5 | Minutes | 48 |

**Time interval prior to onset of vomiting for initial biodosimetry**

[2] Acute symptoms are those that began after the radiation exposure, and not thought to be attributable to another acute cause
[3] Only present subacutely
[4] For prescribing information and other decorporating agents, refer to REMM; for local availability refer to Disaster Plan

Chapter 13

# Pediatrics in Disasters

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# Preface

Disasters affect all segments of the population. Many subsets of the general adult population have specific needs and vulnerabilities.

One group with specific needs, and that is always at high risk in disasters, is children. The physiological, anatomical, developmental, and psychological requirements of children differ from those of adults. Disaster planning must recognize and adapt to this. In addition to being at high risk and having unique requirements, children are also hard to service because many of the guidelines for equipment, supplies, and treatment protocols are designed with adults in mind. This chapter will outline specific pediatric issues that must be addressed by both community and hospital based disaster planners in any disaster document within the Canadian context. This chapter is not meant to provide guidance for situations of prolonged famine, warfare, or disruption of social fabric.

Over the past 5 years, there has been a concerted effort by Canadian healthcare facilities to prepare for disasters. This has been largely a provincial effort with few, if any, Federal/National guidelines or standards against which to assess the true capability of the hospital care system should disaster strike. Limited data collected nationally suggest that there are gaps in readiness.[1] Furthermore, studies have shown that such readiness as does exist in healthcare systems often neglects the unique risks and special needs of children, in both the planning stage and in the availability of supplies and equipment.

The goal of this chapter is to provide guidance on pediatric risks and planning so that healthcare facilities and systems can better prepare to service children. This document was prepared under the auspices of The Centre for Excellence in Emergency Preparedness by a team composed of Emergency Department physicians, rescue workers, pediatricians, social workers, administrators, and pediatric nurses.

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## Section 1: Problems Specific to Pediatric Population

### PHYSIOLOGIC

Children have higher minute ventilation and as such are more likely to be affected by any disaster involving air quality or hypoxia. In addition, due to shorter stature, they are more likely to be exposed to respiratory toxins that are heavier than air and thus, hovering at ground level.

Children have a large skin to body mass ratio and less subcutaneous fat, and thus, they are more prone to hypothermia (both as a result of an event where they are exposed to cold and through medical care such as washing). They are also a higher risk of transdermal absorption of toxins. Due to the fact that children have a high risk of hypothermia and because the onset of hypothermia may be rapid, there needs to be a capacity to provide rapid shelter and/or protection to children in the event of a disaster.

Malnutrition is a more significant problem with smaller children than with adults. There is significant information on the impact of protein–energy malnutrition in children and in the event that a disaster will be of long duration or that it might involve a prolonged isolation of children. There needs to be a process in place to provide and store adequate supplies of age-appropriate food and water.

Children have a smaller fluid reserve, therefore they are at much higher risk of dehydration and shock. This is of specific relevance in situations involving diarrhea, vomiting, or other fluid loss. In addition, it is harder to establish intravenous access in children, and thus, it is often harder to initiate intravenous rehydration.

Oral rehydration has long been recognized as an appropriate and effective therapy for the treatment of dehydration. The American Academy of Pediatrics and the Canadian Paediatric Society have published guidelines for ORT.[2–4] Despite this, it is underused for a variety of reasons, including expense, palatability, parental and healthcare provider knowledge, and acceptance of ORT.[5–7] In addition, although a recipe for homemade oral rehydration solution exists, and is widely used in the developing world, it is not as frequently offered in North America. This may be due to concerns that it will be improperly mixed and result in potential morbidity.[5] To avoid this, pre-made oral rehydration solution and premixed ORT powder is easily available in pouches that just need water added. A simple approach to ORT is available on the Canadian Paediatric Society website (www.cps.ca) under "information for parents" and diarrheal disease. It includes the following suggestions: for babies 6 months and younger: give 30–90 mL (1–3 oz) every hour; at 6–24 months: give 90–125 mL (3–4 oz) every hour; and children older than 2 years: give 125–250 mL (4–8 oz) every hour. If an infant refuses the oral rehydration solution (ORS) by the cup or bottle, the solution may be given using a medicine dropper, small teaspoon, or frozen popsicles. If a child vomits, food should be stopped and fluid replaced with oral rehydration solution. Give 15 mL (1 tablespoon) every 10–15 minutes until the vomiting stops. Increase the amount gradually until the child is able to drink the regular amount.

Breast fed babies pose a unique challenge if they are separated from their mother during a disaster. These infants will need to be weaned to formula given by bottle.

Children vary enormously in both size and weight, and thus, routine protocols and dosages of everything from fluid to medication and ventilatory parameters need to be written per kilogram and calculated on an individual basis.

## ANATOMIC

The pediatric skeleton is far more pliable than that of an adult. Therefore, the pelvis and thoracic cage do not provide the same rigid protection to underlying organs. Thus, in a disaster scenario involving blunt trauma, children may have a higher incidence of underlying organ injuries without fractures.

The ratio of mass of head to body is larger in children than adults, and thus, the likelihood of a head injury in children is higher. This is coupled with the fact that it requires use of different pediatric-specific skills to perform a full neurologic assessment on an infant, potentially posing diagnostic difficulty.

## DEVELOPMENTAL

Children's cognitive and motor skills vary with age, development, and occasionally with other underlying illnesses. It is not always possible to know whether children have deviated from their usual norm because there may not be anyone available to provide information as to what their normal level of function is. This is very different from adults where caregivers have an innate understanding of what a normal level of function is.

Children do not always have the psychological and cognitive maturity to be able to process events. Thus, their risk of emotional injury, anxiety attacks, separation anxiety, or posttraumatic stress disorder (PTSD) is higher than adults.[8–10] Also, in an event where a child is separated from a caregiver, the child may not have the cognitive ability to recognize a risk and evade it.

## PSYCHOSOCIAL

Families should, ideally, be treated as a unit. It may not be reasonable, feasible, practical, or compassionate to separate families when performing decontamination or providing other treatment. This also needs to be taken into consideration for any situation where isolation is required.

There is a need to plan for the care of children in situations where a large number of adults are victims of a disaster. Even though children may not be the primary victims, they may be truly or virtually orphaned as a result of an event that impacts on their parents.

Disaster planning needs to involve liaison among schools, childcare staff, and social services—both community and hospital based—which may play a key role, particularly if a disaster occurs during daytime hours. Also, in an event that involves long-term closure of schools, disaster planning must take into account the need for childcare and its impact on the ability of workers to respond in disasters.

## PAIN MANAGEMENT

Young children do not always identify that they are in pain, may not localize pain well, or may demonstrate pain by irritability, making them difficult to examine. Some healthcare providers may not be comfortable providing adequate analgesia to young patients for fear of side effects. There need to be analgesia protocols in place, particularly for mass casualty events.

Pain management must be considered in all children who have sustained an injury. Children may not have the intellectual ability to report or describe

the location and severity of pain that they are experiencing. Untreated pain has adverse physiological and psychological effects. The presence of pain may make the assessment of an injured patient very difficult, and the physiologic effects of pain may be confused with the signs of hemodynamic instability. It is the responsibility of the healthcare provider to recognize the clinical features of pain in children and initiate appropriate treatment.

## ASSESSMENT OF PAIN

In the pediatric patient, assessment of pain must take into account the developmental level of the child and the nature of the injury. In infants, the best determination of pain is the use of behavioral and physiologic factors. The best behavioral indicators of pain are crying, facial expressions, and motor movements. Physiologic changes include elevated heart rate, increased blood pressure, increased respiratory rate, decreased oxygen saturation, and pupil dilation. Most toddlers will be able to express pain using basic words and may be questioned directly. School-age children and adolescents will be able to express pain directly and may be able to quantify pain using numeric pain scales. The emotional effects of shock, as well as the impact of possible previous trauma, need to be taken into account and may interfere with a child/youth's ability to report pain accurately.

## PHARMACOLOGIC MANAGEMENT

The goal of pharmacologic therapy is to provide safe and effective analgesia. The weight of the child must be approximated and the dose calculated appropriately. Mild to moderate pain may be managed with oral agents. For severe pain, intravenous medications should be considered (Table 13-1).

*Ibuprofen* is a nonsteroidal, antiinflammatory agent that is effective in the treatment of mild to moderate pain. As a single agent (10 mg/kg), it was found to be superior to both acetaminophen (15 mg/kg) and codeine (1 mg/kg).[11]

*Acetaminophen* can be used for mild pain and given orally or rectally. The rectal route may be used in children who are unable to tolerate oral medication.

*Morphine* should be used as the oral opioid agent of choice. Codeine should no longer be used in children. Codeine must be metabolized to morphine to

### Table 13-1: Pharmacologic Management of Pain

| Drug | Dose | Dosing Interval | Maximum Dose |
|---|---|---|---|
| Ibuprofen | 10 mg/kg PO | 6 hr | 600 mg |
| Acetaminophen | 15 mg/kg PO/PR | 4 hr | 1000 mg |
| Morphine | 0.2–0.3 mg/kg PO | 4 hr | 10 mg |
| Morphine | 0.05–0.1 mg/kg IV | 2 hr | 5 mg |
| Fentanyl | 1–2 µg/kg IV | 30 min | 300 µg |

Abbreviations: IV, intravenous; PO, orally.

have therapeutic effect. This metabolism is variable, and there are case reports of patients with significant toxicity from therapeutic doses. This is attributed to patients who rapidly metabolize codeine and achieve very high blood levels of morphine. Conversely ~10 % of the population cannot metabolize codeine and will not receive any analgesic effect.

Intravenous opioid agents should be used for patients with moderate to severe pain. The opioid dose should be titrated cautiously in children due to possible respiratory depression. Morphine is the most commonly used opioid agent and very effective. *Fentanyl* is also commonly used and has a faster onset time but also a shorter duration of action and needs to be given more frequently.

## NONPHARMACOLOGIC MANAGEMENT

Nonpharmacologic interventions may be helpful in minimizing the pain that the child is experiencing. They may help to calm the child and decrease anxiety. Whenever possible the parent should be present to support the child. Infants will respond well to swaddling, rocking, sucking on pacifier, or sucrose on a pacifier.[12,13]

In toddlers, holding/hugging, distraction techniques (toys or music), and security objects (blanket, stuffed toy) may be helpful. School-age children may also benefit from distraction techniques (books, games, and storytelling). For adolescents, breathing techniques, relaxation exercises, and imagery (favourite place) may be helpful.

## MECHANISMS OF INJURY

*Head Injury.* Head injuries account for approximately 60% of all mass casualty incidents (MCIs) and disaster injuries in the pediatric population. This high rate can be explained by the large and heavy heads of children relative to their bodies. Furthermore, in states of unconsciousness, children's upper airways tend to get obstructed by their relatively large, flaccid tongue or kinked because of the head flexion induced by the prominent occiput. Children tolerate multiple organ injuries better than adults, and prognosis usually depends on the severity of the head injury, if present.

*Skeletal Injury.* Children have more pliant and flexible bones than adults and are therefore subject to fewer bone fractures. However, internal organ injuries in the absence of fractures of the overlying bones, in the chest or upper abdomen, for example, are not uncommon. Injuries to children and adolescents also include growth plate injury.

*Thermoregulation.* The less mature thermoregulatory mechanism in children and higher surface area-to-mass ratio compared with adults make heat loss and hypothermia more common in the pediatric population, particularly during exposure to extreme conditions, such as cold weather, decontamination with cold water during biochemical events, or when undressed at triage. Infants are also more susceptible to hyperthermia.

*Blood Loss.* As children have a relatively small amount of blood (80 mL/kg), what may seem to be minor bleeding may represent a significant volume loss and potentially lead to severe shock. Children tolerate cardiovascular stress better. Their compensatory mechanism is inotropic, that is, they can greatly increase heart rate to compensate, considerably more than an

adult; thus, children may tolerate hypovolemic stress better than adults. However, they may decompensate quickly. The clinical implication of this is that children can look quite well and the only sign of impending decompensation is an extremely high heart rate. They can quite quickly go from this state of compensated shock to decompensated shock and arrest.

*Emotional Trauma.* In addition to physical injuries, emotional trauma, for example, caused by separation from the parents, is an important factor in pediatric care. Children may also be more easily frightened by events that they cannot understand such as a healthcare provider in PPE.

### OTHER

The vaccination protocols that are being designed for pandemic scenarios do not include children younger than 6 months. Other potential disasters could include infectious agents for which there may be a vaccine or a treatment that is not studied, approved, or applicable to children, particularly infants.

Children exposed to radiation are at a higher risk of developing radiation-induced cancer such as thyroid cancers. Having higher minute ventilation, children are also at a risk of greater internal exposure to radioactive gases of all types. For children who are being breastfed, it is worth noting that radioactive iodine can be absorbed and secreted in human breast milk.

Children, particularly small children, cannot provide consent for medical treatment. There is implied consent for most resuscitative therapy, but the consent issues are less clear when it comes to nonacute care. There needs to be review of the Canadian legislation to make sure that hospitals are allowed to provide immediate and ongoing care to children who are unable to provide consent and whose guardians are not available for a variety of reasons.

## Section 2: General Planning Considerations for Pediatric Disasters

Disasters are classically divided into four phases: mitigation, preparedness, response, and recovery. This section will review some of the general planning issues related to mitigation and preparedness and their implications in pediatric disaster planning. The subsequent chapters will deal with response. Recovery is beyond the scope of this chapter.

### MITIGATION

It is important to make sure that the following is addressed in your disaster planning:

- Review what pediatric sites (schools, daycare centers, etc.) are within the community and the region. These can generate a large clinical load for the facility, and it is important to know that they exist. More so, the planner may wish to contact them and see what assessments they have made and what hazard vulnerability analysis they have performed.
- Identify within your region and community what facilities and institutions provide services for children with special healthcare needs. These could be short-term programs that are disrupted in an event of a disaster or

long-term facilities for children with chronic illness. It is worth considering also whether there is a juvenile detention facility within your region as this may pose special challenges in the event of a disaster.

- It would be useful, if there are multiple pediatric facilities within your region, to have a centralized and standardized identification method for all children in these facilities as well as a centralized repository for information on the residents in residential facilities. This would be important in patient tracking in the event of a disaster that involves the evacuation of one or more pediatric facilities.

## PREPAREDNESS

This includes items related to the preparation of the facility plan and preparation of any exercises that will involve pediatric patients.

- Work within the community and community agencies to identify sources of children, particularly those younger than school age who may be victims in a disaster.
- Work with schools near the facility to identify children who may require hospitalization because of special needs during an emergency. At the same time, identify the facility to the schools, daycare centers, and other pediatric centers in your region and provide them with a contact person whom they can call in the event of an emergency.
- Formalize a pediatric locating/parent matching/tracking form (see Appendix E).
- Establish inventory for appropriate pediatric supplies, equipment, and nutrition for a minimum of 72 hours (see Appendix H).
- Prepare a job action sheet that is integrated into the overall hospital disaster plan and the IMS structure (see Appendix I).
- Negotiate mutual aid and transfer agreements amongst clinicians and institutions that can assume some of the clinical load in the event of a pediatric MCI. This may extend beyond the immediate region of the hospital in case a disaster covers the entire region.
- It may be useful to have digital photography capability for registration and tracking of patients. This would obviously have to integrate into your existent system.

# Section 3: Prehospital Care

Emergency medical services (EMS) personnel and response vehicles must be equipped with pediatric-specific equipment and medications. This includes supplies for decontamination and assessment/treatment for biological, chemical, and radiological terrorism.

Establish model guidelines and best practices for communication, documentation, community involvement, equipment, medical oversight and strong Incident Command Systems, protocols for basic and advanced pediatric

life support, children with special healthcare needs, day care centers, and schools (both public and private).[14]

## Section 4: Triage in Mass Casualties

Triage is the medical screening of patients according to their need for treatment and the resources available. It is particularly relevant to mass casualty situations, when conventional standards of medical care cannot be delivered to all victims. The goal is to optimize care for the maximum number of salvageable patients. Patients who will do well with minimum care are distinguished from those who will die despite maximal care. Attention is addressed to those who will benefit most from optimal care and rapid surgical intervention.

Effective triage at the scene and within the medical institution is often a major determinant of outcome. In adults, priority for treatment is based on rapid assessment of level of consciousness and vital signs. In children, triage poses a greater challenge, as measurements of vital signs, particularly of blood pressure, are difficult to obtain and cooperation is limited. Although children may account for a significant percentage of victims in mass casualty events and disasters, most of the triage studies to date have focused on the adult population.

Multiple casualty and mass casualty events are different by definition. In *multiple casualty* situations, the number of patients and the severity of their injuries do not exceed the ability of the facility to render care, and patients with life-threatening problems or multiple system injuries are treated first. In *mass casualty* situations, the number of patients and the severity of their injuries exceed the capability of the facility and staff. In this situation, patients sustaining major injuries who have the greatest chance of survival with the least expenditure of time, equipment, supplies, and personnel are managed first.

All accepted methods of triage are subject to under- and overtriage. An undertriage rate of 5% is considered acceptable; anything higher may lead to unnecessary morbidity and mortality in severely injured but potentially salvageable patients. An overtriage rate of about 50% is acceptable, to minimize the number of patients who are undertriaged.[15]

Practically, patients are broadly categorized into one of three groups: (1) immediate care, (2) urgent or delayed care that includes the ambulatory patients, and (3) unsalvageable. Numbers, colors, or symbols may be used to denote the different triage categories. For example, red (priority 1) tags are attached to patients allocated to the immediate-care group, yellow tags (priority 2) to the delayed-care group, and black tags to unsalvageable patients. In Israel, triage models also add a blue tag to identify children and a grey one to identify patients with a combined injury (induced, for example, by chemical and conventional weapons). No matter what the method, the signs need to be appropriate, clear, and uniform across the medical care system. In North America, this is commonly (1) immediate (red), (2) delayed (yellow), (3) ambulatory (green), and (4) unsalvageable (black or yellow/black).

There is a variety of triage tools designed for the field although these are primarily for adults such as START mentioned above. Pediatric triage tools include JumpSTART and SMART TAPE.

In general, ambulatory patients are automatically triaged for delayed care. For others, categorization is based on vital signs for nonambulatory patients. A quick look will determine whether the patient can verbally respond and the

airway is open. Otherwise, the physician performs a simple chin lift or jaw thrust maneuver or attempts removal of oral debris. If there is no respiration after the airway is opened, the patient is declared dead. If respiration is established, the pulse and capillary refill are checked, and if there is no peripheral pulse or capillary refill is delayed, the patient should be triaged for immediate care. If a good peripheral pulse exists and capillary refill is normal, the patient should be triaged for urgent care. Any ongoing bleeding should be stopped in the field.[15] This assessment of airway, breathing, and circulation is also called the pediatric assessment triangle (PAT).

Some PAT systems classify patients using the CUPS acronym for *critical* (e.g., absent airway, breathing, or circulation), *unstable* (e.g., compromised airway, breathing, or circulation, depressed level of consciousness, significant active bleeding, or active seizure), *potentially unstable* (e.g., normal airway, breathing, and circulation but significant mechanism of injury or illness or infant younger than 3 months with fever), and *stable* (e.g., normal airway, breathing, and circulation with no significant mechanism of injury or illness).[16] Although this is a functional method, the authors of this chapter feel that it would be confusing to have different classification systems for adults and children and, as such, suggest that the classification of pediatric patients also follow the adult color codes.

The following recommendations address the minimal elements for proper triage and prehospital care of children by first responders:

- Incorporate use of a pediatric-specific triage system by all first responders and hospital personnel. This will provide guidance for triage personnel making potential life and death decisions that otherwise may be influenced by emotional issues when triaging children. At this time, JumpSTART Paediatric Multiple Casualty Incident Triage (see Figure 13-1) and SMART TAPE (see Figure 13-2) are 2 objective triage systems that address the needs of children.
- Designate a pediatric-specific triage process for use in training by first responders and emergency personnel.
- Continue to develop, improve, and implement triage systems that are objective and child specific to advance the efficiency and accuracy of triage.
- Ensure integration and consistency of use of pediatric triage processes among local, regional, provincial, and federal responders, including Disaster Medical Assistance Teams.
- Ensure the availability of a green area for minor wounds and unaccompanied or displaced children, ideally away from the Emergency Department (ED) or resuscitative areas as this eases the clinical burden of the yellow area.
- Include evaluation of triage processes and performance in quality assessment procedures (performed after the event) at federal, provincial, and local levels, as well as in future research initiatives.[14]

In adults, the patient's ability to walk is an important criterion in the initial decision-making process. For nonambulatory patients, triage is based on the radial pulse and the motor component of the Glasgow Coma Scale. However, infants are

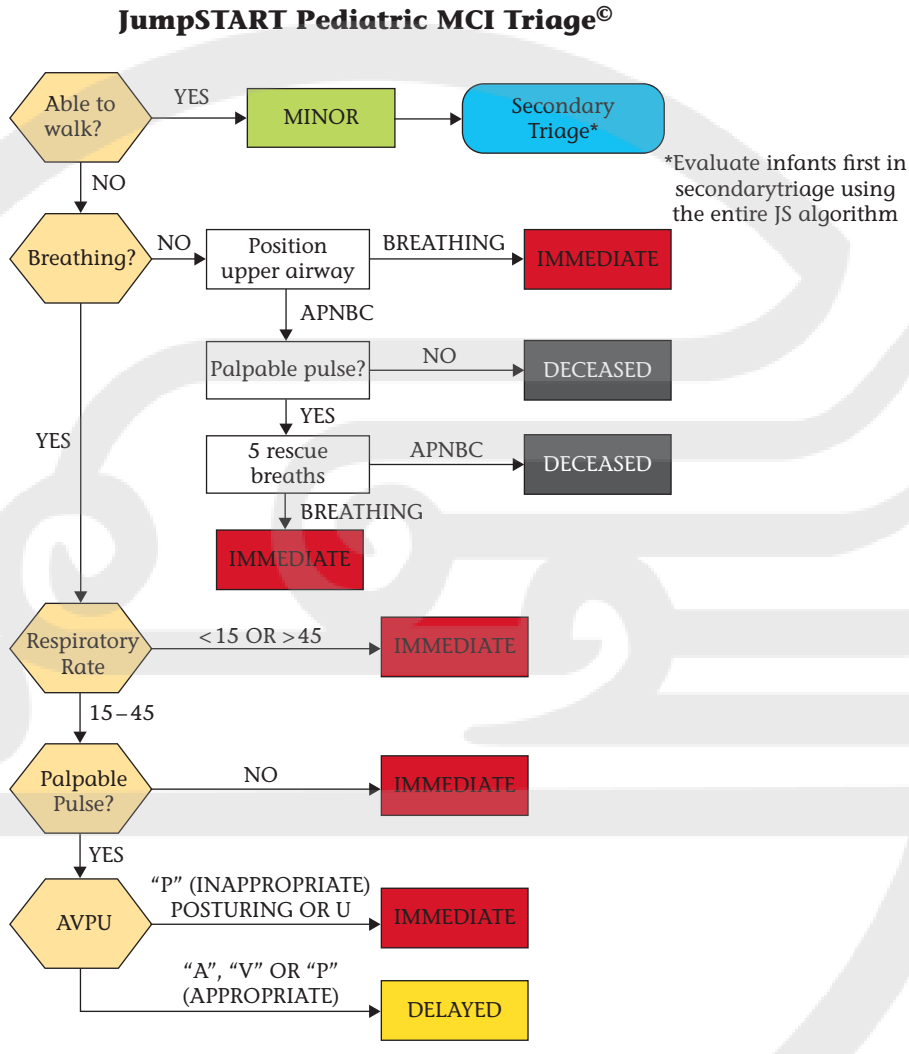


**Figure 13-1: JumpSTART Pediatric MCI Triage.**

unable to walk, and older children are often strapped to a stretcher by the time they get to the ED. Furthermore, communication with children in the preverbal stage may be difficult, and older children may be terrified or refuse to cooperate.

In general, the principles of triage are the same for children and adults, although the priority of children over adults within the same categories is controversial. The Save the Children Fund in 1923 and United Nations Children's Fund (UNICEF) in 1990 declared that children must receive relief first,[15] but this recommendation is not universally accepted.

Several researchers introduced assessment tools, such as the Pediatric Trauma Score (with the Eichelberger modification)[17] and the algorithm proposed by Mackway-Jones et al.[18] to aid clinicians in the triage process. However, both these tools have been found to have some major limitations: (1) Young infants cannot walk and are therefore immediately categorized as at least priority 2. (2) There is no airway-opening maneuver, other than possibly a jaw thrust. (3) The methods require blood pressure measurement, which is difficult to perform and time consuming in children in crises. (4) The methods do not account for differences in physiological parameters with age. Pediatric Canadian Triage and Acuity Scale

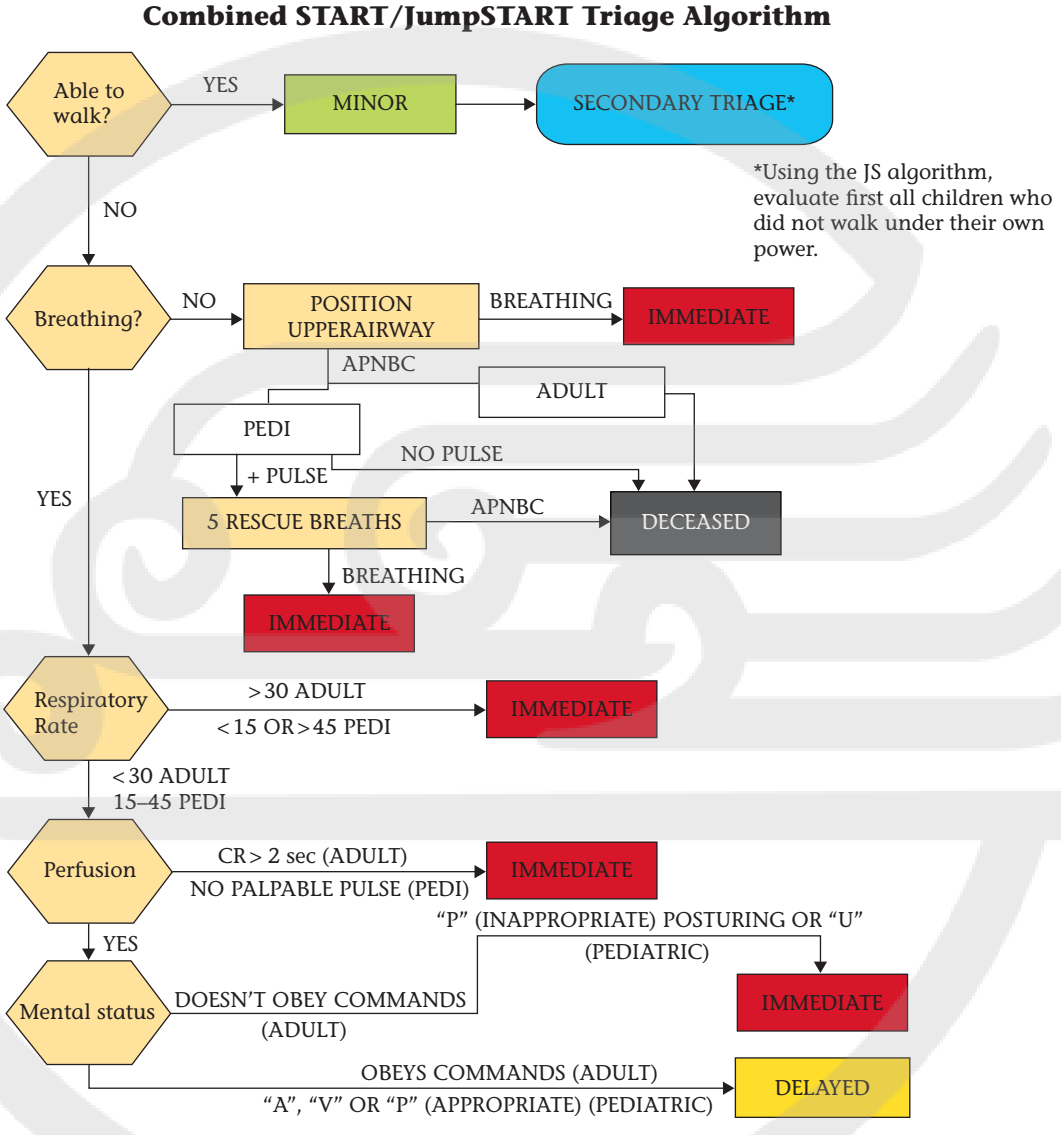


**Figure 13-2: Combined START/JumpSTART triage algorithm.**

(PedsCTAS) is very accurate and quick; the PAT with a quick assessment of the apex beat will usually tell you whether a patient is in need of resuscitation (Red) or delayed care (Yellow).

To address these challenges, Israeli EDs have formulated a new algorithm for pediatric triage in mass casualty events[15] (see Figure 13-3), which has several advantages over the earlier ones. It eliminates time-consuming vital signs measurements; takes into account the level of consciousness in children too young to walk; and uses 4 priority categories instead of 3: 1, immediate care/resuscitation room; 2, urgent care/ED; 3, delayed care; and 4, unsalvageable. In view of the lack of objective measurements for triaging children, their algorithm emphasizes the need for a clinician with experience in pediatrics and trauma care for the quick and accurate assessment of respiratory, circulatory, and central nervous system function in this age group. The most important decision of triage is rapidly identifying patients in category 1. A finding of bradycardia is an indication for the resuscitation room and tachycardia for the immediate-care group. Children with bleeding are assigned to the

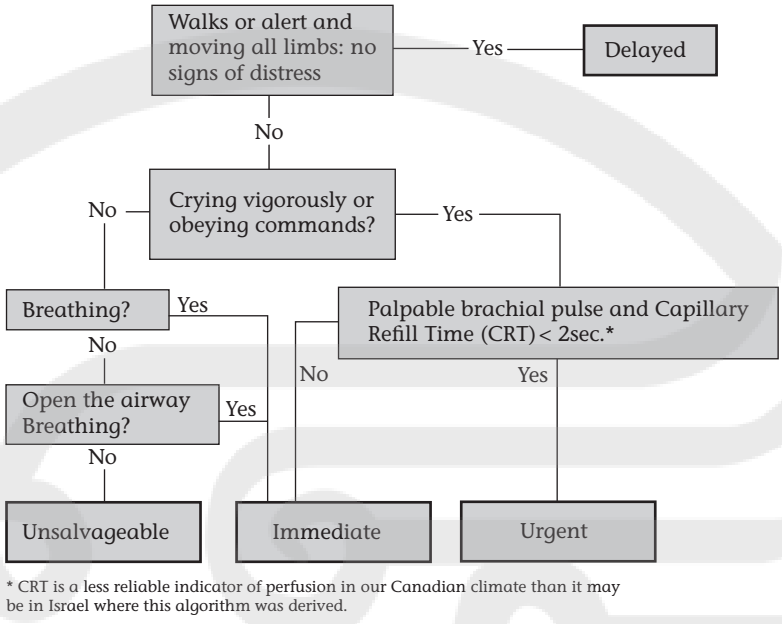


**Figure 13-3: Algorithm for mass casualty pediatric triage.**

immediate-care group as well. As noted in the work of Hirshberg et al.,[19] of the patients in the immediate-care group, it is particularly important to identify critically injured children who require treatment in resuscitation rooms, and of those in the delayed-care group, it is important to identify children with anxiety and acute emotional stress who need to see a social worker or mental health professional.

Differences between conventional triage systems and mass casualty triage used in Israel are summarized in Tables 13-2 and 13-3.[15]

## Table 13-2: Main Differences Between Conventional Triage Systems and the Mass Casualty Triage

| Parameter | Conventional Triage | Mass Casualty Triage |
|---|---|---|
| Triage Site | Inside Emergency Department | Outside Emergency Department |
| Triage Professional | Nurses | Senior Physician |
| Assessment Technique | Clinical + Physiological Measurements | Clinical |
| Measurement of Vital Signs | Required | Not Performed |
| Extent of Resuscitation | Maximal Care for Every Patient | Unsalvageable Category Implemented With No or Limited Care |
| Decision to Transfer | Performed After Initial Care | From Triage, According to Patient Condition and Availability of Local Resources |

**Table 13-3: Routine Medical Practices Unaltered Between Conventional Triage Systems and Mass Casualty Triage Formulated by Authors**

| Parameter | Conventional and Mass Casualty Triage |
|---|---|
| Extent of Care | Immediate attention to airway, breathing and circulatory emergencies in potential viable patient |
| Pain Management | Appropriate management of pain |
| Patient Assessment | Systematic, although abbreviated in mass casualty events |
| Reassessment | Frequent reassessment for changes in status |

## TRIAGE GUIDELINES FOR NONDISASTER PATIENTS

Nondisaster, nonemergent pediatric patients presenting to emergency during a disaster will be registered in emergency or an alternate area per standard triage and registration protocol and then taken to the appropriate care area. This may be outside the ED if the ED is required to deal with the disaster. Consideration should be given to discharging deferrable patients by a PA or RPN/RN without treatment by a physician. From a medico–legal standpoint, in order for a PA, RN, or RPN to be allowed to discharge a patient, there needs to be a formal medical directive in place outlining the special circumstances and criteria for the action. If an alternate clinic is not yet staffed or registration is delayed because of staff priorities, an RN/RPN should remain with the patients. Treatment and disposition will be by clinic staff, according to their usual guidelines.

Nondisaster patients should be triaged as per the PedsCTAS. "Resuscitation" (CTAS level 1) conditions are patients who present with conditions that are a threat to life or limb (or imminent risk of deterioration) and requiring immediate aggressive interventions. "Emergent" (CTAS level 2) conditions are a potential threat to life, limb, or function and require rapid intervention. "Urgent" (CTAS level 3) are patient's conditions that could potentially progress to a serious problem requiring emergency intervention. "Semi-urgent" (CTAS level 4) are conditions that relate to patient age, distress, or potential for deterioration or complications, which would benefit from intervention or reassurance within 1–2 hours. "Non-urgent" (CTAS level 5) are conditions that may be acute but nonurgent, as well as conditions that may be part of a chronic problem, where the investigation or interventions for some of these illnesses or injuries could be delayed.

Nondisaster patients presenting as "resuscitation" or "emergent" will be triaged, registered, and handled as usual in the ED. All other patients may be transferred and managed in an alternate care area.

A triage site dealing with pediatric patients should be ideally staffed by two experienced physicians, one with expertise in emergency medicine and the

other with expertise in pediatrics, pediatric emergency medicine, or critical care. The physicians should be assisted by one nurse each for tagging patients and delivering care. In addition, auxiliary personnel are needed to carry stretchers; and security guards should also be available. At least one physician and nurse should be available for each patient admitted to the immediate-care area. All medical staff assigned to triage must be specially trained in the necessary techniques, a training that is routine for ED triage nurses in Canada. Obviously, the scale of the event will impact on the human resources that are required or available. These guidelines are meant to suggest skill sets more than absolute numbers.

## Section 5: General Guidelines for Treatment Areas and Their Staffing

The following guidelines are extracted from document "Surge Management in Disasters" of The Centre for Excellence in Emergency Preparedness that has been revised and expanded in this textbook. For a more in-depth review of the subject please see Chapter 6.

*Patient Flow*. Patient flow must be in only one direction. Easy-to-read signs and arrows directing staff and ambulatory patients to the appropriate treatment site should be prepared in advance and hung at the time of the event. Walkie-talkies or other means of communication among personnel and the different treatment sites should be stocked and provided as necessary (Table 13-4).

### Table 13-4: Patient Flow

| Triage Code | Patient Flow | Staff |
|---|---|---|
| Major injuries: Requires Resuscitation | Resus Room or Room Adapted for Pediatric Resuscitation | • Emergency MD/RN<br>• Anesthesia<br>• Trauma Team Leader<br>• Trauma Fellow<br>• Surgical Staff<br>• Respiratory Therapy<br>• Patient Tracking Team<br>• Clerical Staff |
| Major injuries: Requires stat assessment or stabilization | Examination Rooms with a bed and a line of sight to Staff | • Emergency MD/RN<br>• Trauma Team Leader<br>• Pediatric Residents<br>• Patient Tracking Team<br>• Clerical Staff (Multiple) |

## Table 13-4: Patient Flow *(continued)*

| Triage Code | Patient Flow | Staff |
|---|---|---|
| Major injuries: Stable | Examination rooms with beds | • Emergency MD/RN<br>• Trauma Team Leader<br>• Pediatric Resident<br>• Patient Tracking Team Member<br>• Clerical Staff |
| Minor injuries: For assessment and treatment | Area ideally away from ED | • Emergency MD/RN<br>• Patient Tracking Team Member<br>• Clerical Staff (as required) |
| Minor injuries: Assessed by waiting room staff | Treatment Area away from ED | • Emergency RN<br>• Emergency MD/ Resident<br>• Outpatient Department RPN<br>• Patient Tracking Team Member |
| Expectant/Palliative | Treatment Area away from ED | • Security<br>• Social work/family and child care<br>• Clergy<br>• Palliative-care staff. |
| DOA | Morgue | • Pathologist<br>• Transport Staff |

Abbreviation: ED, emergency department.

This table provides guidance for a situation with maximal resources such as an urban teaching hospital. Individual facilities may or may not have the locations or staff outlined in this table—each site must adapt these guidelines to their own situation.

Child-care workers or social workers should not be in fixed locations but should case find independently. They would likely find themselves moving between major injuries (stable) and minor injuries. Volunteers who work with children need to be clearly identified, screened (usually including a police check), trained and have well-defined tasks. Once they have been oriented to the layout of the facility, they can also be used as runners and messengers. Social workers are needed to repatriate displaced/ unaccompanied children with correct family.

*Triage Site*. Ideally the triage site is located outside the ED, between the area for ambulance unloading and the entrance to the ED. At the triage

site, patients are categorized to one of the designated sites listed below. History suggests that up to 80% of patients will present themselves and as such there may be value to a separate triage area for ambulances.

*Immediate-Care Site*. The ED resuscitation area or an easily accessible equivalent is reserved for patients in the immediate-care and, unless another appropriate area exists, urgent-care categories. Ideally, the urgent-care area will be in the "routine" areas of the ED. In a general facility, a separate area in the ED should be designated and equipped for children, unless they require the resources of the resuscitation areas.

*Delayed-Care Site*. An area outside the ED but in close proximity to it should be reserved for delayed-care patients. A large waiting room, outpatient clinic, or hallway not normally used for patient care may be used. Again, a separate area should be set aside for children. Carts with appropriate equipment for this level of care should be prepared in advance and brought to the site at the time of the event.

This site may be further subdivided into delayed, ambulatory, and palliative/unsalvageable areas. The area for unsalvageable patients should be away from the ED and ideally allow for grieving families, morgue facilities, and the collection/safeguarding of forensic evidence.

Equipment in the delayed-care areas should take into account the potential for episodic under triage of immediate-care and palliative-care patients. There should be a separate area for the latter group.

The path from the triage site to the delayed-care site should not cut through the ED.

Patient registration at all sites is minimal and should occur at the bedside or "chair side." A number of preprinted prepared packages should be ready ahead of time including admission, ID bracelet, laboratory and X-ray requisitions, and nursing notes, all associated with the same patient ID that should be already entered in the hospital computer. Most admission information is electronic now, however, power/staff/equipment may not be available, so the hospital must be ready to work from a paper chart.

## Section 6: Pediatric Treatment Area Considerations

A detailed equipment and supply list can be found in Appendix H.

- Appropriate hygiene/waste disposal resources and supplies for infection control
- Basic health screening to ensure appropriate levels of available care including specific pediatric screening tool
- Safety and supervision of children around frail adults (including preventing access of children to medications)
- Security of unattended or unsupervised minors. An area that can keep children in and safe from possible predators or media

- Availability to public of medical information resources (computers, posters, phone referral lines, etc.) to aid in appropriate use of medical resources
- Standardized healthcare data collection
- Environmental considerations—distancing from smoking, alcohol, other drugs, and weapons
- Secure transportation within the shelter and the medical care and resources system (transportation of shelter occupants must include appropriate official supervision of and accountability for unattended minors)
- Arrangements for children with special healthcare needs, including providing for patients on long-term medications without affecting local emergency-care resources and battery backup for children with power needs, that is, respirators/electric wheelchairs and so on
- Availability of pediatric information resources for caregivers, specifically age- or weight-related protocols/doses
- Clear identification of children
- Clear identification of caregivers/family members
- Entertainment/distractions

## Section 7: Psychosocial Needs and Treatment

The impact of natural disasters on individuals is substantial. Aside from the hardships of daily living, the survivors may experience injuries and be exposed to other distressing events including witnessing someone dying or being injured, seeing dismembered bodies or body pieces, being trapped under debris, or being separated from family (UNICEF, 2004). Survivors of disasters often experience a range of losses, including loved ones, their home, neighbourhood, and place of worship. Although distressing for all, children may be particularly affected by the loss of their familiar environment (home, school, and peers), as children feel safe and secure when they have consistent and predictable routines in life. Caregivers, during such times, are also often unable to give the care and comfort they provided before the disaster. This can cause anxiety, fear, and a great sense of insecurity among children.

### SUGGESTED GUIDELINES FOR DEALING WITH DISTRESS

- Talk openly about feeling of fear and anxiety.
- Reassure children by word and deed (“we are all together and safe”).
- Keep the family together. This provides concrete reassurance.
- Listen to what children say about their fears.
- Encourage them to talk (“It is normal to be afraid”).
- Restore a sense of routine and avoid inactivity.

- Be aware of your own feelings and the effect these feelings, and your own reactions, have on children.
- Don't focus on temporary, immature behavior—it is typical for children's emotions and behavior to temporarily regress during extreme stress situations.
- Give additional attention and reassurance.
- Encourage contact with friends.
- Rehearse safety measures to be taken in future disasters.

## WHEN PROBLEMS PERSIST

Professional assistance, such as that from a counselor or therapist, can help deal with "adjustment reactions" relatively quickly and easily. Useful interventions may include the following:

**A.** *Understand and monitor child emotional reactions*. When children face any traumatic event, they have both emotional and physical reactions. These reactions and feelings are normal responses and occur in most children who face an event that overwhelms them. Children of different ages may have different reactions. Encourage parents, teachers, and other caregivers to observe the child and report any changes in him or her.

**B.** *Help reduce effects by offering emotional support and security to the child*. Talking about the event and allowing the children to share their experiences and feelings may help to decrease emotional distress in some children and youth. Others may not talk at all but may find it comforting to know that there is somebody who cares. The caregiver should be readily available and should re-assure the child that their feelings are normal. Being available and offering reassurance to the child can help to restore a greater sense of safety and security.

**C.** *Facilitate recovery by modeling healthy coping strategies:* The caregiver should normalize life routines by helping children and youth get involved in routine tasks like returning to school or engaging in recreational activities. Children will look to caregivers to learn how to cope with traumatic incidents. Caregivers should try to model healthy coping by acting with calmness, following regular sleep times, eating well, taking an interest in outside activities, and exercising regularly.

## WHAT TO EXPECT

Most children and adolescents, if given support such as that described earlier, will quickly recover almost completely from the fear and anxiety caused by a traumatic experience. Specific time frames for recovery are difficult to set out; however, there should be evidence of a gradual reduction in anxieties, a decreasing of sadness, and other symptoms of depression over a period of days to weeks. Failure to see positive changes increases the likelihood that a more formal intervention may be needed. When a child is severely traumatized,

enlisting professional support with therapists *trained* in working with children and PTSD is paramount.

## Section 8: Healthcare Facility Risk Assessment—Pediatric Specific

It is critical to engage in a pediatric-specific disaster risk assessment with the community, including school districts, the Office of Emergency Services, EMS, the police department, the fire department, private practitioners, child welfare organizations, child-care establishments, public health organizations, and mental health facilities. It may be that schools or other children's organizations and facilities do not have the information required for disaster readiness.

In addition to the routine risk assessment that the hospital must perform (see Chapter 2), the following pediatric risk assessment (Table 13-5) should be performed.

### Table 13-5: Pediatric Risk Assessment

| Contacting the Following Organizations | Potential of Patients (yr) | | | Any Special Needs |
|---|---|---|---|---|
| | 0–5 | >5–10 | >10–15 | |
| Local Schools | | | | |
| Local Childcare Centers | | | | |
| Child Welfare Organizations | | | | |
| Mental Health Facilities | | | | |
| Other Facilities Housing Children or Adolescents (jails, group homes, etc.) | | | | |
| Others—Church, Day Care Areas | | | | |

## Section 9: General Readiness Assessment (Pediatric Specific) for Hospitals and Healthcare Facilities

### HOSPITAL PREPAREDNESS

- Ensure preparedness in all hospitals, with children's hospitals playing a crucial role in educating the community, training healthcare providers, and directing the care of children in general hospitals when the numbers of children or logistics prevent transport to a children's hospital.

- In the absence of specific guidelines regarding supply stores, the authors recommend 1 of 2 options: (1) facilities should ideally perform a focused risk assessment to estimate the potential pediatric impact of likely disasters and the potential sources of patients (e.g., schools) within their caption area and estimate their needs based on this (Dr. Hezi Waisman, Schneider's Children's Hospital, Israel, July 17, 2009, personal communication) or failing this and recognizing that there is limited evidence to support this option and (2) keep a 48-hour supply of pediatric equipment and pharmaceuticals on hand for the average daily number of patients plus the larger of 50 patients or 0.02% of the local population. This is based on Canadian statistics[20] assuming that 20% of the population would be younger than 16 and that 0.1% of those might be casualties.
- Include a detailed pediatric component in web-based hospital resource availability networks.
- Develop informational resources and training for pediatric-specific responses to biological, chemical, and radiological terrorism.
- Ensure that all hospital emergency operations and preparedness policies include pediatric care and treatment guidelines and account for the unique aspects and needs of children.
- Ensure that all agents and equipment that are stocked for disaster and terrorism preparedness are either specifically for pediatric use or can be appropriately substituted for pediatric use.
- For hospitals that do not routinely treat pediatric patients, there may be benefit to an agreement with a regional pediatric hospital to send a team to assist with pediatric patients who present during a disaster.

## COMMUNITY PREPAREDNESS

- Designate a pediatric specialty resource center and system in every regional or city's disaster plan to include—at a minimum—pediatric critical care, pediatric trauma, and pediatric burn capabilities.
- Form disaster medical and psychological incident response teams capable of managing pediatric patients in every region. The response teams must plan for and receive training in the care of pediatric patients and include appropriately trained providers and provision for pediatric equipment.
- Promote communication and consultation between facilities by availability of multiple horizontal communication systems that include patient records and medical information, which is commonly accessible. A common medical record is ideal, but, in the absence of this, a transfer checklist with attached documents is a minimal requirement.
- Involve pediatric-trained providers in physician volunteer programs. Such programs must have plans to provide pediatric-trained providers to facilities that need additional support in disaster events.
- Fund regional planning efforts.
- Develop multiple systems capable of transporting pediatric patients to link patient care resources.

## GUIDELINES FOR BIOLOGICAL TERRORISM

- In the absence of specific antidotal therapy (see Table 13-6), isolation, or vaccination, there is little role for physical protection beyond handwashing and other hygiene measures against bioterrorist agents in a civilian population.

### Table 13-6: Recommended Therapy and Prophylaxis in Children for Additional Select Diseases Associated With Bioterrorism

| Disease | Therapy or Prophylaxis | Treatment, Agent, and Dosage[a] |
|---|---|---|
| Smallpox | Therapy | Supportive care |
| | Prophylaxis | Vaccination may be effective if given within the first several days after exposure |
| Plague | Therapy | Gentamicin—adjust doses to corrected age and weight. Monitor peak, trough, and renal function.<br>Streptomycin 15 mg/kg IM q12h (maximum 2 g/d, although only available for compassionate usage and in limited supply is a preferred agent) or doxycycline 2.2 mg/kg IV q12h (maximum 200 mg/d) or ciprofloxacin 15 mg/kg IV q12h or chloramphenicol[b] 25 mg/kg q6h (maximum 4 g/d) |
| | Prophylaxis | Doxycycline 2.2 mg/kg PO q12h or ciprofloxacin[c] 20 mg/kg PO q12h |
| Tularemia | Therapy | Same as for plaque |
| Botulism | Therapy | Supportive care, antitoxin may halt progression of symptom but is unlikely to reverse them |

**Table 13-6** *(continued)*

| Disease | Therapy or Prophylaxis | Treatment, Agent, and Dosage[a] |
|---|---|---|
| Viral Hemorrhagic Fevers | Therapy | Supportive care, ribavirin may be beneficial in select cases[d] |
| Brucellosis | Therapy[e] | Trimethoprim/ sulfamethoxazole 30 mg/kg PO q12h and Rifampin 15mg/ kg q24h or gentamicin 7.5 mg/kg IM qdx5 |

Abbreviations: IM, intramuscular; IV, intravenous; PO, orally.

This table was created from recommendations developed at the Consensus Conference and in part is based on reviewed reference materials from the AAP, Centers for Disease Control and Prevention, and Infectious Disease Society of America.

[a]In a mass casualty setting, parenteral therapy might not be possible. In such cases, oral therapy (with analogous agents) may need to be used.

[b]Concentration should be maintained between 5 and 20 mcg/mL: Some experts have recommended that chloramphenicol be used to treat patients with plague meningitis, since chloramphenicol penetrates the blood-brain barrier. Use in children younger than 2 may be associated with adverse reactions but might be warranted for serious infections.

[c]Other fluoroquinolones (levofloxacin, ofloxacin) may be acceptable substitutes for ciprofloxacin; however, they are not approved for use in children No quinolones have pediatric approval in Canada.

[d]Ribavirin is recommended for Arenavirus, Bunyavirus and may be indicated for a viral hemorrhagic fever of an unknown etiology although not FDA approved for these indications. For intravenous therapy, use a loading dose: 30 kg IV once (maximum dose 2 gm), then 16 mg/kg IV every 6 hr for 4 days (maximum dose, 1 gm) and then 8 mg/kg IV every 8 hr for 6 days (maximum dose, 500 mg). In a mass casualty setting, it may be necessary to use oral therapy. For oral therapy, use a loading dose of 30 mg/kg orally (PO) once then 15 mg/kg/day PO in 2 divided doses for 10 days.

[e]For children younger than 8 years. For children older than 8 years, adult regimens are recommended. Oral drugs should be given for 6 weeks. Gentamicin, if used, should be given for the first 5 days of a 6-week course of trimethoprim/sulfamethoxazole.

## GUIDELINES FOR CHEMICAL TERRORISM

- There is no pediatric autoinjector kit that is currently produced and marketed in Canada that the authors could identify. Doses need to be individualized on a per kilogram basis.
- All agents listed in Table 13-4 should be available and in appropriate dosage and forms for children in all chemical terrorism medication provision plans. This would include the NPS, Push Packs, federal, provincial, and local health department stocking and deployment of these agents, and local responder and chemical terrorism treatment provisions. If items are not stocked in your facility, ensure that the facility disaster plan includes instructions on how to obtain them promptly.
- Make an organized body of knowledge regarding chemical weapons readily available to pediatric and emergency services healthcare

professionals. Include details on the known pediatric toxicology of chemical weapons, with management protocols based on a consensus guideline development process, and real-time contact resources (e.g., poison control centers, CDC).

- Provide educational programs on possible chemical terrorism for EMS and community healthcare workers (e.g., school nurses) and provide for ongoing training and assessment.
- Publicly disseminate a condensed version of this information and include advice on the mental health care of children. This information should be reviewed by professional organizations and/or government agencies to ensure that it is appropriate for the general public.
- Include pediatric and mental health input in decontamination and treatment protocols in state, regional, and local EMS plans. This implies some national consensus process for hospital-based decontamination.
- Keep adequate stocks of antidotes, especially those for nerve agents, available for use by EMS and hospital EDs. The numbers of stock items should be based on risk assessment to determine the numbers of all possibly exposed children and those children being transported for treatment. The NPS must include adequate provisions for pediatric dosing and administration of antidotes.
- Ensure that EMS and EDs have protocols for rapid delivery of critical nerve agent antidotes and for use of the current Mark 1 autoinjector in children.
- Make cyanide antidotes, with clear size-adjusted dosing regimens, widely available.
- Strongly consider developing a universal, size-adjusted dosing system (such as the Luten–Broselow color coding paradigm) for cyanide antidotes and other critical care medications that require intravenous administration.
- Because pediatric doses are based on weight, it may be helpful to have preprinted medication sheets with doses per kilogram. This would help prevent medication errors occurring when calculating doses under stressful conditions and, for those hospitals with budget constraints, would cost less than Broselow kits.
- Treatment protocols for chemical terrorism should be based on the recommendations in Tables 13-7 and 13-8.

## Table 13-7: Recommended Treatment and Management of Chemical Agents Used in Terrorism

| Agent | Toxicity | Clinical Findings | Onset | Decontamination[a] | Management |
|---|---|---|---|---|---|
| Nerve agents | | | | | |
| Talurin, sarin, soman, VX | Anticholinesterase, muscarinic, nicotinic, and central nervous system effects | Vapor, miosis, rhinorrhea, dyspnea | Vapor: seconds | Vapor: fresh air, remove clothes, wash hair | Airway, breathing, circulatory support<br>Atropine 0.05–0.1 mg/kg IV,[b] IM[c] (minimum 0.1 to maximum 5 mg), repeat q2-5 minimum PRN for marked secretions, bronchospasm, hypoxis, respiratory compromise, apnea, cardiopulmonary arrest<br>Pralidoxime 25–50 mg/kg IV, IM[d] (maximum 1 g IV; 2 g IM), may repeat within 30–60 min PRN, then again q1h for 1 0r 2 doses PRN for persistent weakness, high atropine requirement<br>Diazepam 0.05–0.3 mg/kg (maximum 10 mg) IV, lorazepam 0.1 mg/kg IV or IM |

## Table 13-7 *(continued)*

| Agent | Toxicity | Clinical Findings | Onset | Decontamination[a] | Management |
|---|---|---|---|---|---|
| | | | | | (maximum 4 mg), midazolam 0.1–0.2 mg/kg (maximum 10 mg) IM PRN for seizures or severe exposure |
| | | Liquid: diaphoresis, vomiting<br>Both: coma, paralysis, seizures, apnea | Liquid: minutes to hours | Liquid: remove clothes, copious washing of skin and hair with soap and water, ocular irrigation | |
| Vesicants | | | | | |
| Mustard | Alkylation | Skin: erthema, | Hours | Skin: soap and water | Symptomatic care |
| Lewisite | Arsenical | vesides. Eye: inflammation. Respiratory tract: inflammation, respiratory distress, acute respiratory distress syndrome | Immediate pain | Eyes: irrigation (water)<br>Both: major impact only if done within minutes of exposure | Possibly British anti-Lewisite 3 mg/kg IM q4-6h for systemic effects of lewisite in severe cases |

## Table 13-7 *(continued)*

| Agent | Toxicity | Clinical Findings | Onset | Decontamination[a] | Management |
|---|---|---|---|---|---|
| Pulmonary agents | | | | | |
| Chlorine, phosgene | Liberate HCl, alkylation | Eyes, nose, throat irritation (especially chlorine)<br>Bronchospasm, pulmonary edema (especially phosgene) | Minutes<br>Bronochospasm: minutes<br>Pulmonary edema: hours | Fresh air<br>Skin: water | Symptomatic care |
| Cyanide | Cytochrome oxidase inhibition: cellular anoxia, lactic acidosis | Tachypnea, coma, seizures, apnea | Seconds | Fresh air<br>Skin: soap and water | Airway, breathing, circulatory support, 100% oxygen. Sodium bicarbonate PRN for metabolic acidosis. Sodium nitrite (3%):<br>Dosage (mL/kg) Estimated hemoglobin (g/dL) for average child<br>0.27 10<br>0.33 12<br>0.39 14 |

## Table 13-7 *(continued)*

| Agent | Toxicity | Clinical Findings | Onset | Decontamination[a] | Management |
|---|---|---|---|---|---|
| | | | | | Maximum 10 mL<br>Sodium thiosulfate (25%) 1.65 mL/kg (maximum 50 mL) |
| Tear gas (CS and CN type) (Mace®), capsaicin (pepper spray) | Neuropeptide substance P release, alkylation | Eye: tearing, pain, blepharospasm<br>Nose and throat irritation<br>Pulmonary failure (rare) | Seconds | Fresh air<br>Eye: irrigation (water) | Topical ophthalmics, symptomatic care |

Abbreviations: IM, intramuscular; IV, intravenous.

[a]Decontamination, especially for patients with significant exposure to nerve agents or vesicants, should be performed by healthcare providers dressed in adequate personal protective equipment. For emergency department staff, this consists of a nonencapsulated, chemically resistant body suit, boots, and gloves with a full-face air purifier mask/hood.

[b]Intraosseous route is likely equivalent to intravenous.

[c]Atropine might have some benefit via endotracheal tube or inhalation, as might aerosolized ipratropium.

[d]Pralidoxime is reconstituted to 50 mg/mL (1 g in 20 mL water) for IV administration, and the total dose is infused over 30 min, or it may be given by continuous infusion (loading dose 25 mg/kg over 30 min, then 10 mg/kg/h). For IM use, it might be diluted to a concentration of 300 mg/mL (1 g added to 3 mL water 0 by analogy to the Mark 1 autoinjector concentration), to effect a reasonable volume for injection.

## Table 13-8: Autoinjector Usage

| Approximate Age (yr) | Approximate Weight (kg) | Number of Autoinjectors (Each Type) | Atropine Dosage Range (mg/kg) | Pralidoxime Dosage Range (mg/kg) |
|---|---|---|---|---|
| 3–7 | 13–25 | 1 | 0.08–0.13 | 24–46 |
| 8–14 | 26–50 | 2 | 0.08–0.13 | 24–46 |
| >14 | >51 | 3 | ≤0.11 | ≤35 |

Each Mark 1 kit contains two autoinjectors (0.8-inch needle insertion depth), 1 each of atropine 2 mg (0.7 mL) and pralidoxime 600 mg (2 mL); although not approved for pediatric use, they should be used as initial treatment in circumstances for children with severe, life-threatening nerve agent toxicity for whom intravenous treatment is not possible or available or for whom more precise intramuscular (milligram/kilogram) dosing would be logistically impossible. Suggested dosing guidelines are offered; note potential excess of initial atropine and pralidoxime dosage for age/weight, although within general guidelines for recommended total over first 60–90 min of therapy for severe exposures. *This table lists usage of the Mark 1 kit only down to age 3 based on adherence to recommended dosages for atropine and pralidoxime. However, if an adult Mark 1 kit is the only available source of atropine and pralidoxime following a nerve agent exposure; it should be administered to even the youngest child. In such a situation, one should follow weight-based dosing guidelines.*

## GUIDELINES FOR RADIOLOGIC TERRORISM

- Potassium iodide (KI) is a valuable intervention for children exposed to radioiodines. Determination of need for KI should be based on a community risk assessment to determine based on possible events what population of children would receive the minimal exposure of 5 cGy, which would require treatment. Typically this is a minimum of a 10-mile radius but could be as great as a 50-mile radius.
- Develop plans and distribution systems in all localities that provide for KI administration within 2 hours of exposure to radioactive iodine to ensure that all children who need KI can receive it.
- Adhere to graded dosing of KI whenever possible. If local emergency planners conclude that graded dosing is logistically impractical for populations at risk for radioiodine exposure, the overall benefits of receiving 130 mg of KI instead of the lower doses recommended for certain age groups far exceed the small risks of overdosing.
- If KI dosing based on projected thyroid radioactive exposure is logistically impractical during a radiological emergency, administer KI to children at the lowest possible threshold that is ≥5 cGy projected internal thyroid exposure in children.
- Involve pediatric experts in the development of plans for a safe and effective response to a radiation event. This is essential because children are significantly more affected by radiation exposure than adults.
- Increase the knowledge base among all pediatric care providers about medical and psychological aspects of radiation exposure.

- Except as stated above, ensure that the dosing of KI conforms to Table 13-9.
- Assure availability of appropriate marrow stimulative agents for children who may be victims of radiologic terrorism or radiologic exposure through a nonterrorism event. The marrow stimulative agents available and their dosages are listed in Table 13-10.

## Table 13-9: Guidelines for Potassium Iodide Dose Administration

| Patient/Age | Exposure, GY (RAD) | KI Dose[a] (mg) |
|---|---|---|
| >40 yr | >5 (500) | 130 |
| 18–40 yr | 0.1 (10) | 130 |
| 12–17 yr | 0.05 (5) | 65 |
| 4–11 yr | 0.05 (5) | 65 |
| 1 mo through 3 yr of age | 0.05 (5) | 32 |
| Birth through 1 mo of age | 0.05 (5) | 16 |
| Pregnant or Lactating Women | 0.05 (5) | 130 |

This table was created from recommendations developed at the Consensus Conference and in part is based on reviewed reference materials from the American Academy of Pediatrics, Centers for Disease Control and the Food and Drug Administration.

[a]Children/adolescents weighing more than 70 kg should receive the adult dose (130 mg).

## Table 13-10: Marrow Stimulative Agents

| Agent[a] | Action | Dosage[b] |
|---|---|---|
| Epoetin Alpha[a] (Epgen, Procrit) | Induces erythropoieses | 150 units/kg/dose |
| Filgrastim (Neupogen) | Granulocyte colony-stimulating factor | 2.5–5 µg/kg/d (dosages of 20 µg/kg/d may be needed in selected patients) |
| Sargramostim (Leukine) | Colony-stimulating factor (GM-CSF) | 5–10 µg/kg/d (dosages of 30 µg/kg/d may be needed in selected patients) |

[a]Epostin Alpha may also be useful to reduce the overall requirements for blood transfusion in any mass casualty incident.

[b]Dosage derived from Medical Management of Radiological Casualties, Armed Forces Radiobiology Research Institute, 1999 and accepted dosages for pediatric oncology and pediatric congenital neutropenia and erythropenia patients.

## Table 13-11: Radionuclides Produced After Radiologic Terrorism or Disaster, Internal Contamination, Toxicity, and Treatment

| Element | Respiratory Absorption | Gastrointestinal Absorption | Skin Wound Absorption | Primary Toxicity | Treatment |
|---|---|---|---|---|---|
| Americium | 75% | Minimal | Rapid | Skeletal deposition, marrow suppression, hepatic deposition | Chelation with DTPA or EDTA |
| Cesium | Complete | Complete | Complete | Whole-body irradiation | Prussian blue |
| Cobalt | High | <5% | Unknown | Whole-body irradiation | Supportive |
| Iodine | High | High | High | Thyroid ablation, carcinoma | Potassium Iodide |
| Phosphorus | High | High | High | Bone, rapidly replicating cells | Aluminum hydroxide |
| Plutonium | High | Minimal | Limited, may form nodules | Lung, bone, liver | Chelation with DTPA or EDTA |
| Radium | Unknown | 30% | Unknown | Bone, marrow suppression, sarcoma | Magnesium sulfate lavage |
| Strontium | Limited | Moderate | Unknown | Bone | Supportive |
| Tritium | Minimal | Minimal | Complete | Panmyelocytopenia | Dilution with controlled water intake, diuresis |
| Tritiated water | Complete | Complete | Complete | Panmyelocytopenia | Dilution with controlled water intake, diuresis |
| Uranium | High | High to moderate | High absorption, skin irritant | Pulmonary, nephrotoxic | Chelation with DTPA or EDTA, $NaHCO_3$ to alkalinize urine |

Abbreviations: DTPA, diethylenetriaminepentaacetic acid; EDTA, ethylenediaminetetraacetic acid.

- Include in all medication availability for radiologic exposure antiemetics to treat the emesis caused by this exposure and prevent dehydration for which children have increased susceptibility.
- Ensure availability of all the medications listed in Table 13-11 for treatment of radiological internal contamination and that all testing of these agents and their treatment protocols include considerations for the treatment of children.

### DECONTAMINATION

- Design decontamination systems so that they can be used for decontamination of children of all ages (including infants), the parentless child, the nonambulatory child, and the child with special healthcare needs.
- Address the following pediatric considerations in all federal, provincial, and regional/local protocols and guidance for decontamination: (1) water temperature and pressure (high-volume, low-pressure, and heated water systems), (2) nonambulatory children, (3) children with special healthcare needs, and (4) clothing after decontamination.

## Section 10: Children With Special Healthcare Needs

- Incorporate considerations for Children With Special Healthcare Needs (CSHCN) in all disaster and terrorism planning at the national, provincial, and regional/local levels (e.g., water, dialysis, medication).
- Identify all CSHCN to ensure each child has a medical home, adequate medical coverage, and support mechanisms before a disaster or terrorist event.
- Ensure that all CSHCN are considered in emergency preparedness plans.
- Develop mechanisms for identification of and community planning for children with increased vulnerability in disasters, including CSHCN and their families, at the national, provincial, and regional/local levels.
- Provide federal, provincial, and local government funding for emergency preparedness planning and implementation of services to meet the needs of CSHCN. This funding must be timely, immediately accessible, and of sufficient duration.
- Explore, within government agencies, development of nontraditional, community-based support systems for CSHCN and their families (e.g., independent living centers, faith-based groups, parent-based groups).
- Mandate continuity of operations and mutual aid planning among community health facilities to address disaster and terrorist events for pediatric populations, including CSHCN.

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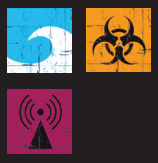

# Appendix A – General Activation Plan for Ambulatory Care Areas in a Mass Casualty Incident

## During working hours

**Notified by:** Overhead Announcement (Emergency Voice Communication System) of Code Orange

**FUNCTIONS:**

1. All clinics will close immediately, and patients will be asked to leave by the main entrance.
2. Designated areas will prepare to treat nondisaster emergency patients according to the established guidelines for triaging patients (2 RNs).
3. One designated area will become the patient discharge area if declared by the Command Post. This area will be staffed by ambulatory care staff and available inpatient staff (2 RNs and 1 clerical, if available).
4. One designated area will prepare for the reception of disaster patients with minor injuries. This area will be staffed by ambulatory care and emergency staff (1 RN).
5. Designated area can be used to accommodate overflow suture cases depending on the type of disaster victims.

## After Normal Working Hours

**Notified by:** Admin on call

Note that based on the scenario and the resources available, those units can be combined or divided/duplicated.

**FUNCTIONS**

1. Areas and their function are the same as in working hours.
2. Fan out will occur to enlist staff (requires a fan out protocol).
3. Dedicated preassigned staff from inpatient areas will report to and set up the treatment areas in ambulatory clinics.
4. As staff arrives, the incoming staff are delegated to the intake areas first and then the discharge areas and the depleted wards.

**NOTE**
Staffing in brackets is only a suggestion; each facility must decide its own staffing structure. For another model, see Table 13-4.

This and other plan templates are included as examples. Every facility is different, and organizations must develop their own specific versions.

# Appendix B – Behaviors Manifest in Emotionally Traumatized Patients Generally and by Age Groups

*When there is a major interruption in the natural flow of life, children can experience anxiety and fear. Disaster such as earthquakes, tsunamis, and fires are dramatic and intense experiences, especially unsettling to children.*

During and after these problems, adults can help children cope by understanding (1) what children feel, (2) how they act, and (3) what actions can be taken to deal with distress.

Children traumatized by events or disasters often experience a pervasive sense of loss:

- Loss of feeling safe
- Loss of identity /future
- Loss of feeling of control over one's life
- Loss of trust in others
- Loss of hope
- Loss of personal power

In children, such feelings of loss may present in physical symptoms:

- Headaches
- Aches and pains
- Overeating or loss of appetite
- Bowel problems
- Skin disorders
- Sleep disorders (nightmares or excessive sleeping)
- Emotional/behavioral reactions
- Loss of interest in activities
- Decrease performance levels
- Disruptive behavior
- Resistance to authority

- Increase difficulty in relating to parents and siblings
- Sadness or depression
- Antisocial behavior such as stealing and lying

These reactions are understandable. Fear and anxiety are normal reactions to danger. Recognize that a child's fears may arise from imagination as well as "accurate" reactions to real events.

*Preschool children (0–5 years):* Typical reactions can include crying, whimpering, and screaming. Nonverbal signs include trembling and frightened facial expressions. Helplessness and passivity may be manifested by a fear of being separated from the parent, immobility and/or aimless motion, excessive clinging, and total withdrawal. Children may return to behaviors exhibited at earlier ages (these are called regressive behaviors), such as thumb sucking, bedwetting, and fear of darkness. Children may not understand that the immediate danger is over or may feel magically that what happened is a punishment for something they have done or thought. Children in this age tend to be strongly affected by the parents' reactions to the traumatic event. Preschool children have an incomplete understanding of death.

*School-aged children (6–12 years):* School-aged children may show extreme withdrawal, disruptive behavior, and/or inability to sustain attention. Regressive behaviors, nightmares, sleep problems, irrational fears, irritability, refusal to attend school, outbursts of anger, and fighting are also common in children of this age. Also, the child may complain of stomach aches or other bodily symptoms that have no medical basis. Schoolwork often suffers. Depressed mood, anxiety, feelings of guilt, and emotional numbing or "flatness" are often present as well. Children in this age group may feel a sense of responsibility for what has happened and express guilt and fear for their safety or security. Some may feel overwhelmed by all the feelings they are experiencing.

*Adolescents (13 and older):* Adolescents may exhibit responses similar to those of adults, including flashbacks, nightmares, emotional numbing, avoidance of any reminders of the traumatic event, depression, substance abuse, problems with peers, and antisocial behavior. Also common are withdrawal and isolation, physical complaints, suicidal thoughts, school avoidance, academic decline, sleep disturbances, and confusion. The adolescent may feel extreme guilt over his or her failure to prevent injury or loss of life and may harbor revenge fantasies that interfere with recovery from the trauma.

Note: Some children may initially overfunction, appearing quite emotionally stable until weeks or months after the disaster when there are expectations for more "normalized" functioning.

Some youngsters are more vulnerable to the effects of extreme stressors than others. The impact of a traumatic event is likely to be greatest in the child or adolescent who had a pre-existing mental health problem, a history of prior trauma, greater exposure to the disaster and its aftermath, and those who lack family and peer support.

# Appendix C – The Role of Urgent-Care Centers and Primary Care Providers

Urgent-care providers, community health centers, and primary care providers should participate in local plans to handle acute pediatric patients in addition to their normal patient load during disaster and terrorist events. Primary care providers have numerous roles and are invaluable in pediatric terrorist and disaster preparedness. They should:

- Prepare, regularly update, and practice an office disaster plan
- Provide guidance on home disaster preparedness and encourage families to develop family disaster plans, which may include distribution of the Family Readiness Kit (endorsed by the Canadian Paediatric Society)
- Be educated in issues of pediatric disaster management, including biological, chemical, and radiological events
- Assist in developing their local hospital disaster plan that ensures the proper care of children
- Be involved in EMS (e.g., be proficient in CPR and first aid)
- Know liability and licensure issues in providing care during and after disasters
- Participate in provincial and regional/local community response team planning
- Participate in Provincial Health Alert Network/Communications and Information Technology
- Anticipate and prepare for loss of community services
- Aid schools and child care facilities in developing disaster plans
- Provide guidance to families of children with special healthcare needs
- Contact volunteer organizations to provide onsite emergency and primary health care at emergency shelters and to encourage and support community efforts to develop plans for addressing communication, transportation, and other logistics related to children in out-of-home settings
- Advocate for inclusion of the needs of children in all federal, provincial, and regional/local disaster planning
- Advocate for research on the pediatric aspects of biological, chemical, and radiological terrorism including mechanisms, pathophysiology, and treatments (including availability of appropriate medications and antidotes)

## Guidelines for Children with Special Healthcare Needs

- Incorporate considerations for CSHCN in all disaster and terrorism planning at the national, provincial, and regional/local levels (e.g., water, dialysis, medication).
- Identify all CSHCN to ensure each child has a medical home, adequate medical coverage, and support mechanisms before a disaster or terrorist event.
- Ensure that all CSHCN are considered in emergency preparedness plans.
- Develop mechanisms for identification of and community planning for children with increased vulnerability in disasters, including CHSCN and their families, at the national, provincial, and regional/local levels.
- Provide federal, provincial, and local government funding for emergency preparedness planning and implementation of services to meet the needs of CSHCN. This funding must be timely, immediately accessible, and of sufficient duration.
- Explore, within government agencies, development of nontraditional, community-based support systems for CSHCN and their families (e.g., independent living centers, faith-based groups, parent-based groups).
- Mandate continuity of operations and mutual aid planning among community health facilities to address disaster and terrorist events for pediatric populations, including CSHCN.

## Guidelines for Displaced Children

- Develop plans for communication, healthcare delivery, contacting and reuniting children and their families in communities, local school districts, and child care facilities. Integrate these plans into state, regional, and local disaster plans.
- Develop plans in government agencies for temporary medical and mental health care, shelter, guardianship, and placement of children during disaster and terrorist events in case of injured or deceased family members.
- Facilitate prompt communication among family members in community disaster plans. Develop evacuation plans that allow for contacting and reuniting children with their families.
- Consider development of a single-point information collection system to facilitate contacting and reuniting families in community disaster plans.
- Develop a plan to ensure documentation through the continuum of care to ensure appropriate tracking of family members.

## Guidelines for Disaster Simulations and Drills

- Include sufficient proportions of pediatric victims and child-related scenarios in all regional disaster drills and actively involve the major pediatric care providers within the community (e.g., children's hospitals, pediatric societies, day care centers, schools). Such drills should also

address the needs of children with special healthcare needs and mental health emergencies.

- Conduct drills with federal, provincial, and regional/local emergency managers that include exclusively pediatric victims or a majority of pediatric victims in various circumstances (e.g., in schools, day care facilities, school buses) to adequately test the capacity of the system to handle pediatric patients.
- Develop educational adjuncts for disaster and terrorism planning that accounts for events with pediatric patients in proportion to their existence in the population and for events that disproportionately affect children. However, these should not supplant physical pediatric disaster drills or the regional planning efforts necessary to stage them. Such adjuncts should address the variety of ages, developmental levels, and sizes of children who would require care during a disaster or terrorist event, as well as children with special healthcare needs and children with mental health emergencies.
- Facilitate the development of a model pediatric disaster drill template and related best practices. In addition, foster the creation of technical assistance teams to help regions conduct pediatric disaster drills in their areas. Such model drill templates and best practices must address the mental health needs of participants and actors before, during, and after pediatric disaster drills.
- Promote the standardization of pediatric disaster-related vocabulary with respect to incident command structures and field triage tools.

# Appendix D – Terrorism/ CBRN-Specific Readiness Assessment for Pediatrics

Once the needs of children have been addressed in general for all types of emergencies, preparedness specifically for a terrorist event must be considered. Addressing the needs of children is especially important in terrorism preparedness and response because the unique physiology and anatomy of children not only make them more susceptible to terrorist agents but also may require unique therapies.


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There are inherent difficulties in providing pediatric care while wearing CBRN gear. Aside from complicating even the simple task of taking the pulse of a 1-year old with gloves on, the suits are potentially frightening. In an attempt to alleviate this, there have been child-friendly masks proposed (such as the Mickey Mouse Mask (left) designed by the Fun Rubber Company in WWII), but these have never been mass manufactured.

The following recommendations address the needs of children in preparedness and response to biological, chemical, and radiological terrorism including decontamination and the National Emergency Stockpile System.

- Keep all agents listed in Tables 13-2 and 13-3 in appropriate dosages and forms for children in all bioterrorism medication provision plans. This would include the Strategic National Stockpile (Push Packs, Vendor Managed Inventory), state and local health department stocking and deployment of these agents, and local responder and chemical terrorism treatment provisions.
- Chemotherapy and chemoprophylaxis protocols should be based on the recommendations in Tables 13-2 and 13-3.
- Include provisions for study and/or use in children in any new investigational vaccine studies.
- Anthrax: The currently licensed anthrax vaccine (Anthrax Vaccine Adsorbed, AVA, Bioport, Lansing, MI) is approved for persons aged 18–65 years. This vaccine may have a limited role as an adjunct to postexposure chemoprophylaxis, although data are limited. There is limited potential for use of this vaccine in a civilian pre-exposure setting, but advocate that future studies of new-generation vaccines include children.
- Smallpox: The currently licensed smallpox vaccine (Dryvax, Wyeth, Philadelphia, PA) makes no mention in its package insert of an approved age range. In practice, until the early 1970s, this vaccine was administered

to 1-year olds. Currently, the CDC recommends against vaccination of children younger than 1 year. All contraindications to smallpox vaccination are relative. After bona fide exposure or known usage of weaponized smallpox, even the youngest exposed at-risk infants should be vaccinated. Moreover, future studies of new-generation vaccines must include children.

- Botulism: A licensed trivalent (types A, B, and E) antitoxin is available through the CDC. This antitoxin is to be used in children of any age known to have been exposed to botulinum toxin of the appropriate serotypes. An IND pentavalent (types A–E) botulinum immune globulin (human) is available through the California Department of Health specifically for the treatment of infantile botulism. The study of this product must be continued and that licensure be pursued.
- Plague: No licensed plague vaccine is currently in production. A previously licensed vaccine was approved only for persons aged 18–61 years. There is little, if any, role for this or similar vaccines in a bioterrorist context.

For information on specific Biological Terrorism agents, see Table 13-6 in the main document and Appendix G.

For information on specific Chemical Terrorism agents, see Tables 13-7 and 13-8 in main document.

For information on specific Radiological Terrorism response, see Tables 13-9 through 13-11 in main document.

# Appendix E – Parent Matching Form/Patient Tracking Form

**INITIAL COPY STAYS AT PARENT RECEPTION CENTER**

**ONE COPY STAYS WITH PATIENT CHART**

PATIENT IDENTITY STICKER OR STAMP

## PART A - INTAKE

Information taken (please circle) By phone In person

Support worker's name: (1) _____

(2) _____

---

Child's Name _____

Sex: ☐ M ☐ F ☐ Age _____ ☐ D.O.B. _____

Address _____

City _____ ☐ Prov _____

Height: _____ Weight: _____ Race: _____

Eye Colour: ☐ Brown ☐ Blue ☐ Green ☐ Other _____

Hair: ☐ Brown ☐ Blond ☐ Black ☐ Other _____

Clothing: ☐ jacket: colour _____ ☐ top: colour _____

☐ bottom: colour _____ ☐ other _____

Birth Mark or Other Identifying Information: _____

_____

Allergies or Other Medical Information: _____

_____

Language Spoken: ☐ English ☐ French ☐ Other _____

Mother's Name: _____ Phone (h): _____

Identity Verified by (Staff initials)_____ (w): _____

(c): _____

Father's Name: _____ Phone (h): _____

Identity Verified by (Staff Initials)_____ (w): _____

(c): _____

Alternate Guardian: _____ Phone (h): _____

Identity Verified by (Staff Initials)_____ (w): _____

Relationship Verified by (Initials) _____ (c): _____

## PART B - DISPOSITION

Child reunited with: ☐ Father ☐ Mother ☐ Guardian ☐ Care transferred
(add details below) Care Transferred to:

☐ Child care authorities (name of agency)_____

Individual receiving child for transfer_____

Identity Verified by (Staff initials)_____

☐ Other facility (name of facility)_____

Individual receiving child for transfer_____

Identity Verified by (Staff initials)_____

Comments:_____

_____

_____

_____

_____

_____

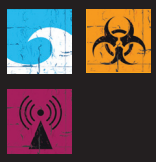
_____

_____

_____

_____

_____



# Appendix F – Topics for Didactic Lectures and Case Histories

- Definition and overview of disasters: the international humanitarian disaster response system
- Introduction to case history, small-group assignments, preceptors
- Rapid epidemiological assessment
- Triage
- Malnutrition
- Renal emergencies for children in disasters
- Water, shelter, and sanitation: logistics and resource management
- Personal preparedness
- Infectious diseases part I–II
- Immunizations
- International humanitarian law and Geneva Conventions
- Emergency obstetrics and basics of newborn resuscitation
- The psychosocial issues for children who suffer disasters
- Ethical issues
- Breastfeeding
- Security issues for relief workers
- Negotiation and conflict resolution: issues affecting women and children
- Sex- and gender-based violence

*Source*: Olness K, Sinha M, Herran M, et al. Training of health care professionals on the special needs of children in the management of disasters: experience in Asia, Africa, and Latin America. *Ambul Pediatr.* 2005;5(4):244–248.

# Appendix G – Biological Weapons Recommended Diagnostic Procedures, Isolation, and Treatment in Children

| Agent | Incubation Period | Diagnostic Sample(s) | Isolation Precautions[a] | Treatment Options[b] | Prophylaxis[c] | Comments |
|---|---|---|---|---|---|---|
| Anthrax | 1–60 d | Blood culture, blood smear; skin lesions or tissue, culture, or fluorescent antibody (FA) staining | Standard, contact for skin lesions | Ciprofloxacin[d] or doxycycline[e] or vaccine, if available (see text) | Ciprofloxacin[d] or doxycycline[e] | Alternate agents: gentamicin, penicillin, clarithromycin, meropenem, vancomycin, chloramphenicol |
| Brucellosis | 5–60 m | Blood or bone marrow, culture, acute/ convalescent sera | Standard, contact if lesions are draining | Doxycycline and rifampin; if <8 yr, trimethoprim–sulfamethoxazole | Doxycycline and TMP/SMX | Trimethoprim |
| Plague | 2–6 d | Blood, sputum, lymph node aspiration, culture, or FA staining | Standard and droplet precautions | Streptomycin or gentamicin, doxycycline or chloramphenicol | Doxycycline, tetracycline | Trimethoprim–sulfamethoxazole is alternative; chloramphenicol for meningitis |

*(continued)*

| Agent | Incubation Period | Diagnostic Sample(s) | Isolation Precautions[a] | Treatment Options[b] | Prophylaxis[c] | Comments |
|---|---|---|---|---|---|---|
| Q fever | 10–40 d | Acute/ convalescent sera | Standard | Doxycycline or tetracycline | Doxycycline, tetracycline | |
| Tularemia | 1–21 d | Sputum or tissue, culture,[f] FA available, acute/ convalescent sera | Standard | Streptomycin or gentamicin | Doxycycline, tetracycline | |
| Smallpox | 7–17 d | Pharyngeal swab or lesions, culture | Standard precautions plus airborne and contact | Cidofovir[h] | NA (vaccine effective but not easily available) | |
| Botulism | 1–5 d | Serum for toxin if <3 d; stool or gastric secretions, culture for organism and look for toxin; nerve conduction | Standard precautions | Antitoxin (CDC)[i] | If ingested, induce vomiting, gastric lavage, purgation and high enemas may benefit | Aminoglycosides potentiate paralysis; antitoxin after exposure for asymptomatic not usually given |

*(continued)*

| Agent | Incubation Period | Diagnostic Sample(s) | Isolation Precautions[a] | Treatment Options[b] | Prophylaxis[c] | Comments |
|---|---|---|---|---|---|---|
| Staphylococcal enterotoxin B | 1–6 h | Nasal swab, culture serum, and urine for organism and look for toxin | Standard | Supportive care | NA | |
| Ricin | | | | | NA | |

[a]For decontamination guidelines, see text.

[b]See the Report of the Committee on Infectious Diseases (*Red Book*) 24th ed, 1997 (or the most current edition) for drug doses. Intravenous therapy for severely ill patients is usually indicated, but oral therapy can be effective and may be the only practical alternative when large numbers of people are exposed.

[c]Prophylaxis should only be initiated after consultation with public health officials in situations where exposure is highly likely. The duration of prophylaxis has not been determined for most agents.

[d]If susceptibility unknown. Ciprofloxacin is not FDA approved for persons younger than 18 years but is indicated for potentially serious or life-threatening infections (see *Red Book*).

[e]If susceptibility unknown. Tetracyclines, including doxycycline, are not FDA approved and usually contraindicated in children younger than 8 years, but treatment is warranted for selected serious infections (see *Red Book*, 2000).

[f]Penicillin should be used only if the organism is known to be susceptible.

[g]Special media required for culture, laboratory hazard: only immunized technicians should ordinarily process cultures.

[h]Pediatric dose not established.

[i]Centers for Disease Control and Prevention Drug Service. 404-639-3670 (weekdays, 8–4:30 ET) or 404-639-2888 (weekends, evenings, and holidays).

# Appendix H – Supply and Equipment Lists

The following is a suggested supply use (excluding linens) for a pediatric disaster response.

- Please note the following:
- Supplies are organized by areas (clinical, resuscitation, and incident).
- This does not include equipment, which would be in the treatment areas already, only consumables.
- This is a suggestion list based on the requirements of a tertiary care pediatric center and, as such, can only be viewed as a suggestion. Each facility needs to review its own needs and modify the list appropriately.
- In addition to the items below, consideration should be given to nonmedical equipment such as books, toys, TVs, diapers, formula, glucose water, and soothers. Containers of bubbles can be very helpful to help in calming children—both emotionally and physiologically.
- Blank space has been left in these tables for facilities to insert their own specific supply needs.

## Incident Supply Cart – ED Examination Area

| Items | Amount | Items | Amount |
|---|---|---|---|
| Normal Saline 500 mL | 10 | Dressing, Elastoplast 7.5 cm | 2 Boxes |
| Normal saline 1000 mL | 12 | Tape clear 1/2” | 6 |
| Dextrose 5% NaCl 45% | 10 | Tape clear 1” | 6 |
| Ringer’s Lactate 500 mL | 10 | Sponge gauge, 4” × 4” | 5 Boxes |
| Ringer’s Lactate 1000 mL | 10 | Sponge gauge, 2” × 2” | 5 Boxes |
| Tubing, IV Pump | 10 | Pad abdominal | 50 |
| Solution Adm. Set | 10 | Bandage Conforming 7.5 cm | 12 |
| Armboards, Child | 10 | Bandage Conforming 10 cm | 12 |
| Armboards, Infant | 10 | Bandage Conforming 15 cm | 12 |
| Catheter Tray | 3 | Syringes 1cc | 50 |
| Urine Drainage Bag | 3 | Syringes 3cc | 50 |
| Foley # 8 FR | 3 | Syringes 5cc | 50 |
| Foley # 12 FR | 3 | Syringes 10cc | 50 |
| Face mask | 1 Box | Syringes 20cc | 40 |

*(continued)*

| Items | Amount | Items | Amount |
|---|---|---|---|
| Sterile gloves size 6 ½ | 1 Box | Syringes 60cc | 30 |
| Sterile gloves size 7 | 1 Box | Needles 23 G | 1 Box |
| Sterile gloves size 8 | 1 Box | Needles 28 G | 1 Box |
| Sterile gloves size 8 ½ | 1 Box | Butterflies 23 G | 50 |
| Catheter IV Insyte # 24 G | 1 Box | Gloves Medium | 1 Box |
| Catheter IV Insyte # 22 G | 1 Box | Gloves Large | 1 Box |
| Catheter IV Insyte # 20 G | 1 Box | Intraosseous Needle 16 FR | 3 |
| Catheter IV Insyte # 18 G | 1 Box | Intraosseous Needle 18 FR | 3 |
| Tubes, Connecting | 5 | Minor Suture Trays | 5 |
| Tubes, Yankuer Suction | 5 | Major Suture Trays | 2 |
| Chest Tube Thal Quick size 10 FR | 1 | Savlon | 3 |
| Chest Tube Thal Quick Size 16 FR | 1 | Suture 4 Nylon | 1 Box |
| Catheter Central Vein 24 FR | 1 | Suture 5 Nylon | 1 Box |
| Catheter Central Vein 20 FR | 1 | Suture 4 Silk | 1 Box |
| Catheter Central Vein 16 FR | 1 | Suture 4 Plain Gut | 1 Box |
| Four-Way Stopcock | 5 | Suture 5 Plain Gut | 1 Box |
| Oxysensor Neonatal | 5 | Betadine | 1 Bottle |
| Oxysensor Infant | 5 | Connecting Tubes | 5 |
| Catheter Dual Lumen 4 FR | 1 | Chlorhexidine | 1 Box |
| Stethoscope | 2 | | |

## Incident Supply Cart – Resus Room

| Items | Amount | Items | Amount |
|---|---|---|---|
| Wash basins and K basins | 10 | Normal Saline 500 mL | 5 |
| Sterile Gowns | 20 | Dextrose 5%, NaCl 45% 500 mL | 5 |
| Burn Dressing Bundles | 10 | Ringer's Lactate 500 mL | 5 |

*(continued)*

| Items | Amount | Items | Amount |
|---|---|---|---|
| Burn Dressing Trays | 3 | Tubing IV Pump | 10 |
| Burn Linen Bundles | 10 | Y-Type Blood Sol. Set | 2 |
| Minor Suture Trays | 5 | Solution Adm. Set | 5 |
| Major Suture Trays | 3 | Syringes 1 mL | 25 |
| Cut down Trays | 2 | Syringes 3 mL | 25 |
| Normal Saline 500 mL | 8 | Syringes 5 mL | 25 |
| Sterile Water 1000 mL | 5 | Syringes 10 mL | 25 |
| Chest Tube Tray With Heimlich Valve | 1 | Syringes 20 mL | 15 |
| Osysensor Neonatal | 5 | Syringes 60 mL | 10 |
| Oxysensor Infant | 5 | Catheter IV Insyte # 24 | 1 Box |
| 4" × 4" | 1 Box | Catheter IV Insyte # 22 | 1 Box |
| 2" × 2" | 1 Box | Catheter IV Insyte # 20 | 1 Box |
| Bandage Conforming 7.5 cm | 1 Box | Catheter IV Insyte # 18 | 1 Box |
| Bandage Conforming 15 cm | 1 Box | Needles 23 G | 1 Box |
| Sterile Gloves Size 6 1/2 | 1 Box | Needles 18 G | 1 Box |
| Sterile Gloves Size 7 | 1 Box | Tubes Connecting | 5 |
| Sterile Gloves Size 8 | 1 Box | Tubes, Yankuer Suction | 5 |
| Sterile Gloves Size 8 ½ | 1 Box | Catheter Suction # 10 FR | 5 |
| Dressing, Thermal Saline | 2 Boxes | Catheter Suction # 12 FR | 5 |
| Chlorhexidine | 1 Box | Catheter Suction # 14 FR | 5 |

*(continued)*

| Items | Amount | Items | Amount |
|---|---|---|---|
| Suture 4 Nylon | 1 Box | Catheter Tray | 5 |
| Suture 5 Nylon | 1 Box | Foley # 8 FR. | 5 |
| Suture 4 Silk | 1 Box | Foley # 12 FR | 5 |
| Suture 4 Plain Gut | 1 Box | Urine Drainage Bag | 3 |
| Suture 5 Plain Gut | 1 Box | Tegaderm Small | 1 Box |
| Normal Saline 1000 mL | 10 | Armboards, Child | 10 |
| Armboards, Infant | 10 | Bruselow Tape | 3 |
| Tape 1" Plastic | 6 | Endotracheal Tubes | Variety of sizes, cuffed and uncuffed, at least 2 of each |

## Incident Supply Cart

| Items | Amount | Items | Amount |
|---|---|---|---|
| Bandage Conforming | | | |
| 5 cm | 10 Rolls | Bandage, Elastic 7.5 cm | 10 |
| 7.5 cm | 10 Rolls | Bandage, Elastic 10 cm | 10 |
| 10 cm | 10 Rolls | Bandage, Elastic 15 cm | 10 |
| 15 cm | 10 Rolls | Plaster Slab 7.5 × 38 cm | 1 Box |
| Tissue Facial | 6 Boxes | Plaster Slab 10 × 76 cm | 1 Box |
| Towel J-Cloth | 1 Box | Swab Cotton 15 cm | 1 PG |
| Dressing Elastoplast | | | |
| 3.8 cm | 1 Box | Water for Irrigation Sterile 1 L | 5 |
| 6.3 cm | 1 Box | Normal Saline 500 mL | 5 |
| 7.5 cm | 1 Box | Container Specimen Clean 90 ml | 15 |
| Closure Skin 6 × 75 mm | 1 Box | Mask Face Isolation | 1 Box |
| Tincture Benzoin | 2 Bottles | Proviodine-Iodine Solution 500 mL | 1 Bottle |
| Gloves | | | |
| Small | 1 Box | Isopropyl Alcohol 70%, 500 mL | 1 Bottle |

*(continued)*

| Items | Amount | Items | Amount |
|---|---|---|---|
| Medium | 1 Box | Dressing, Thermal Saline | 2 Boxes |
| Large | 1 Box | Brace Clavicle Infant | 2 |
| Sterile Gloves | | | |
| 6 ½ | 1 Box | Brace Clavicle Pediatric | 2 |
| 7 | 1 Box | Brace Clavicle Adult | 2 |
| 8 | 1 Box | Bandage Cast Padding 10 cm | 1 PG |
| 8 ½ | 1 Box | Bandage Cast Padding 15 cm | 1 PG |
| Sponge Gauge Sterile 5 × 5 cm | 4 Boxes | Scrub Brush | 10 |
| Eye Pad | 10 | Dressing Nonadhering 3" × 8" | 10 |
| Bandage Bandaid 1.3 × 7.5 cm | 1 Box | Suture Removal Kit | 4 |
| Bandage, Triangular 44" × 36" | 15 | Blue Basins | 10 |
| Bandage, Elastic 5 cm | 10 | K-Basins | 10 |
| Burn Dressing Trays | 2 | Polysporin Tubes | 5 |
| Burn Dressing Bundles | 2 | Ventolin | 1 |
| Minor Suture Trays | 10 | Aerosol Mask Pediatric | 2 |
| Suture 4 Nylon | 1 Box | Aerosol Mask Adult | 2 |
| Suture 5 Nylon | 1 Box | Normal Saline (3 mL) | 20 |
| Suture 4 Silk | 1 Box | Peroxide | 1 Bottle |
| Suture 5 Silk | 1 Box | Adaptic | 1 Box |
| Suture 4 Plain Gut | 1 Box | Abdominal Pads 4 × 4 | 1 Box (20) |
| Savlon | 5 Bottles | | |

# Appendix I – Sample Job Action Sheets

These job action sheets are examples based on the disaster plan at specific facilities. Each facility will need to modify the sheet to match its own risks. These are presented as examples only. Many thanks to Children's Hospital of Eastern Ontario – CHEOnet April 2008, for providing this information.

| Pediatric Logistics Unit Leader Job Action Sheet | | |
|---|---|---|
| Immediate | ___ | Receive briefing from Logistics Chief:<br>• Number of expected pediatric patients and their conditions<br>• Timeline for supply needs |
| | ____ | Depending on extent of HEICS expansion, meet with Logistics Chief and the following Unit Leaders:<br>• Procurement<br>• Transportation<br>• Materials Supply<br>• Nutritional Supply |
| | ____ | For Procurement Unit Leader:<br>• Receive briefing from Logistics Chief and Pediatric Logistics Unit Leader<br>• Initiate Disaster Call list if warranted<br>• Work with vendors of the following pediatric supplies<br>❑ Hospital Vendors<br>❑ Local Community resources (local pharmacy, grocery chain, hardware store)<br>❑ Back-up resources |
| | ____ | For Transportation Unit Leader:<br>• Receive briefing from Logistics Chief and Pediatric Logistics Unit Leader<br>• Initiate Disaster Call list if warranted<br>• Assess transportation requirements for pediatric patients. |

*(continued)*

| Pediatric Logistics Unit Leader Job Action Sheet | | |
|---|---|---|
| | | • Count open stretchers, carts, cribs, and wheelchairs for pediatric transportation<br>• Report transportation options to Logistics Chief<br>• Coordinate delivery of transportation options to designated pediatric area or ED depending on scenario<br>• Designate transporters as needed from CS staff or Labor pool |
| | ____ | For Materials Supply Unit Leader:<br>• Receive briefing from Logistics Chief and Pediatric Logistics Unit Leader<br>• Initiate Disaster Call list if warranted<br>• Collect and coordinate essential pediatric medical equipment and supplies to include but not limited to:<br>❑ Food, Formula<br>❑ Bottles/Nipples<br>❑ Pedialyte<br>❑ Diapers<br>❑ Pacifiers<br>❑ Toys/Diversion Supplies<br>❑ Pediatric blood pressure cuffs<br>• Assist in preparation of predesignated pediatric disaster care area with Pediatric Services Unit Leader |
| | ____ | For Nutritional Supply Unit Leader:<br>• Receive briefing from Logistics Chief and Pediatric Logistics Unit Leader<br>• Initiate Disaster Call list if warranted<br>• Estimate the number of pediatric meals needed for 48 hours |
| Intermediate | ____ | Obtain regular updates from Logistics Chief |
| | ____ | Assess additional equipment/supply needs for pediatrics |

*(continued)*

| Pediatric Logistics Unit Leader Job Action Sheet | | |
|---|---|---|
| Extended | ____ | Addresses pediatric concerns, questions and issues as needed |
| | ____ | Document actions and decisions and reports to Logistics Chief<br>• Review areas of success<br>• Identify opportunities for improvement<br>• Thank and congratulate team |
| | ____ | Participates in debriefing and makes recommendations as needed |

| Pediatric Services Unit Leader Job Action Sheet | | |
|---|---|---|
| Immediate | ___ | Gather external information from Treatment Area Supervisor/ED Charge Nurse:<br>• Type of disaster<br>• Number of expected pediatric patients and their conditions<br>• Current total number of ED patients<br>• Time frame for patient arrival |
| | ____ | Gather internal information<br>• Determine number of available pediatric/crib beds (ED and in-patient) and report number to Operations Chief for planning purposes<br>• Determine onsite pediatric qualified staff members<br>• Determine additional staff needed based on expected patient volume<br>• Alert Discharge Unit Leader to institute early discharge/transfer of patients |
| | ____ | Initiate the Pediatric Disaster Call Team as per Plan<br>• Predetermined Physicians (Pediatric/Family Practice/Staff and Community)<br>• Predetermined Nurses (with Pediatric experience and/or PALS/ENPC certification) |

*(continued)*

| Pediatric Services Unit Leader Job Action Sheet | | |
|---|---|---|
| | | • Predetermined technicians with pediatric experience<br>• Others as predetermined |
| | ____ | Communicate with Operations Chief to assure coordination of non- pediatric ancillary/support personnel as per the HEICS plan |
| | ____ | Assure preparation of pre-designated Pediatric Disaster Care Area<br>• Clear area<br>• Designate each specific area based on expected casualties<br>• Assign personnel to each area<br>• Assure delivery of medical and nonmedical pediatric equipment<br>• Assure set up of pediatric equipment by clinical staff |
| | ___ | Communicate preparation status "ready" with Treatment Area Supervisor |
| | ___ | Receive pediatric patients<br>Determine patient status<br>Communicate findings to Treatment Area Supervisor for dissemination as per disaster plan |
| | ___ | Following triage of all children, move uninjured/unaffected children to pre-designated safe area with adult supervision to await family reunification |
| Intermediate | ___ | Assess ongoing staffing needs based on patient status report:<br>Pediatric healthcare personnel<br>Nonpediatric ancillary/support personnel<br>Additional resources utilizing the HEICS model (i.e., Treatment Area Supervisor to Operations Chief to Planning Chief to Labor Pool) |

*(continued)*

| | | |
|---|---|---|
| | ___ | Assess additional medical and non-medical equipment/supply needs<br>Communicate with Pediatric Logistics Unit Leader via Operations Chief to Logistics Chief<br>Assure delivery of needed supplies |
| | ___ | Assess Pediatric Disaster Call Team basic needs:<br>• Food<br>• Rest<br>• Psychological well-being |
| | ___ | Obtain status of pediatric casualties (planned discharges, admissions and transfers) and report through to Operations Chief |
| | | Hold information sessions with Public Information Officer as needed |
| Extended | ___ | Debrief Pediatric Disaster Call Team:<br>• Summary of Incident<br>• Review areas of success<br>• Identify opportunities for improvement<br>• Thank and congratulate team |

| **Emergency Charge Nurse/Clinical Leader Job Action Sheet** |
|---|
| 1. Immediately notify the Emergency Physician on duty with the following information:<br>• Number of casualties expected<br>• Status of casualties<br>• Estimated time of arrival |
| 2. Notify:<br>• Operations Director<br>• Operations Director on-call (after normal working hours)<br>• Switchboard, to initiate incident fan-out/calls |
| 3. Assess staffing status/needs in consultation with the Emergency or on-call Operations<br>Director as follows:<br>• Emergency staff currently in department<br>• Available staff from other departments<br>• Emergency Fan-Out System as required |

*(continued)*

| Emergency Charge Nurse/Clinical Leader Job Action Sheet |
|---|
| 4. Obtain red apron labeled NURSE IN CHARGE from blue Emergency Preparedness Cupboard in the Emergency Department Conference Room |
| 5. Assess the need for extra supplies and make appropriate arrangements to obtain them |
| 6. Assign area Charge-Nurse and support staff for:<br>• Resus<br>• Examination Rooms<br>• Examination (nonincident)<br>• Surgery clinic |
| 7. Make a quick round of all regular emergency patients with the ED physician in-charge and make a decision on their disposition (admit to inpatient units or discharge) |

| Emergency Physician In-Charge Job Action Sheet |
|---|
| 1. In consultation with Clinical Leader declare a state of "Major External Incident" following an assessment of the situation and in consultation with the Emergency Medical Director and Emergency Department Operations Director |
| 2. Notify the Charge-Nurse of Emergency |
| 3. Assess the need for additional medical manpower, in consultation with the Medical Director of Emergency Department or designate |
| 4. Initiate the callback of Emergency medical personnel |
| 5. Assign available Trauma Team Leaders to resus or Emergency Department room |
| 6. Assign medical staff to the designated treatment area for the casualties |
| 7. Make a quick round of all regular emergency patients, with the Charge nurse, and make a decision of their disposition (admit to inpatient units or discharge) |
| 8. Assign staff specialist if required or direct them to the Professional/ Personnel Pool |
| 9. Hand over coordinating duties to Medical Director, once arrived onsite. |

| Messengers/Runners Job Action Sheet |
|---|
| Notified by<br>Regular hours:<br>On standby after announcement over Public Announcement System. After activation, Professional/Personnel Pool will make requests of respective departments<br>Off-Hours:<br>Call-back initiated by Vice-President, Patient Services, and Allied Health or equivalent |
| Qualifications<br>1. Good knowledge of the lay-out of Emergency and the location of various hospital departments such as the Laboratories and Diagnostic Imaging<br>2. Able to deal with patients and public<br>3. Able to handle stressful and chaotic situations<br>4. Able to handle the sight of blood and severe injuries |
| Functions of Messengers/Runners<br>1. Report to the charge-nurse of Emergency who will assign an area of work, in any of the following areas:<br>• Command Post: 6 runners stationed at entrance to be available for immediate dispatch<br>• A runner with each Emergency Triage Team (A and B), stationed outside the emergency entrance to courier Incident Patient Information Form to Patient Tracking Team Coordinator<br>• A runner in each of the Emergency Department areas: Resus, ED waiting room, Examination area, surgery clinic, etc.<br>• Receive an identifying apron (yellow, labeled MESSENGER), a cue card with "role" description, as well as a brief orientation of your duties |
| 2. Deliver laboratory specimens to the laboratories<br>3. Escort parents to the Parent Reception Area and Registration<br>4. Deliver messages throughout the Emergency Department<br>5. Obtain additional equipment, such as wheelchairs and stretchers from other areas in the hospital<br>6. Assist with the transport of stretcher patients<br>7. Escort nonincident patients and their parents to appropriate location |

*(continued)*

| Messengers/Runners Job Action Sheet |
|---|
| Functions of Secretaries<br>1. Report to the Patient Service Clerk of Emergency who will assign an area of work, a clipboard with role description and an apron with identifying role<br>2. Potential assignments would include:<br>❑ Act as secretary to an assigned area, according to role on clipboard<br>❑ Log in all incident patients taken to each treatment area of Emergency and the Surgery Clinic on the appropriate forms<br>❑ Communicate effectively on the phone<br>❑ Handle any other clerical duties as requested by the Charge Nurse of Emergency |

| Emergency Patient Registration Clerk Job Action Sheet |
|---|
| Notified by<br>Charge Nurse, Emergency<br>Key Responsibility<br>Responsible for maintaining accurate patient demographic information in the ADT system as received. |
| Functions<br>1. Assign registration clerk to each of the following areas:<br>❑ Two clerks to emergency registration desks<br>❑ Triage Teams A and B (1 clerk for each team)<br>2. Enter patient demographic information to the ADT system as received.<br>To Register Incident Patients:<br>❑ Complete "Incident Patient Information Form" or equivalent with as much information as available at the time of encounter<br>❑ Parent/guardian of incident patients (when present) will be sent to Emergency Registration by Patient Tracking Team member, escorted by a runner when deemed appropriate<br>❑ Runner will present to Registration with parent/guardian and the copy of the emergency chart from the patient's bedside<br>Registration Clerk will:<br>❑ Use the patient's unique number transcribed onto this copy of the emergency chart to access patient file in the ADT system<br>❑ Update the ADT system will all pertinent patient information using the patient care level O/DSAS and the service Med/Emer |

*(continued)*

**Emergency Patient Registration Clerk Job Action Sheet**

- ❑ Transcribe all pertinent information onto the copy of the Emergency chart
- ❑ Give completed copy of emergency chart to runner who will then accompany parent/guardian back to the patient's bedside and will ensure that the Patient Tracking Team member receives completed copy of the emergency chart

To Register Emergent/Resuscitation Emergency Patients:

- ❑ Registration of these patients will occur according to standard protocol for registering emergency patients
- ❑ Patients will access registration via the triage nurse using the usual triage assessment record

Registration Clerk will:

- ❑ Register patients in the ADT system
- ❑ Instruct the parent/guardian where to wait post registration as per triage nurse instructions

To register Nonurgent Emergency Patients:

- ❑ Registration of these patients will be done according to standard protocol for registering emergency patients.

- Patients will access registration via the triage nurse using triage assessment record.

Registration Clerk will:

- Register patients in the ADT system
- Instruct the patient/parent to wait in the Emergency waiting room until transport person is able to relocate them to the appropriate area

# Appendix J – Pediatric Safe Area Checklist

| YES | NO | |
|---|---|---|
| ☐ | ☐ | 1. Needle boxes are at least 48 inches off the floor |
| ☐ | ☐ | 2. Do the windows open? |
| ☐ | ☐ | 3. Are the windows locked? |
| ☐ | ☐ | 4. Do you have window guards? |
| ☐ | ☐ | 5. Can you contain children in this area? (Consider stairwells, doors, elevators) |
| ☐ | ☐ | 6. Do you have distractions for the children? (Videos, games, toys) |
| ☐ | ☐ | 7. Poison—proof the area (cleaning supplies, hemaoccult developer) |
| ☐ | ☐ | 8. Choking hazards (cords) |
| ☐ | ☐ | 9. Are your med carts and supply carts locked? |
| ☐ | ☐ | 10. Do you have a plan for security for the unit? |
| ☐ | ☐ | 11. Do you have a plan to identify the children? |
| ☐ | ☐ | 12. Are there any fans or heaters in use? |
| ☐ | ☐ | 13. Are they safe? |
| ☐ | ☐ | 14. Do you have an onsite or nearby day care? |
| ☐ | ☐ | 15. Could they help you? |

# Appendix K – Pediatric Preparedness Nonmedical Needs Outline

In the event that your hospital will take care of 20 pediatric clients less than 5 years of age for 48 hours; below is an outline and issues to consider for the nonmedical needs of pediatric patients:

Job Action Sheets which reference pediatric considerations

1. Dietary Department
2. Materials Management
3. Pharmacy

Nonmedical Needs

1. Food/formula
2. Diapers
3. Pedialyte
4. Bottles/Nipples
5. Pacifiers
6. Toys/Child Life
7. Others

Process of ordering/reordering nonmedical supplies during disaster

1. Memorandum of understanding with vendors
2. Reconcile on-hand available pediatric supplies with what will be required to manage the pediatric patient surge
3. Define delivery system/modalities to hospital/designated unit

Nonmedical Needs Resources

1. Hospital vendors you have a contract with
2. Others: (Local Community Resources)
   a. Local pharmacy
   b. Grocery chain
   c. Hardware store
3. Back up resource other

Chapter 14

# Family Reunification in Mass Casualty Incidents

By Alan Dick, MSW, RSW

# Preface

"Hospitals are sensitive to the medical care demands that can result from disasters and mass casualty situations, and by and large they prepare themselves to meet these demands. There is a tendency, however, for hospitals to be less sensitive, in their planning and operations, to the emotional and social components related to such emergencies. Yet, psychosocial components are present to some degree in all casualty-producing situations, and in a surprising number of instances the demands they place upon a hospital's non-medical resources are greater than those placed upon its medical and surgical facilities."[1]

The question of whether hospitals should be expected to address psychosocial needs when they prepare their major mass casualty incident (MCI) response plans has been asked since the 1970s, and probably much earlier than that. Part of the challenge in answering the question comes from a lack of direct research and writing on the topic, despite the general acknowledgment of such a need, and the existence of much anecdotal comments. One exception where the question has been answered with action is Israel, where, unfortunately, experience demands a hospital's emergency planning always include a response to psychosocial needs of the family and the patient in the aftermath of an MCI.[2–5]

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# The Basics of a Hospital Psychosocial Response

## Psychosocial Surges

### First Surge

In most mass casualty incidents (MCIs), the first surge at a hospital will begin with the arrival of injured who do not need ambulance assistance[6–8] and will be upward of 80%[9] of the incident's overall patient load. Sometimes known as the "walking wounded," these survivors may be only minimally injured and will be coming in from the incident on their own or helped by passersby. They may arrive en masse, depending on a particular hospital's vicinity to the incident. Many will be emotionally distressed, in some cases severely, suffering from acute stress due to what they have just experienced, including exposure to myriad sensory disaster stimuli—death, loss, separation, and terror.

These first arrivals can overwhelm an emergency department[10] and, in their emotional state, make irrational, insistent demands and requests as they seek information, assistance, and safety.[6] In the midst of this chaos, additional patients will begin arriving—those too injured to bring themselves to hospital, but with the ability to flag down cars and gain assistance. They will be followed by the more severely injured, who arrive by ambulance.

When looking at the overall surge of survivors in a hospital, it has been observed that the ratio of psychological casualties can outnumber the primarily medical patients by 4/1 or greater.[4,9] The greater psychological casualty numbers come from incidents in which people are unsure of whether or not they have been physically compromised, such as gas or radiation attacks.

### Second Surge

The second psychosocial surge to be experienced by a hospital involves families and friends who have heard through a variety of sources, including traditional and, more recently, social media, that survivors have been brought to the hospital and sometimes to a specific hospital. For various reasons, these families believe that their loved ones may have been caught in the incident.[3] They may have tried to make contact, but have been unsuccessful. Hearing where the survivors have been taken is a chance at hope, and they will take it. In September 2006, after the shooting at Dawson College, an estimated 300 family members[8] surged to the closest Montreal hospital to Dawson College, McGill University Health Centre. The hospital was "inundated."[8] When they did not find who they were searching for at the first hospital, some of these same families moved on to other area hospitals in a roving surge. The authors of a study on the effects of Dawson now recommend the need for hospitals to have psychosocial intervention plan including a space for families.[11]

It is a known phenomenon that families make it a priority in crisis to reconnect and reunify.[3,5,9,10,12–15] The fear of potential loss drives these situations. It is neither irrational nor panic—although it may resemble it from outside—but a primal need to find the family and bring them to safety. Social support has been identified as an individual's most important resource in crisis. Many other needs

in these situations become secondary. In "Five Essential Elements of Immediate and Mid-Term Mass Trauma Intervention," the authors list these primary needs as: promotion of safety, calming, self and group efficacy, connectedness, and hope.[12] The importance of connection or reconnection with family is a basic need. Connection is also listed as a major factor in *Psychological First Aid*, the newest standard of psychosocial response.[13] Keeping families together is a primary goal.

The drive of social supports to reunify is inexhaustible; anecdotal examples of searching families can be found after every major incident, whether it is family members putting themselves at risk digging through rubble after an earthquake or attaching countless missing persons posters displaying personal information to every surface possible in New York City in the days after 9/11. It is also not unusual for families to move from one hospital to the next while they are searching,[8,10] and this can go on for days or weeks. In these cases, families may at first try to contact a hospital by phone, but at these times, the phone lines are often overloaded or the operators staffing the phones just don't have the information needed to answer all the questions. The UK system of setting up a "Casualty Bureau"[16] in major incidents allows access to a single number that is broadcast via the media and avoids jamming hospital switchboards. Israeli hospitals broadcast specific phone numbers for the purpose to avoid jamming the regular hospital phone lines. Despite these plans, a certain amount of families still go to the hospitals.

Families in these situations would rather be at the hospital in person, "just in case." If they believe that their missing family member or friend is in a specific hospital, they will not be redirected. Locking them out may only lead to negative relationships with the family down the line when you may need them involved.

Preplanning combined with a family's advance knowledge of community resources and/or of an alternate hospital family support site in an emergency may be the only way to mitigate the second psychosocial surge on a hospital as in the UK plan. This would likely require a change in the current Canadian system and require community-wide planning initiatives, education, and a comprehensive crisis communications strategy.

# Guiding Principle of an Effective Psychosocial Response

## Family Focus

The most important guiding principle in a hospital psychosocial response is taking a family-focused approach. Over the years, many hospitals have moved to a patient-focused model of care, in which the patient is included as an active partner in the decision-making process and care planning. In this decision-making process, families may often feel left out, as patient focused does not always interpret as family focused, although they have a large role to play in a patient's recovery, discharge, and supply vital information on a patient's medical history. In a disaster scenario, this family role is magnified. The patient is not just a singular person, a survivor existing in vacuum, but the family as a whole. The patient him/herself may be the injured party, but the family is psychologically

wounded along with the patient, and this is especially the case if the person the family is looking for cannot be found. Taking the family-focused approach means working for the good of the patient and the family simultaneously.

## Components and Tasks of an Effective Psychosocial Response

*"The primary objective of a psychosocial response is to provide an immediate, short-term service that will help disaster, or trauma survivors to restore their feeling of safety, confidence, competence, and trust."*[17]

There are 3 primary components of a hospital psychosocial response:

- The development and implementation of a Family Information and Support Centre (FISC), in response to a surge of searching families.
- Coordination of emergency department FISC support.
- A planned response to deal with psychological casualties.

There is also a secondary component, although not a less important one, addressing the unique needs of patients (and their family members) already in the hospital before a major incident taking place.

## FISC

The hub of a hospital's psychosocial response is what can be called a Family Information and Support Centre, or FISC. The concept is simple; a FISC is a temporary team made up of hospital staff and deployed in a Code Orange/MCI event to address the needs of searching families. Its first and primary responsibility is the reunification of searching families with the missing individuals. In addition, it provides families with information, referral to outside resources, and emotional support in a difficult time, while at the same preventing these same families from draining emergency department resources at the affected hospital and others.

# How to Establish a FISC Plan

The following is a basic practical guide to establish a FISC plan. It is based on the plan that continues to evolve at Sunnybrook Health Sciences Centre in Toronto, Ontario, Canada, since before 2001. In addition, the general plan has been used to educate other Toronto hospitals to develop their own FISC plans for 2010 G20 Summit preparations. Coincidentally, this plan is very similar to a FISC plan developed for New York City hospitals after 9/11.[18] For the purpose of this chapter, the approach will be generic, as individual FISC plans should be created to fit individual hospital needs and resources.

## Location

A well-thought-out location is of great importance to FISC planning to prevent and deter families from surging into the emergency department along with the

patients from the incident. Containment and security issues are keys. If possible, a hospital will want to make sure that the FISC has a separate outside entrance. The hospital will want the ability to easily direct searching families into the FISC or back out without their need to travel through the general areas of the hospital. A FISC must at the same time have a relatively direct route to the emergency department in the event that a specific family member is required there. Ideally, the FISC should not be directly beside the emergency department itself, thereby removing the temptation of families going to look for loved ones on their own. Other considerations are practical—having washrooms close by, in addition to enough phone and data links to meet equipment needs. The size of the space can be flexible, but an auditorium, cafeteria, or large classroom would be the first place to start as they have the furniture already. Having access to smaller rooms for use in counseling or private discussions, such as death notification, would be helpful.

## Services Provided

As previously mentioned, the primary service of a FISC is to reconnect families. This will require registration and gathering of information, not just for the missing person but for the searchers as well. Information gathered should include physical identifiers, in case the patient is unable to provide specific personal identification such as name and date of birth.

You will want to make sure that you have up-to-date information about the incident and the resources, both in the community and from the hospital, available to families, as some may now be evacuated or be without other resources, including money or communications. Remember to provide the information on the reunification process regularly and accurately. Continue to have regular announcements even if you have nothing substantial to report. In addition, there may be circumstances in which the FISC crisis support staff may be called on to assist with death notification or in extreme circumstances perform this task on their own. It is important to remember some victims will not be found, or whose bodies cannot be removed from the event site, so families may be there for a while. Having access to translation services is essential.

Involve a member of the hospital's communications department in developing a comprehensive crisis communications strategy.

## Equipment Needs

These are minimal and should not require a lot of extra expenditure as some of the equipment can be reallocated from other areas of the hospital in time of need. The setup is essentially a waiting room: chairs and tables, a place for registration, and access to washrooms. What is different is that the room will also have computers and phones, ideally for the use of both staff and families, providing ways that family can communicate outside of the hospital is essential for speeding up the reunification process, as it eliminates the searching families whose missing members are actually safe, but have been unable to find each other due to overloaded communication devices or access.

The other supplies for the FISC are basic refreshments such as cookies, juice, coffee, and water. Some families may be waiting a long while to find out whether their loved ones are in the hospital, providing them with refreshments means

they will be in a better state of mind if decisions need to be made. Resources on acute stress would be helpful, as would supplies such as magazines, newspapers, and games for the children. Some FISCs have a corner where children of searching families, for short periods of time, can be cared for.

## Registration

FISC documentation is a hospital version of a missing persons report. This is the essential step for reunification. *Who do you as a family member want the hospital searching for?* The information will include both patient identification such as name, date of birth, and address, and also patient identifiers such as hair and eye color, height, weight, identifying marks, scars, and tattoos. Have families complete paper forms with this information? It may be useful for the information to be in duplicate so that copies of the forms can be sent to the emergency department psychosocial team collecting survivor information to compare. (Ideally, this information would be compared online with any electronic admission or patient records but this would require further preplanning and expense for a system that may not be used.) The alternative is a paper version in the emergency department as well, listing the same type of identification as the families have listed, for easier correlation.

Once registered, families could be given visible ID (badge, bracelet, etc.) to identify them as registered. This will enable the staff in the room to better control the situation and know who should be there from who should not or who has not been registered yet.

## Staffing

Resource the FISC with staff typically used to assist families in crisis; within hospital, this would be social workers and chaplaincy. Also useful are psychologists, psychiatric RNs, and other mental health staff, although they do not typically work in the acute care areas or with the families of patients in these areas. What is important is having allocated individuals who could be from clinical areas closed down due to the crisis, or other Allied Health staff, that is, physio, occupational therapist, speech, patient relations, and so on. Hospital volunteers are also a useful staff resource for the FISC for roles of runners, clerical, and reception. The development of a call-out procedure will be necessary, as not all the staff needed for the FISC will be immediately available or even on-site if the incident happens at night.

## Roles

The roles needed for the FISC are not fixed. The FISC coordinator needs to have at least an intermediate knowledge of the hospital's IMS structure, code orange plan and process, and the FISC connection to it. It is more important to have someone knowledgeable about the issues rather than someone already in management. There should be someone to act as the logistics person for the group to make sure that the equipment and supplies are available and setup. In addition to the coordination, basic task areas include door screening, registration, emotional support/counseling, and runners/escorts.

## Communication

As part of the overall hospital code orange plan, the FISC needs to be able to receive detailed updates from the hospital emergency operations center (including any details that would make it easier to plan for specific populations and groups that may be impacted by the incident) and supply hospital decision makers with information on the family surge and any ongoing or anticipated needs. In addition, the FISC by its nature would need to be in contact with all of the units with specific code orange psychosocial connections, such as the emergency department or code orange established discharge center. Remembering the primary purpose of family reunification, a well-established means of communication should be setup in advance so that activation of such a system is seamless. Lastly, the FISC should be connected and familiar with the community's greater psychosocial response in advance of any major incident. This community response may be in the form of community public health, Red Cross, or emergency social services reception or evacuation center. Referrals to this outside resource may be necessary.

## Security

It is necessary to keep the FISC space safe for the families to legitimately search for their missing loved ones. Security is there to keep the peace and to remove any individuals who become overly belligerent or abusive or who are in the FISC for insincere reasons such as a media reporting on the incident. Security staff should be given training in the psychosocial issues of trauma and basic psychological first aid.

It is important to be vigilant in looking out for press and/or instigators masquerading as relatives who wish to gather information or access to the hospital.

## Reunification

If a match between a searching family member and patient/survivor is confirmed, reunification should not take place in the FISC if reasonably possible. One family member should be escorted to see their family member wherever they are in the hospital for at least a short visit. Circumstances that involve a dying patient, child, or need for a substitute decision maker to be present may require a family member to remain in the emergency department unescorted or if a survivor is now on another hospital unit, regular hospital visiting rules may then come into effect. Release of patients with minor injuries can be done through a neutral "discharge area" rather than interfering with the processes of either the FISC or the emergency department.

# FISC Preparedness

It is expected that a FISC may be setup for a maximum of 72 hours but this is an estimate; it could be more or less depending on the incident. The forms, handouts, and procedures should be prepared and practiced in advance and stored for a possible code orange event where a FISC coordinator and leadership team have quick and easy access for start-up at a moment's notice. Regular

training and exercising of the staff you would expect to be available for the FISC are essential.

# Emergency Department Psychosocial Tasks and FISC Support

Although FISC being a central part of a hospital psychosocial response plan, it cannot function on its own. It requires consistent access to information and support from the hospital emergency operations center, and it requires the emergency department to have a psychosocial response of its own. The psychosocial tasks of an emergency department are essentially 2-fold: first, the gathering patient identification information, and second, the triage and support for the psychological casualties. Neither of these should be considered more significant than the other and may in the end require different staff and skill sets for the tasks involved.

## Gathering Survivor Information in the Emergency Department

The gathering of identifying information for the survivors of a large-scale incident has traditionally not been considered necessary or a priority when dealing with a major, critical patient emergency department surge.[3,10] Frequently, this information is excluded from the standard MCI triage. The development of a strategy for gathering patient identification information early in a patient's emergency department triage will enable a hospital to reconnect families quickly. The information gathered will provide crucial medical history and, in some cases, when dealing with patients with only minor physical injuries or psychological symptoms, it may help to expedite discharge from the hospital. Conscious and capable patients should be encouraged to contact their family straight from the emergency department, resulting in a mitigation of family anxiety, a minimizing of hospital surge, and the discharge of patients who can be picked up soon after their families have been informed. This process may benefit from having a separate but temporary discharge unit, if space is available. A place where the actual reunification of patient and family would take place and where additional information can be given to family, including information on acute traumatic stress symptoms and healthy coping, follow-up appointments and homecare can be arranged.

All the identification information gathered from the survivors would then be sent to the FISC to look for possible matches for family waiting there. If a patient has already been discharged, searching family members can be informed about this.

There may occasionally be problems with parent/child separation if children are taken to different hospitals or areas within that hospital.

## Responding to Psychological Casualties

Psychological casualties are those survivors who come into hospital in the midst of an MCI without any apparent major injuries, but with moderate-to-severe

psychological reactions to the incident they have just been involved in. Some hospital staff may be tempted to view only physically harmed patients as legitimate casualties, but psychologically impacted individuals are equally incident victims. Their psychological injuries come from exposure to traumatic material (such as being trapped for a period of time or witnessing the death or serious injury of others) and sensory information (such as smells and sounds). In addition, they may have had a traumatic perception that they were going to die.[4,12] A hospital response to this population, once individuals are identified, would likely, if possible, involve moving them to an area separate but close to the emergency department. Psychological casualties will need to be triaged, a psychological Triage or PsyTriage, of which PsySTART is one example,[19] to determine those individuals with the most serious acute stress responses, traumatic exposure, and behavioral issues, from those who only need a safe environment for a few hours, in addition to the information and possible referrals to community mental health supports. For those with higher acute stress and risk, longer monitoring may be needed, including in-patient treatment. Left unidentified, denied, or ignored acute stress can manifest as PTSD, depression, and a host of social issues including domestic abuse and violence, substance abuse, and isolation.[4,6,9,13]

### Already Existing Patients

Lastly, we must not forget those patients, and their families, who were already in the hospital before the MCI. They were listed near the beginning of the chapter as a secondary priority of the psychosocial response and although they are not a priority to the response itself *per se*, they are an equally important hospital population overall. An MCI causes them fear, disruption, and sometimes displacement. They may feel that they do not have a voice. They are affected quite profoundly through suddenly restricted visiting hours and sudden moves to other units, or to whole new facilities or possibly home much earlier than expected. The key response to this group is providing them with information on how they will be directly affected. Provide it regularly, timely, and accurately.

## A Community-Wide Reunification Plan: An Example from the City of Toronto

Large-scale displacement and separation of families were clearly seen in the news reports after 9/11 and Hurricane Katrina as families ended up separately and in different evacuation centers or desperately posting homemade missing person posters on every wall surface imaginable. But an effective reunification plan cannot be created during an incident. Multihospital efforts for the reunification of families require advanced planning, as issues of privacy protection and procedures need to be worked out. One such case of preplanning took place in Toronto for the G20, 2010. For this major event, a unique hospital family reunification safety net was created for the City of Toronto. The project was supported by the Local Health Integration Network (LHIN), a lead agency for Toronto G20 Emergency Medical planning.

Ten participating Toronto area hospitals were asked to prepare FISC plans as a baseline reunification plan. Toronto Public Health was also involved in the planning. Some of the hospitals already had FISC plans established, but for most, this was their first venture into FISC planning and they were supplied with instructions and ideas on how this could be done. Then through a long process of negotiation with the hospitals and their privacy officers, an agreement was struck in which a central, secure online database was created. To this database, if activated by an MCI, would be uploaded code orange patient identification information (i.e., name, address, date of birth, hospital file number) and/or identifying features (i.e., gender, hair/eye color, weight/height, scars, tattoos, etc.). Uploaded information would include the hospital where the patient was located and whether individual patients were identified or unidentified. One of the hospitals was asked and agreed to provide the physical server space to host this database and portal.

Although this shared database is simple in concept, existing privacy laws and general privacy considerations made its execution a complex undertaking. There was a considerable discussion to determine how much personal information could be collected and shared. The ultimate determination was that all conscious and capable patients would be asked for consent to upload their information. Unconscious and incapable patients would not need to give consent as it is considered as a standard and accepted practice to make reasonable efforts to find their substitute decision makers for unconscious or incapable patients.

If activated, the plan would have enabled a family searching for a loved one after a major incident to identify themselves and register at any of the 10 hospital FISCs. Each could provide information on the missing person, if they'd have been admitted to any of the participating hospitals. If a potential victim was not found in the standard hospital registration system, the staff of that hospital's FISC would then be able to cross-reference the family provided identification information with that in the portal database and make a probable match, and then provide this location information to the searching family. The overall aim of the plan was to reduce the anxiety of possible searching families, as well as the need for roving family search surges moving from one hospital to another. Further, Toronto Public Health would also have had access to this database, what was referred to as the Family Reunification Portal. Toronto Public Health nurses are part of the emergency shelter/evacuation center plan for Toronto and could have accessed the database from these locations if needed. Only the Public Health Staff in the reception centers could access the patient identification information as they are covered under the provinces exiting patient privacy laws. The plan was active for a 2-week period surrounding the G20.

Although not required during the G20, it was agreed upon by many that this reunification plan would benefit Toronto if in place permanently. Steps are currently underway to look into this possibility.

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Chapter 15

# Disaster Psychiatry

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# Preface

What has established disaster medicine as a distinct specialty applies to disaster psychiatry as well. Naturally, one might assume that disaster psychiatry is merely an extension of trauma assessment and treatment. Although there are undoubtedly common features between the two areas, disaster psychiatry is emerging with its own unique challenges and intervention approaches.

Traumatic events and disasters may appear to overlap but by no means are the terms interchangeable. Appreciating the distinction—from a psychiatric standpoint—promotes the development and refinement of effective (and by necessity creative) intervention strategies.

One of the great lessons of Hurricane Katrina was the message that, even with the resources of the United States, substantial psychiatric fallout could follow a catastrophe in New Orleans just as it could in Ko Phi Phi, Thailand, following the tsunami. The importance of planning and preparation is underscored by the unique personality of what is a disaster.

Disasters place frontline medical and mental health personnel alongside nonprofessionals from a range of vocations, each of whom may contribute to goals of resilience and victim recovery. Rescue workers, clergy, educators, and others become necessarily integrated into disaster psychiatry. Disasters strike communities, and therefore, interventions should be designed around community models in ways that expand beyond the roles of the traditional caregiver–patient relationship.

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# The Uniqueness of Disaster and the Resulting Mental Health Needs

It is the very essence of a disaster that defines its challenges to medicine. According to Webster's Dictionary, a disaster is "a sudden calamitous event bringing great damage, loss, or destruction."[1]

A disaster impacts the masses. The effects of a disaster that are most pertinent to mental health are as follows:

1. **Disintegration of a Community**

   Disasters cause widespread population and economic displacement. Established resources for support are degraded, destroyed, or overwhelmed by the scope of needs. Because infrastructure is needed to organize institutions that support a community, when that infrastructure evaporates, assistance cannot reach those in need. Rescuers and caregivers cannot be coordinated or efficiently mobilized. Often, victims have no means of communication to summon assistance.

   In the wake of disaster, a person lacking shelter finds nowhere in the once-familiar community to restore a sense of home. The aftermath of the catastrophe leaves no fitting environment for rest, let alone shelter, or a sense of safety and security. Delivery of social services and health care is delayed. Everything that integrates a family, even a person, with the outside community is ripped away without opportunity to adjust to such unexpected circumstances. Orientation to one's surroundings is lost. Ultimately, the disintegration of a community is reflected in the chaos that ensues.

2. **Economic Loss**

   Losing one's home may be compounded by losing one's workplace as well and the wherewithal to establish livelihood. Disintegration of community renders any efforts to restore shelter difficult, if not impossible.

3. **Injury and Death of Loved Ones**

   Injuries may be permanent and disabling. When a care-giving or wage-earning parent becomes disabled, the entire family unit is further weakened.

   Disaster may claim the lives of multiple victims in the same family. Children are then forced into developmental challenges they neither anticipated nor prepared for. Disintegration of the community adds to the disintegration of the family itself, and vice versa.

4. **Displacement**

   Loss of shelter and livelihood coupled with disintegration of the community and its infrastructure ultimately force migration. Wars, for example, inevitably displace populations into a limbo of primitive existence. Because survivors are often forced to live in close quarters with strangers, the sense of boundaries and dignity evaporate. Separation from community may be compounded by separation from loved ones, which grows more likely as the magnitude of the disaster increases.

### 5. Social Isolation

Displacement and disintegration fracture the connections one has with the community and even within the family. Without established points of connection, surviving families drift and focus on only their most primitive needs—if they can even mobilize to that degree. Loss of institutions renders one incapable of replacing those connections.

When one family member suffers under such circumstances, the impact on others is that much more pronounced. Psychological effects on children are far more pronounced when parents are affected and disabled by disaster.[2]

Isolation is heightened by the effects of displacement; these effects are all the more manifest in children forced to assume more independent skills than are realistic for their developmental stage. Depression only augments isolation through symptomatic social withdrawal.

### 6. Loss of Meaning and Connectedness

Devastation disintegrates a home, a family, and a community; it displaces, isolates, and erodes a sense of meaning and connection. How is one to connect when nothing exists to which one links? What is there to believe in when all that remains is nothing? What is there that matters when all can be lost? Individuals may ask themselves: "Where was God, the righteous God, and how did a Creator allow this to happen?"

Distrust in leaders and the community itself further disintegrates the community's capacity to mobilize its resources. After Katrina, New Orleans and its vicinity experienced a huge population shift, a large percentage of whom never returned, even when offered compensation to do so. What they left behind is not necessarily erased so much as it is abandoned, a reflection of a connection irretrievably broken.

It is the effect, not the event, which defines a disaster. Disaster is the effect as it is experienced by the resident of the affected area, not how we experience the pictures and emotions delivered to us over the television or Internet. This approach keeps us in a patient-centered mode and challenges us to maintain dynamic thinking in unorthodox conditions with those we hope to assist whose needs vary.

Many examples illustrate disaster and its definition. Natural disasters are phenomena such as typhoons, hurricanes, floods, cyclones and tsunamis, earthquakes and volcanoes, wildfires, and lethal exposures that impact broadly populated areas. Man-made disasters aim at populations and communities and include genocide, terrorism, and war. It is the disintegration of community that compounds trauma to the individual.

Not all traumatic events are disasters. A traumatic event impacts at a more contained, individual level. Rape, murder, assaults, and even some terrorist events devastate the victims involved and others who witness or are absorbed in the spectacle of the event. However, the fabric of the community, its supports, and its capacity to anchor and reflect normalcy are preserved. Even in the face of terrorist events and mass

shootings, which extend their impact through the news media's capacity to spread panic and despair among the general population, community infrastructure is preserved and broader morbidity is easier to limit than it is in the aftermath of disaster.

Those impacted by trauma can experience the same kind of emotional and psychological distress seen in disaster victims—particularly because the trauma is so shattering to their world.

What distinguishes disasters and their psychological impact, however, is how the effect is amplified because the trappings of normalcy, what one would normally reach to in times of personal trauma, are obliterated.

To help estimate the potential mental health fallout from any particular disaster, Berren et al. identified several disaster variables that may help determine the event's emotional impact on survivors:

- Is the event an act of nature or a purposeful event?
- Is the disaster of long or short duration?
- Is the personal impact of the disaster high or low?
- Is the potential for recurrence high or low?
- Is the control over similar future events high or low?[3]

These distinctions illustrate the important prospective role psychiatry must play in addition to crisis intervention and psychological first aid, in the disaster response.

## Case 1 Disaster's Unique Effects: Chernobyl

The explosion at a nuclear reactor in Soviet Ukraine teaches much about the effects of a disaster and the complexity of its psychological fallout. On April 26, 1986, at 1:23 A.M, a steam explosion at reactor number 4 at the Chernobyl plant near Pripyat, Ukraine, tore off the top of the reactor and exposed the reactor core. Large amounts of the radioactive waste products iodine-131, cesium-137, and strontium-90 were dispersed.[4] Plant workers, unaware of how much radiation had spread from the explosion, invariably died from radiation sickness. Firefighters and other rescuers, who came to the scene in the middle of the night to try to contain the fire from spreading to neighboring reactors, were told it was an electrical fire. Many of them died from radiation sickness as well.

Three men, including engineers, volunteered to open gates to a pool that was accumulating water and setting the stage for another steam explosion that would have ejected even more radioactive material into the atmosphere. The men worked under water in darkness, and never returned alive—but the mission was accomplished. This serves as a reminder of how disasters can also leave a legacy of extraordinary heroism.

At least 49 people died as a direct result of the reactor's destruction; 2 from an initial steam explosion and the rest from radiation exposure.[5]

Although the meltdown of the Chernobyl nuclear plant released a cloud of radiation 100 times the quantity of the atomic bombs dropped at Hiroshima and Nagasaki,[6] Pripyat was not evacuated until over 36 hours after radioactive material had been released to the atmosphere—and only after the alarm was raised in

radiation detectors at a nuclear reactor in Sweden.[7] Even then, government officials downplayed the nature of the threat to Pripyat residents by telling them to pack for only a 3-day evacuation.[8] Yet to this day, an exclusion zone of 30 km remains uninhabitable and preserved as it was when evacuated. Not surprisingly, this misinformation seriously undermined public confidence in their leadership.

The radioactive plume affected one-third of Belarus, as well as parts of Russia and northern Ukraine.[9] Forests near the reactor turned brown and died. Animals died from the destruction of their thyroid glands by radiation. Aquatic systems were affected, and fish were contaminated in the aforementioned countries as well as in Scandinavia. Over 17 million people were contaminated, including 2.5 million children. Hundreds of communities were deemed uninhabitable, and over 300,000 people were resettled. There was a 300-fold increase in thyroid cancer and an increase in the incidence of leukemia; and toxic levels of radiation were found in food and milk for a number of years afterward.[10]

More than 20 years after the mishap, the governments of Ukraine, Belarus, and Russia still struggle to establish the real risks to public health. Their efforts are undermined by public skepticism fostered in turn by misleading government communication when the reactor blew up in 1986. The news media was skeptical of scientists as well, their reportage further undermining public confidence and increasing anxiety in the Ukraine, Belarus, Russia, and beyond. Ground truth has been difficult to ascertain, as governments' unreasonably modest representations are countered by the hyperbole of environmentalist advocates. As a result, for example, predicted cancer deaths attributable to the Chernobyl disaster have ranged from 4000 to 210,000 people (Figure 15-1).

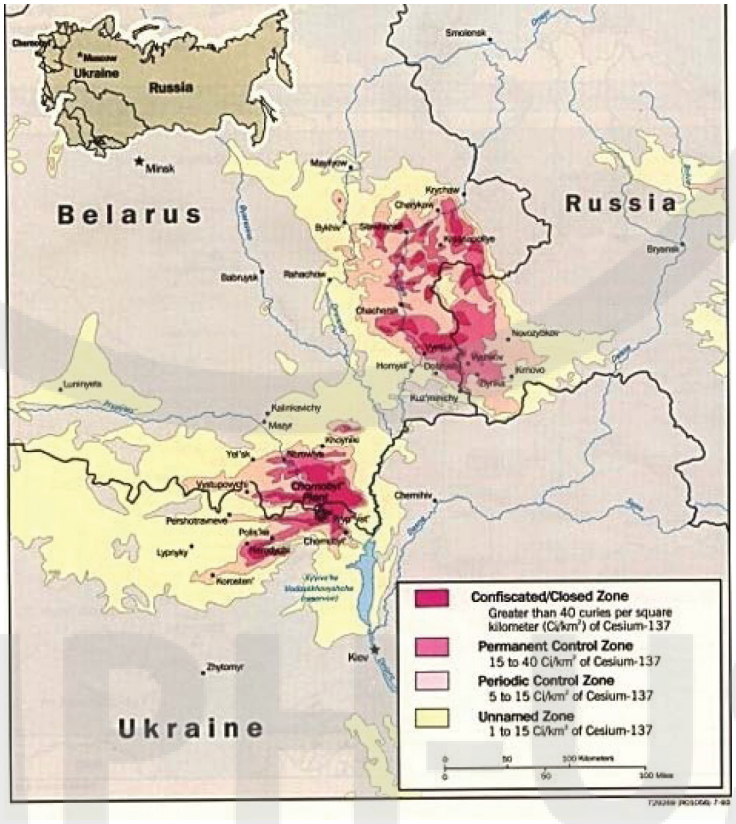


**Figure 15-1: Area affected by Chernobyl disaster.[9]**

Those in the contaminated areas who developed thyroid cancer and underwent surgery were left with a scar dubbed the "Chernobyl Necklace."[11] The Chernobyl Necklace was a constant reminder of one's sense of defectiveness and led many to distance themselves from others. Many others in the affected areas developed psychosomatic neuroses for conditions they anticipated and to some degree imagined.

Women who were pregnant at the time of exposure risked having a baby with severe birth defects and were urged to have an abortion; it is estimated that as many as 200,000 women complied. One of those who did not was the mother of tennis star Maria Sharapova, who was in Belarus at the time of the explosion and moved to Siberia. Yet many babies were clearly born with horrible birth defects in the aftermath of the Chernobyl event. Religious families confronted intense psychological conflict over this issue, questioning their faith for having to make such painful choices. Misinformation and hysteria continue to have a negative influence on the adoption of nuclear energy technology,[12] even as the rest of the world continues to struggle with limited oil reserves.

### Case 2 War as Disaster: Iran–Iraq

The Iran–Iraq War, which lasted from 1980 to 1988, cost the lives of 1.5 million soldiers and civilians.[13] Cities were shelled and oil wells bombed. Beyond those killed, hundreds of thousands were injured, maimed, and/or psychologically afflicted; some continue to struggle with psychological problems to this day.[14]

Iraq was widely understood to have used chemical weapons in the battlefield and on civilians, killing tens of thousands with nerve gas. Iraq also expelled an estimated 100,000 Shi'ite Muslims from its territory. In addition, Iran, using well-worn Muslim rhetoric of the glories of martyrdom, manipulated children to run across minefields to clear the way for Iranian soldiers to advance.[15]

Most attention to war and its consequences focuses on democracies with high regard for collateral suffering. War, to those whose frame of reference are the armies of the more developed nations, witnesses violence carried out in far more surgical if imperfect fashion.

War typically is imprecise in its targeting. In countries where human rights or the Geneva Convention are routinely disregarded, or where no free press exists to check abuses of power, combatants typically aim to be as savage and brutal to the defenseless as possible. Some of these nations are the richest or most powerful—and are unaccountable to the anointed world-governing bodies dependent on their largesse and captive to their political clout. Most wars are not fought by countries seeking to promote civilization but rather to control it. Creating disaster is a vehicle to that control.

As such, in many parts of the world, from Congo to Pakistan to Sudan, wars disintegrate the social infrastructure of large swaths of territory, cause enormous personal and material losses, instigate large population shifts, and dehumanize by design[16] to rob peoples of meaning and connectedness.

## Interventions and Roles

Disaster psychiatry aims to mitigate the damaging emotional, psychological, and mental effects of a disastrous event on a community and its citizens. Beyond offering guidelines to assess and initially address the immediate psychological trauma, disaster psychiatry proactively promotes the education and training of

emergency, medical, and mental health professionals and the public *before* a disaster happens. Solid training helps early responders to:

1. Recognize normal reactions and symptoms of abnormal psychological distress
2. Understand an individual's risk for developing serious psychiatric illness
3. Know and use appropriate intervention techniques
4. Understand and collaborate in implementing other psychosocial interventions

# Stages of a Disaster and Interventions

## During and Immediate Aftermath

Psychiatrists' role in this stage is to minimize the exposure of survivors to stimuli that would trigger traumatic memories. For those who have been exposed, limiting the duration of that exposure is equally important.[17] Removing survivors to separated areas where visual and other reminders of the disaster are absent is a priority (this includes protecting them from media coverage of the disaster). In so doing, it is also imperative to establish and ensure a sense of safety among survivors.[18]

It is at this immediate stage when psychiatrists and medical personnel begin to identify those who may be at greater risk for developing serious or more long-standing psychiatric conditions. Some examinees may not manifest actual symptoms but reflect high risk of developing posttraumatic stress disorder (PTSD) or other major condition when any of the following are present:

- Dissociation, disorientation, and highly disorganized behavior[19]
- High emotional arousal around the time of the event[20]
- Level of exposure to the trauma,[21] including television consumption[22]
- Belief or reality that one has been exposed to chemical or radiological toxins[23]
- Physical injury from the events[24]
- Dehydration for prolonged period before rescue[25]
- Significant contact with the dead, particularly children[26]
- Loss of relatives[27] or close friends[28]
- Those parents who are homeless and confront severe financial ruin[29]
- Adolescence[30]
- Children who have lost parents[31]
- Children with physically or emotionally incapacitated parents[32]
- A history of drug or alcohol abuse or dependence[33]
- Separation from family[34]

- Loss of home[34]
- No access to prescribed psychotropic medicines[35]
- No access to medicines that, if skipped, would have cognitive or emotional effects

Disaster impact is stunning, and in these earliest stages, emphasis is on what is known as psychological first aid.[36] Nonfamily members perform a number of vital functions: mental health professionals, healthcare workers, and other trained authorities help victims to *absorb what happened*, serving as an anchoring reality that orients them. The survivor may have important questions, and the caregiver is a responsible party to this orientation. Information must be conveyed with sensitivity to the survivor's stage of development, but telling the truth is essential—especially during an event where belief in established institutions and one's surroundings is challenged. A supportive environment requires trust.

The psychiatrist and health professional help victims to *understand their emotional and psychosomatic reactions* to what is happening around them, without presuming these emotions. Many endure disaster without psychological unraveling, and this resilience is to be encouraged and protected, not disbelieved and attacked. Finally, aid them in understanding *what to do next* and to develop their own plan of action. The potential benefit of an outside force considers that victims may be proud or underestimate their own needs, but cannot be forced to adopt judgment that is not their own.

Psychological first aid can be taught to and provided by many responsible parties, as it does not require sophisticated technique or medical expertise. Teachers, principals, clergy, elected officials, nurses, emergency service workers, military, and others who assume important community service functions can provide such support amidst chaos.

Psychologically related interventions are not necessarily the most valuable assistance mental health caregivers can provide a survivor. Shelter, water, sanitation, health, and safety are fundamental needs. Absence of these only adds to the stress and emotional burden of the disaster just experienced. Providing these resources to survivors is an immediate priority. Professionals can also aid in reuniting survivors with loved ones, thus minimizing the fallout from loss, disconnection, and displacement and restoring normalcy in any way possible.

Medical and mental health personnel, in separating survivors for assessment and safety, should ensure an environment conducive to the private and comfortable sharing and disclosure of experiences.[37]

It is important to inspire trust and convey genuine empathy and warmth in a setting where there is no time to get to know someone. These functions are adaptable to paraprofessionals and clergy—the latter of whom may be especially helpful with spiritual comfort.

## Crisis Questioning and Crisis Listening

More than diagnostics, the primary goal for the professional in interactions with the survivor is to maintain an open, patient, and validating ear. Victims may have difficulty expressing themselves or may be too overwhelmed to do so. For children lacking the expressive skills, detailing history may be that much more difficult. The effective crisis professional engenders a sense in the victim that all emotions are understandable and that their experiences are shared by

others. Each has a story to tell and needs to feel that the entirety of their story is important to the professional they are interacting with.

Throughout the encounter, it is important to maintain and exhibit an attentive ear, leading as need be but otherwise conveying a respectful, silent, and warm engagement. Open-ended questions yield thoughtful and informative answers and may include the following:

- How did this disaster come into your life?
- What was your community/neighborhood like?
- Who (and what) have you lost?
- How has your world changed?
- Is there anything that frightens you?
- How do you see things differently?

It is easy to offer pat reassurance in the setting of these interactions. However, this may be counterproductive; a survivor may need to experience and emotional and verbal catharsis. Platitudes do not equate with support. At the same time, one cannot force an examinee to elaborate. Debriefing can often be counterproductive, and people may benefit from repressing their responses to disaster.

The most important balance creates the optimal climate for one to speak candidly and personally without feeling pressure or the need to satisfy the expectations of a crisis worker. The caregiver should not try to steer the conversation but should lead it to the point where one can offer some suggestions to help the individual.

The psychiatrist and care worker should be armed with lists of telephone numbers and websites of various agencies who provide specific material services, such as the Red Cross or local agencies. Faith-based groups exist for every denomination and may be even more welcome to survivors, especially those who have trouble opening up to strangers.

Remote assistance offers any individual suffering from any distress the opportunity to connect with Internet and telephone help groups. Remote assistance can also offer relaxation techniques for stress and coping strategies for losses to those isolated from accessible assistance or who may prefer to communicate with someone anonymously or at odd hours.

Disaster psychiatry emphasizes the importance of being prepared and urges all medical and mental healthcare providers to know the telephone numbers and the Internet sites offering these kinds of help. As disaster psychiatry owes its best effectiveness to preparation, this information should also be published in local newspapers daily and on accessible local information pages, alongside other public safety information, in the unlikely event of disaster.

Only a small percentage of those affected seek assistance after disaster.[38] For this reason, caregivers and responsible public safety officials need to recognize that a person they encounter who has obvious needs or who is at high risk may never again be in a position to encounter a responsible and compassionate authority. At the front lines, the nurse, the teacher, the police officer, and the physician assistant may be best equipped to make a difference, *because* they did not wait for a higher authority to discover a person in need.

## Aftermath

Interventions after resolution of the disaster advance beyond priorities of immediate needs and focus on restoring normalcy however possible. At this stage, interventions with high-risk populations begin.

Group participants gain validation from symptoms and may have distorted ideas corrected by others. The latter may be instrumental in diminishing survivor guilt and continued fears. With limited professional resources, benefits can be scaled to aid much larger numbers of survivors through groups as opposed to one-on-one interventions.

Many of these groups follow a debriefing format. Although debriefing may be harmful for some,[39] when properly undertaken in soldiers and frontline personnel, it has been shown to reveal history and symptoms that herald risk for enduring psychological maladjustment.[40] Therefore, professionals can use debriefing groups to identify those more appropriate for ongoing observation or referral for specific therapies (see later in text) or even medication.

The emotional presentation in survivors spans a broad range. Commonly, survivors of disaster advance through the same emotional stages that are common to loss in general[41]:

*Shock*. Although understandable and not pathological in and of itself, the more profound the disorientation and the longer it lasts, the more it reflects a pathological condition. Gentle reorientation by a mental health professional or crisis volunteer can help the survivor absorb the reality of the situation, assess losses, and make a plan. Psychotic phenomena, such as hallucinations, are cause for clinical concern, especially if they persist, as well as dissociative phenomena.

*Denial*. The enormity of the event may sink into the survivor only gradually; survivors should be comforted that it is understandable to feel like events are a dream and did not really happen. Again, an anchoring mental health professional assists the victim to absorb reality and facilitates adjustment and adaptation.

*Guilt*. With so much death and desolation around, many survivors question what they could have done to save others, or even why they survived and others did not. If the disaster is manmade, survivors may feel even more remorse for having failed to recognize the impending catastrophe or to prevent it. Pathological guilt is that persists and accompanies symptoms of depression or that assumes irrational proportion.

*Anger*. The feelings of helplessness in those affected by loss can naturally evolve into anger. Chaos persisting in a disintegrated community frequently spawns anger against public officials and even rescue workers. The short-term and even more remote anger reactions following Hurricane Katrina transformed rational critique into enduring bitterness and spawned pathological responses to quell such anger. Political opportunism and media irresponsibility in seizing upon the anger contributed to the enduring loss of connectedness and sense of community that still afflicts the New Orleans area to this day.

*Depression*. In the aftermath of great personal, material, and community loss, depressed feelings are normal. Bereavement is normal and culturally appropriate; mourning should be encouraged and supported. Memorials are part of this process and enable survivors to attach themselves to a disaster in a manageable and meaningful way; they can respect the departed while maintaining their functional balance.

The above reactions diminish in intensity with the help of psychological first aid, group interventions, and with time. Acceptance of events and growth from the trauma are desired endpoints that each individual achieves in his or her own time. Psychiatric and psychosocial interventions that reestablish a degree of normalcy and self-efficacy (even in such fundamental ways as sleep, diet, and exercise) aid this progression.

If shock, anger, guilt, or depression persist or dominate thinking to the degree of limiting function or are associated with symptoms such as insomnia, fatigue, and other unexplained physical symptoms, hopelessness, or nightmares, these may indicate syndromes such as major depression or PTSD.[42] When the symptoms of a condition overwhelm one's ability to adapt or to function in the context of the survival of a disaster experience, more individual interventions are appropriate.

## Mental Disorders

### Depression

Depressed mood is not uncommon in survivors of disaster. There are clear differences, however, between feelings of grief and sadness and a major depressive episode.

A major depressive episode is characterized by a period lasting at least 2 weeks during which there is either a depressed mood or the loss of interest or pleasure in nearly all activities, or anhedonia.[43] The person is often described as feeling hopeless, depressed, sad, or discouraged. One might not admit to feeling depressed—and many will not—yet their facial expressions mirror intense despondency, and loved ones experience their mood as sad.

To meet the criteria for a major depressive episode, as defined by the *Diagnostic and Statistical Manual of Mental Disorders*, the individual must have 5 or more of the following symptoms nearly every day during a 2-week period.

1. Depressed mood most of the day, as indicated by either subjective report (e.g., feels sad or empty) or observation made by others (e.g., appears tearful). (In children and adolescents, this may be characterized as an irritable mood.)
2. Markedly diminished interest or pleasure in all, or almost all, activities.
3. Significant weight loss when not dieting or weight gain (e.g., a change of more than 5% of body weight in a month) or decrease or increase in appetite.
4. Insomnia or hypersomnia.
5. Psychomotor agitation or retardation (slowed or jerky movements).
6. Fatigue or loss of energy.
7. Feelings of worthlessness or excessive or inappropriate guilt.

8. Diminished ability to think or concentrate or indecisiveness.
9. Recurrent thoughts of death (not just fear of dying), recurrent suicidal ideation without a specific plan, or a suicide attempt or a specific plan for committing suicide.

It is important to remember that these symptoms are unusual for the individual and must cause clinically significant distress in social, occupational, or other areas of functioning.

## Posttraumatic Stress Disorder

Acute and chronic PTSD deal with symptoms that became apparent relatively soon after the disaster. Delayed-onset PTSD deals with symptoms appearing at least 6 months after a traumatic event.

To meet the criteria for the diagnosis of PTSD, a person must have been exposed to a traumatic event that involved actual or threatened death or serious injury to himself or others. His response to that event must have involved intense fear, helplessness, or horror.[44]

In addition, for at least a month, the person must show some symptoms from each of the following 3 symptom clusters. The symptoms must cause him clinically significant distress or impairment in social, occupational, or other important areas of functioning.

A. *Intrusive Recollection*. Persistent re-experiencing of the disaster through recurrent images, thoughts, dreams, illusions, hallucinations, flashback episodes, and/or a sense of reliving the experience. One experiences intense psychological and/or physiological distress on exposure to reminders of the traumatic event.

B. *Avoidance and Numbing*. Active avoidance of reminders of the trauma such as thoughts, feelings, conversations, activities, places, and/or people. A sense of numbness, detachment, and/or an absence of emotions, a markedly diminished interest in activities once enjoyed, or a sense of foreshortened future is present.

C. *Hyperarousal*. Persistent hyperarousal, perhaps with difficulty sleeping, poor concentration, hypervigilance, or an exaggerated startle response.

## Acute Stress Disorder

As in PTSD, the person must have been exposed to a very dangerous event and felt intense fear, helplessness, or horror. Beyond exhibiting some or many of the symptoms of PTSD, within the first 4 weeks of the trauma, the individual experienced the following symptoms:

1. A reduction in awareness of his or her surroundings (e.g., "being in a daze")
2. Derealization (the world seems strange and unreal)
3. Depersonalization (the person might become disconnected from their "self")

The symptoms cause him or her clinically significant distress or impairment in social, occupational, or other important areas of functioning. The disturbance lasts between 2 days and 4 weeks.[45]

## Generalized Anxiety Disorder

It is not unusual for disaster victims to develop a generalized anxiety disorder (GAD) or even panic attacks.[46] Because the symptoms of panic attacks—sweating, nausea, increased heart rate, shortness of breath, dizziness, and diarrhea—can mimic some symptoms of cardiac disease,[47] this disorder underscores the importance of medical professionals knowing the basic symptoms of stress-induced psychological disorders. Overall, the symptoms of GAD are as follows:

1. Excessive anxiety and worry about a number of events or activities, such as work or school performance. These symptoms occur more days than not for at least 6 months and cause clinically significant distress or impairment in social, occupational, or other important areas of functioning.
2. The anxiety and worry are accompanied by at least 3 of the following symptoms:
    a. Restlessness, feeling keyed up or on edge
    b. Being easily fatigued
    c. Difficulty concentrating or mind going blank
    d. Irritability
    e. Muscle tension
    f. Difficulty falling or staying asleep or restless unsatisfying sleep

## Panic Attacks

In general, the symptoms of a panic attack are intense fear or discomfort, in which 4 or more of the following symptoms developed abruptly and reached a peak within 10 minutes:

1. Palpitations, pounding heart, or accelerated heart rate
2. Sweating
3. Trembling or shaking
4. Sensations of shortness of breath or smothering
5. Feeling of choking
6. Chest pain or discomfort
7. Nausea or abdominal distress
8. Feeling dizzy, unsteady, lightheaded, or faint
9. Feelings of unreality or detached from oneself
10. Fear of losing control or going crazy
11. Fear of dying
12. Paresthesias (numbness or tingling sensations)
13. Chills or hot flushes

Again, panic attacks can mimic medical problems such as infarcts or asthma attacks (chest pain, shaking, and shortness of breath). An underlying

psychological disorder should be suspected if no medical basis is found for such symptoms.

### Specific Phobia

> A phobia is an excessive or unreasonable persistent fear, cued by the presence or anticipation of a specific object or situation (e.g., flying, heights, animals, injections, blood). A person who experiences such a phobia avoids the phobic situation as a result, or endures it with intense distress.[48]

Specific phobias are common after disaster. For instance, in the wake of September 11, it was not unusual for people to develop a fear of flying. An avid swimmer may no longer wish to swim, and even may be afraid of the water, in the wake of a tsunami. The physical symptoms brought on by a phobia are similar to those listed above for a panic attack.

Phobias can interfere significantly with a normal routine, occupational (or academic) functioning, or social activities or relationships; and there may be a marked distress about having the phobia.

## Family and Child Function

Continued maladjustment within families may reveal themselves in family violence or through alcohol or drug abuse. Parents benefit from education about better support for their children, including adolescents with drug and alcohol abuse. In many cultures, treatment of children can occur only with parents' direct participation. Other cultures may require open communication or consent from a village elder.

Children's difficulties may manifest in unusual and subtle ways, such as aggression, learning problems, disruptiveness or poor school performance, intense need for attention and reassurance, or even in the preoccupation of their leisure. Younger children may regress by thumb sucking and bedwetting.

Although children are more accurate observers of their own internal distress than adults, adults are better historians about children's behavior.[49] Some children, for example, are too young to have the verbal skills to express signs of numbing and withdrawal such as that of PTSD.[50] For these and other reasons, parental participation in children's trauma treatment extends the therapy work and reinforces coping strategies.[51]

Caregivers must continue to be mindful of material issues, such as housing and insurance coverage, or grieving for the dead that may weigh on both children and adults as obstacles to recovery. Survivors continue to need a sense of control, and facilitating such a sense is an important contribution.

## Relief Phase

The influx of relief supplies and workers heralds the involvement of other communities, nongovernmental organizations (NGOs), volunteers, and government grants. Such an unusually generous gifting of resources affords the opportunity for various psychosocial interventions that impact a community and the mental health of its survivors[52] with goals such as reducing emotional distress, facilitating problem solving, and returning survivors to normal functioning or recovery.

Psychosocial interventions that can help survivors reach these goals include:

1. Identity-building activities
2. Social and cultural networking
3. Religious activities
4. Outlets for stress relief
5. Livelihood training

## Identity-Building Activities

A number of gender- and age-sensitive activities can be developed that promote a renewed sense of identity in a decimated community. Cleanups can be organized, interdependent, and collective. Along the way, skills training can focus on the needs of the community.

Handcrafting parleys the local culture as an enduring and marketable asset and source of pride. This art and the products of other developed skills can contribute to festivals that bring community members together in a way that builds pride and meaning.

These experiences, and educational infrastructure, instill a sense of self-efficacy in community members for how to build disaster resistance in themselves and loved ones. Along the way, a disintegrated community re-establishes itself and its institutions.

For displaced people, regardless of their age, it is imperative to cultivate a frame of reference that one will survive, overcome the losses and displacement, and achieve their goals—find a new place to live, get a job, and feel alive again.

## Social and Cultural Networking

Networking facilitates a sense of normalcy about one's response and organizes around a shared understanding and experience. Volunteers are only a temporary presence; survivors must connect with their own community again. With mutual instruction about coping, proactive problem solving is encouraged.

Isolation after disaster need not be conceded. Research on a 1988 earthquake in Yun Nan, China, demonstrated that those enduring the disaster experienced fewer broken steady relationships with friends or neighbors than did a control group.[53] Survivors helping survivors diminishes isolation and enhances a sense of community and resolve and builds momentum toward reintegration of the affected area. Ultimately, those who engage in such networking also experience increased self-efficacy.

Even recreation in groups serves a constructive function by creating or maintaining a sense of community and purpose and prevents isolation. Activities such as fishing or walking contribute to self-efficacy without immersing one in the disaster and its tragedy.

Children should also be absorbed in activities that connect from protecting ties and time with playmates to donating toys or volunteering and assisting with cleanups, to baking cookies and treats for friends. Returning to school as quickly as possible is also exceptionally important.

## Religious Activities

Religion is uniquely able to provide a sense of order in the face of chaos. Particularly in times of mourning, religion and its rituals honor the departed and prepare one to move on as generations before have done.

Religion engages both the conscious and the unconscious and enhances optimism. When belief in anything is challenged, religion enables faith in the unknown and in the face of adversity. Disaster presents conditions of adversity that may require faith to see beyond the unmistakable despair.

Volunteer activities are often organized by religious institutions. Although it is understandable that activities sponsored by religious organizations have a faith-based context, many of their efforts can be nondenominational and do not attempt to proselytize. These are constructive, contribute to both the disaster victim and the volunteer's sense of connectedness and meaning, promote a sense of self-control, restore a sense of order, and reorient to goodness at a time when alienation is a beckoning alternative.

## Outlets for Stress Relief

Survivors are encouraged to seek support. Relaxation and tension-reducing techniques are widely taught and promote self-efficacy. Beyond the benefits of psychiatric counseling, extracurricular activities such as art and theater are therapeutic through expression—particularly for children who struggle to communicate. Athletic endeavors channel rage adaptively, as does writing in diaries, blogs, and personal journals. Writing may provide a useful window into emotions one has difficulty expressing, feelings that may warrant clinical attention and may be otherwise undetectable.

Alcohol restriction is strongly recommended, especially when survivors are housed under cramped and unsupervised conditions in which one might be more easily victimized. Alcohol may relieve stress for some, but the potential consequences from its use—especially as a stress-relief agent—far outweigh the benefits of its sedation. Self-medicating with alcohol or (to a lesser frequency) other drugs creates substantial risk of an alcohol or other drug dependency.

News and information are best accessed through responsible officials or specifically constructed websites. Survivors are best advised to avoid sensationalistic news coverage of disaster events. Although informative to others, the priorities of the many mass media outlets are to maximize shock value and titillation with the effect of occasionally increasing discontent.[54] This heightens the traumatic experience for survivors.

## Livelihood Training

Opportunities in environmental stabilization are obvious, and the disaster economy is built around cleaning up. Skills training can bring a survivor to the point that he/she can recover economic independence or at least viability, such as working in, or even opening, a local small business of marketable goods.

## Relief-Stage Interventions

Psychosocial interventions are especially important in areas with low acceptance of psychiatric care and stigmatization of emotional infirmity. Regrettably, the

greatest impact of natural disasters affects those who reside in the communities of such developing countries.[55]

Even before the devastating tsunami of 2004 killed over 200,000 people and displaced millions of others,[56] the Red Cross estimated that 85% of those affected by disasters from 1967 to 1991 lived in Asia.[57] Many of these people lived in the Ring of Fire—a horseshoe-shaped arc bordering the western coasts of South and North America up to Alaska and the Eastern coasts of Russia, past Japan, and encompassing the Philippines, Indonesia, New Zealand, and primarily comprised of the Pacific Ocean.[58] Because of the shifting of tectonic plates, this area suffers the great majority of the world's earthquakes and volcanoes.

## Case 3 Hanshin-Kobe Earthquake

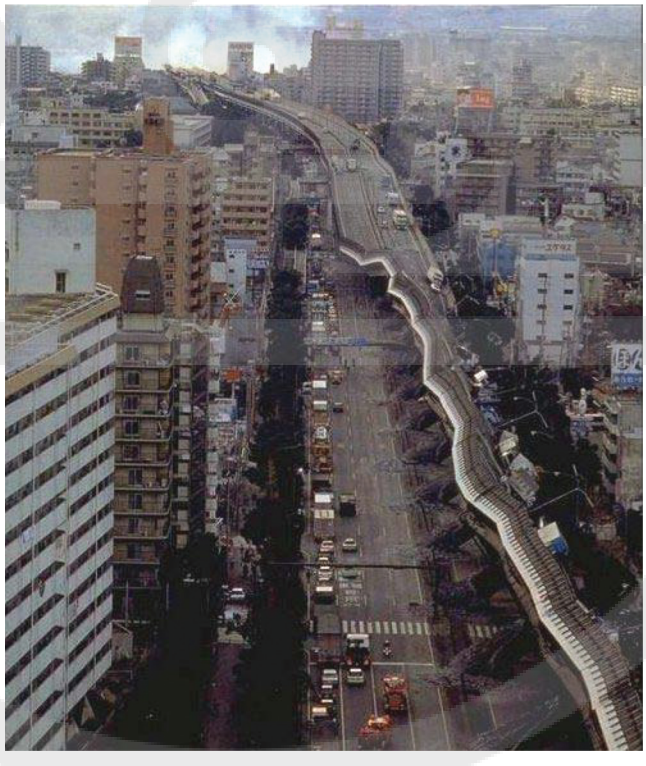

**Figure 15-2: Kobe, Japan—post-earthquake 1995.[59]**

On January 23, 1995, a powerful earthquake struck Hanshin, Japan, at 5:46 AM, killing almost 7000 people (Figure 15-2).[60] However, its tremendous damage to the infrastructure of the city, from highways to buildings to high-speed mass transportation, demonstrated that were the disaster to have struck at another time, mortality would have been that much higher.

Over 300,000 were rendered homeless by buildings ruined by collapse or fire. The public severely criticized what they saw as insufficient earthquake proofing of buildings, poor early-warning capabilities, and poor management of volunteers. Ninety-seven percent of the lost property was uninsured.[61]

Later, research demonstrated an association between unemployment, financial costs, and fatigue with depression; many of those who were isolated were particularly affected.[62] Although volunteers poured in from all over Japan, psychiatrists were in short supply.

Disaster interventions included educational pamphlets. Mass education proved to be especially helpful, as the area was plagued with over 400 aftershocks that the public could feel among thousands in total, over the course of the next 20 months. The public was understandably skittish about a repeat disaster, and educating the public improved residents' self-efficacy at a time they needed to rebuild and maintain confidence.

It was this event, however, that destigmatized PTSD and trauma-related mental health problems among the Japanese and some other Asians. In addition, the Kobe earthquake became a watershed event for volunteering as a major form of civic duty and engagement.

## Case 4 Indian Ocean Tsunami

On December 26, 2004, a tremendous earthquake centered in the Indian Ocean triggered a tsunami, or tidal wave, that radiated outward and overwhelmed the coasts of several countries many thousands of miles apart.[63] Well over 200,000 people were killed,[64] and millions were rendered homeless. Indonesia suffered more casualties than all other affected nations combined, but a number of deaths were reported as far away as Somalia. Environmental damage severely affected the fishing industry of Sri Lanka, tourism (for fears of another tsunami), ecosystems and coral reefs, farmland, and groundwater.

Although a tsunami warning system was in place, it was not available for the location of the earthquake, whose epicenter was the extreme west end of the Ring of Fire. The Onge tribe, an aboriginal people located on India's Andaman Islands, was expected to have been wiped out. However, the Onge recognized changes in the sea and clouds and survived by heading for higher ground.[65]

Significant psychological trauma has been reported in the affected areas.[66] Aceh is a traditional Muslim society in Indonesia that does not draw tourism because of armed sectarian unrest. Here, women, who can only be approached with great discretion, were unable to mourn properly because few of the bodies of loved ones were ever found.

The major countries affected were Indonesia, Sri Lanka, Thailand, and India. Because thousands of foreign tourists were among the dead, the tragedy was widely publicized, triggering a tremendous outpouring of support totaling over 8 billion dollars, with the United States as the leading donor. As time passed, however, many initial pledges from foreign governments were not fulfilled. In Sri Lanka and elsewhere, strongholds of the political opposition complained that aid was diverted in unequal ways. Others expressed concerns that numerous NGOs descended on South Asia in the aftermath of the event and focused more on creating photo opportunities to send back to donors than in coordinating with established channels like the International Red Cross.

As little as 6% of the funds provided to countries affected by the 2004 tsunami had been earmarked for psychosocial-related activities. It is no surprise, in view of the low priority given to this issue, that ongoing psychological trauma has been found in the affected areas.

## Resilience and Recovery

The majority of disaster survivors have the resilience to not develop psychiatric illness. Resilience reflects the ability to maintain a stable equilibrium.[67]

Despite resilience being the key factor in the psychiatric survival of the majority of disaster victims, treatment initiatives aim not at resilience, but for recovery in that minority of survivors who have developed alcoholism, depression, acute stress disorder, PTSD, or other common conditions.

Those who do have protective qualities that promote their resilience to disaster may actually be undermined by well-intentioned programs like debriefing that undercut their natural and successful coping and adaptation.[68]

Research has identified a number of personality qualities associated with resilience. Although not absolute, these qualities may reflect those who prove to have a higher threshold for being affected by the emotional toll of disaster:

*Hardiness*—specifically, being committed to finding meaningful purpose in life; the belief that one can influence one's surroundings and the outcome of events and that one can grow from both positive and negative life experiences.[69] *Self-enhancers* maintain a high level of self-esteem and exceptional self-confidence, even through disastrous events. *Repressors*, those who unconsciously bury their emotions and sensitivities, have shown better adjustment as survivors of abuse.[70] Those who cope with adversity with *positive emotions and laughter* also demonstrate better adjustment to adversity.[71] Resilience may also be accounted for by indigenous practices or ritual.[72]

Israel is matched by few countries in its history of events that could result in disastrous psychiatric effects. These include multiple wars, recurrent and continual terror attacks, and, more recently, the Iranian nuclear weapons development, specifically geared to destroy Israel.

Israeli research has demonstrated the importance of safety to promoting resilience in the face of disaster.[73] Therefore, preventive measures designed to protect the public increase a sense of safety and promote resilience. The native born tend to be more resilient, as do optimistic nationals.

At the same time, economic losses, including substantial loss of income, and societal concerns are associated with a loss of resilience. Persistent terrorism is associated with increased mental health needs, a loss of optimism, and also a loss of resilience. In that sense, continual terror establishes its value of eventually demoralizing its target.

## Adaptation and Development after Persecution and Trauma

One often-cited model, adaptation and development after persecution and trauma (ADAPT),[74] directs response to those domains specifically challenged by disaster such as:

- Security and safety
- Interpersonal bonds and networks
- Justice and protection from abuse
- Identities and roles
- Institutions that confer meaning and coherence

What distinguishes ADAPT is its added emphasis on justice and the rule of law and secure institutions that provide a foundation for a rebuilding community. Amidst chaos, those who exploit a lack of resources and lack of institutional integrity perpetuate the effects of disaster and extend its fallout. People affected by disaster are already challenged to believe in institutions and the capacity of their leaders to prioritize their interests.

ADAPT aims to establish coherence and meaning, emphasizing a foundation of work and education. Care is provided for those whose trauma reactions impede their adaptation, and concurrent efforts aim at reuniting families, kinship, and communities. Indigenous resources are promoted, providing culturally

familiar supports, to maximize resilience within a community. ADAPT emphasizes the need to restore religious and cultural institutions, with appreciation for their crucial role as an alternative to mental health care, particularly in some societies.[75]

The rule of law promotes a durable sense of safety and security among disaster survivors. Effective justice and government institutions protect those already reeling from the emotional burden of experiences that challenge one's sense of order and meaning, contributes to resilience, and is vital in restoring a sense of national identity.

### War and the Limitations of Intervention

War presents limitations to the most well-meaning of disaster interventions. Some militaries specifically target psychosocial services, to worsen the suffering of the enemy or even their own people (to manipulate sympathetic news media). In other instances, caregivers who volunteer are dragged into taking sides because one side is brutal enough to intimidate them into loyalty. Still other scenarios find caregivers targeted because armies fear they are spies or otherwise surreptitiously helping the enemy.

It is a particular tragedy when caregivers are targeted, either as hostages for ransom or for execution, such as beheading for propaganda. These losses demoralize the public in need of the generosity of such volunteers. Such degenerate callousness compounds the suffering of war and reflects on the perpetrators and those who aid them.

Professional care does not abide racism or intolerance. Disaster care doctors and aid workers must treat all victims, without discrimination.

## Case 5 Rwanda

Children are especially affected by war. Such impact is vividly illustrated by research on survivors of the Hutu massacre of Tutsis in April 1994. Approximately 800,000 were killed in a 100-day orgy of violence.[76]

Of children surveyed subsequent to the Rwanda catastrophe[77]:

Those who hid under dead bodies—16%

Those who witnessed killing with machetes—58%

Those who witnessed rape or sexual assault—31%

Those who witnessed the death of family members—6%

Those who witnessed bodies or parts of bodies—87%

Those who witnessed massacres—53%

Those who witnessed killing or violence by children toward others—36%

The aforementioned history would encumber those child witnesses with triggers for PTSD, unless they were particularly resilient. Complicating their experience was the disintegration of not only their community but also their own families that would customarily serve as a support system and decimation of churches that would otherwise provide support when families are limited.

In Rwanda, the lack of prosecution and accountability to perpetrators only adds to the fear of the children who witnessed atrocities. As noted above, the implementation of justice is vital for survivors to gain confidence and meaning in their communities and lives. To presume that time alone heals is an empty platitude. This mentality, typically dressed up under the title "reconciliation," ignores the worsening of the trauma of the victims to enable those in authority to feel comfortable with not prosecuting individuals responsible for genocide and man-made disaster.

# Treatment Approaches

For those who do not respond to psychological first aid, a number of treatment options are available. The major limitation of many of these treatments is that the research supporting their protocols was undertaken with traumatized subjects, not disaster survivors. Disaster psychiatry is a new enough specialty that the distinctions in conflicts and stressors affecting different age groups have not been fully identified. Still the extraordinary circumstances of disaster medicine have afforded a closer look at newer treatments and approaches.

## Cognitive Behavioral Therapy

Cognitive behavioral therapy (CBT) is based on the principle that our own thoughts—rather than merely external events—cause pathological feelings and behaviors.[78] Applied to one's reactions to disaster, this office-based intervention often involves homework assignments and requires a number of sessions, depending on the individual, the complexity of his thoughts and behaviors, and his engagement in treatment.

There are two techniques utilized in CBT that are demonstrated to be useful in depression, anxiety, PTSD, and phobias: exposure therapy and cognitive restructuring (CR).

### Exposure Therapy

Exposure therapy brings the individual to reminders of the trauma (from images to location) until the reminders no longer elicit anxiety or avoidance. This technique was shown to be a very effective treatment for those having PTSD[79]; it is also used to treat obsessive-compulsive disorder and phobias. More specific to disaster, there has been increased interest in using virtual reality exposure therapy for the veterans returning from Iraq and Afghanistan based on promising early results.[80]

Exposure therapy can be practiced with either imaginal exposure or in vivo exposure. Imaginal exposure utilizes systematic desensitization; the person is asked first to imagine something that causes mild anxiety. He progresses, stepwise, to imagine something that causes him a great deal of anxiety. The therapeutic technique ensures that he stays relatively comfortable and avoids becoming overwhelmed.

In vivo exposure also uses systematic desensitization and follows the same process, but instead of asking the person to imagine a stressor, the patient is placed in the presence of a stressor. For returning veterans, virtual reality exposure therapy simulates the combat environment that triggered the anxiety disorder. Again, the images would progress stepwise from mildly disturbing to extremely disturbing. As these stimuli are encountered, once they are unaccompanied by any negative events, the individual slowly stops associating these images with negative emotions.

### Cognitive Restructuring

CR is the process of learning to replace the flawed thinking that stems from the trauma with more rational, accurate, and positive beliefs. CR operates from the frame of reference that when an individual focuses on these unrealistic and

negative goals or thoughts, he is laying the foundation for failure and perhaps depression. The goal of this therapy is to establish a more realistic and accurate way of thinking that does not set one up for failure. As such, CR works well with individuals who appreciate logic and pragmatism and have little appreciation for psychoanalytic or more abstract psychotherapeutic approaches.

For example, if a Hurricane Katrina survivor were to say "If I had been home, I could have saved her," it is the goal of CR therapy to help that survivor realize that he is blameless because even if he had been home, he might not have been able to save her. Research found "that combining imaginal exposure, in-vivo exposure, and CR resulted in greater treatment effects for both PTSD and depressive symptoms than did exposure alone." A treatment plan may consider combining CR with exposure therapy for optimal results.[81]

## Eye Movement Desensitization and Reprocessing

Eye movement desensitization and reprocessing (EMDR) has its roots in the treatment of PTSD caused by traumatic events. However, research has demonstrated its particular adaptability to disaster settings.[82]

During the procedure, the patient focuses on a disturbing image or memory, conjuring up emotions, beliefs, and body sensations and thoughts—both negative and positive—that are related to the image or memory. Although the patient is doing this, the therapist is introducing bilateral and distracting stimulation in the form of visual tracking, auditory, or tactile stimulation. The external visual, auditory, and tactile stimuli help the patient to refocus the trigger stimuli and replace the negative reactions with positive beliefs and images.[83] The treatment showed promise in its first empirical study involving victims of sexual assault and traumatized Vietnam veterans. After just a single session, the subjects showed a significant decrease in distressing symptoms such as flashbacks and sleep disturbances.

In a later study at one of America's most well-respected trauma care centers, researchers found EMDR to be more effective than a popular medication, fluoxetine, in achieving sustained reductions in PTSD and depression symptoms.[84]

**Case 6** Marmara Earthquake

**Figure 15-3: Marmara, Turkey 1999.[85]**

On August 17, 1999, an earthquake measuring 7.4[86] on the Richter scale struck northwestern Turkey (Figure 15-3). Estimates of the death toll range from 17,000 to 40,000; the wounded numbered in the many tens of thousands, and hundreds of thousands of people were left homeless.[87]

Refugees lived in large tent cities. Although a concerted volunteer effort drew from many countries, survivors lived in an atmosphere of low confidentiality. There was little familiarity with psychotherapy, further impeding goals to aid emotional fallout. Moreover, aftershocks continued; efforts that might refocus negative thinking through CBT would therefore be impractical. The surrounding chaos of the refugee camps reinforced negative perception. Homework associated with CBT would be impractical in this setting.

Researchers utilized EMDR with survivors who had PTSD, with considerable success. Major reductions in PTSD were recorded, even with 3 or more trigger images. Effects were seen regardless of education and were sustained over time. The mean number of sessions needed was 5, required no homework, and the intervention required no disclosure of traumatic details. In this regard, EMDR showed itself as unusually adaptable to primitive conditions and with a population that might not typically welcome psychotherapy or merely an open disclosure.[88]

## Lifeline Psychotherapy

The Chernobyl disaster inspired creative therapeutic application of contemporary technology, in a manner that is replicable in disasters to come. Kronik's Internet-based psychotherapy involved 10 sessions directed toward adolescents in a school-based or community-based application.[89]

Lifeline psychotherapy engages participants to reconstruct a life narrative, with events, dates, color-emotional tone, and causal links. The therapist enhances formulation of the narrative of a trauma in which participants establish linkages to positive life events as well. As a result, participants are better able to see the positives and achievements beyond the event, are more forward thinking, and gain a greater appreciation for small miracles.

The catastrophe is incorporated into context, and the event assumes a less dominating influence. As a result, the participant develops a greater sense of control over life.

## Trauma/Grief-Focused Therapy

Local therapy groups offer psycho educational tools that survivors can use to deal with trauma and grief, such as stress-decreasing exercises and adaptive coping techniques. This learning and training promotes developmental progress and builds coping skills. For those who are passive, dependent, and immature, and as such are at risk for emotional fallout from disaster, this intervention may be well suited if available.

## Psychopharmacology

PTSD, depression, and anxiety resulting from a mass casualty disaster can be treated with antidepression medication, most commonly selective serotonin reuptake inhibitors (SSRIs) and β-adrenergic blocking agents. Mood stabilizers and antipsychotics are less frequently prescribed but may also be beneficial for selected individuals with pertinent symptoms.

### SSRIs

SSRIs increase the amount of serotonin in the brain by limiting the amount of serotonin that the brain cells reabsorb. The increased serotonin helps alleviate depression. Popular SSRIs are citalopram (Celexa), escitalopram (Lexapro), sertraline (Zoloft), paroxetine (Paxil, Paxil CR, and Pexeva), and fluoxetine (Prozac).

Other types of antidepressants may be prescribed to combat particular symptoms of PTSD. Monoamine oxidase inhibitors, commonly referred to as MAOIs, have been used to reduce depression, but they are also extremely valuable for reducing night terrors and flashbacks. Selective norepinephrine reuptake inhibitors are used to treat intrusive and hyperarousal symptoms. Finally, tricyclic antidepressants can help reduce flashbacks, as well as insomnia and dream disturbances.

### α-Adrenergic Blocking Agents

Also called β-blockers, these drugs block β-adrenergic substances such as adrenaline (epinephrine), a key substance in the sympathetic portion of the autonomic nervous system. These drugs slow the heartbeat and lessen the force with which the heart muscle contracts. This drug has been shown to be effective for people who suffer from anxiety, especially those with physical symptoms such as rapid or pounding heart rates. Widely used β-blockers are acebutolol (Sectral), atenolol (Tenormin), and propranolol (Inderal).

### Mood Stabilizers

Mood stabilizers are used not only to treat symptoms of bipolar disorder but also to treat depression, mania, and PTSD. Anticonvulsants are the most prescribed type of mood stabilizer and include drugs such as Lamotrigine (Lamictal) and Valproic Acid (Depakene). The most well-known mood stabilizer—and the first approved by the FDA—is lithium carbonate.

### Antipsychotics

Antipsychotic medication is used to treat hyperarousal and dissociative symptoms that can be associated with PTSD and depression.

## Final Thoughts—Priorities and Emphasis

Disaster psychiatry is more than merely a range of psychotherapies or interventions tailored for events with extreme effects. The discipline places great emphasis on the importance of education and training before and after disaster strikes with the anticipation of continued impact on the affected community.

Being prepared for a disaster demands an understanding of the effects that a disaster will have on individuals and the community. These include ways to protect one's self, evacuation protocols, a system for tracking others, plans for educating parents, and efforts to reduce traumatic reminders in the environment.

Caregivers and volunteer workers benefit from advanced training in psychological first aid and in knowing the resources available to help people

gain control over their lives as soon as possible. Crisis intervention, and proper listening and interviewing techniques, helps caregivers and responsible authorities assist adults and children with a range of communication skills. Disaster psychiatry educates others to recognize the difference between normal and pathological responses to disaster and the basis for referral for follow-up services.

This training can be targeted to schools, hospitals, agencies, local law enforcement, and physicians. Disaster psychiatry works in conjunction with social agencies in recognition of the significance of restoring normalcy through home, physical health, sobriety, safety, and structured education. These agencies and responsible parties are also trained to recognize who needs a referral for more specialty treatment interventions and who is best not referred to therapy and why.

There are also approaches in which the disaster community can minimize the magnitude of war as disaster. The following can be accomplished, especially with countries dependent on foreign aid:

- Child conscription must be eliminated
- Hate and nihilism teaching must be eliminated
- Forced starvation must be prevented
- Targeting must not desecrate the enemy's environmental assets
- Refugees have to be settled in new communities rather than maintained in separate camps

Promoting qualities that enhance resilience can be done in schools and through other community agencies. This is how training may enable disasters to serve as organizing events that promote growth in survivors and an appreciation of purpose and their individual sense of competence.

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Chapter 16

# Psychosocial Issues in Disasters

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# Preface

In planning for mass casualty events, psychosocial considerations must be addressed. Extreme events and emergency situations cause psychosocial effects that ripple out from the individual level, to families, communities, organizations, and society at large. These effects are both direct and indirect and may even be caused by the rescue and response interventions themselves.[1] Psychosocial effects cover a wider scope of impact than direct medical injuries. They can also have a significant impact on health outcomes because psychosocial, biological, and cognitive effects are interrelated.[2] The psychosocial footprint extends out beyond immediate medical footprint, with psychological casualties outnumbering the physical ones at ratios as high as 500:1.[3,4]

The 5 topics that have been addressed in this chapter on psychosocial considerations are as follows.

1. The Psychosocial Risk Management and Assessment Framework (P-RAM) and its applications.
2. Psychosocial considerations for the healthcare environment.
3. Psychosocial considerations for the public.
4. Psychosocial considerations for the staff.
5. Psychosocial considerations about disaster time phases.

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# Psychosocial Considerations in Mass Casualty Events

Successful recovery from mass casualty events begins with effective pre-event planning. One key component of this emergency planning is including the cascade of psychosocial considerations. Understanding the motivations for behaviors in the public and in the responder community can be of assistance when determining which interventions to apply.

## The Psychosocial Risk Management and Assessment Framework

Planning for disasters and other extreme events is often focused on the hazard or pathologies. In response to this mindset, Lemyre et al. (2007) designed the Psychosocial Risk Assessment and Management (P-RAM) framework, a multilayered framework that is population driven.[1] Figure 16-1 depicts a multilevel, multitier P-RAM framework.

1. *Effects.* As shown in the diagram, documented evidence on psychosocial impact of major events can be categorized into 10 main categories of psychosocial effects that ripple through 3 tiers. These effects include both positive and negative effects and consist of information seeking, helping behavior, social cohesion, resilience, public confidence/trust, compliance, stigma, worry, somatization, and lastly, extreme effects (pathologies).
2. *Population.* Psychosocial effects occur at multiple population levels. The P-RAM framework addresses multiple population levels including individual, family, organization, community, and the society. Although the clinical effects on individuals have been more documented and may be more obvious, other population groups are also affected as the various effects move outward like a drop of water hitting a pond. For example, individuals who require extended treatment following a disaster may cause their family to experience financial difficulties. Ripple effects not only travel from the individual level outward but also from the societal level inward when a surge on healthcare system challenges routine and elective services. Psychosocial responses are necessarily complex and occur in context. Moreover, embedded within these multiple population levels are at-risk population, such as children, the elderly, pregnant women, and transitory populations, among others, who experience extreme events differentially and may require interventions tailored to their needs.[5]
3. *Interventions.* The interventions themselves can cause secondary effects. Psychosocial interventions can be grouped into broad categories: clinical, bioenvironmental, risk communications, education, social support, professional counseling, and policies. Although these interventions are often used in response to negative psychosocial effects or to promote positive effects, at times the interventions may cause secondary, unintended effects. For example, the use of personal protective equipment, although essential from a safety standpoint, can cause secondary effects among patients in that their use conveys a high level of

worry or concern, which may be contradictory to what is being officially communicated to the public. Similarly, protective equipment may cause children to become afraid of medical personnel, thereby slowing down decontamination procedures.[6]

4. *Risks and protective factors.* Although most of the concern, of course, goes to the risks and morbidity, each situation also comes with strengths, assets, resilience, and protective factors that a comprehensive and integrated analysis has to take into account and foster to develop.

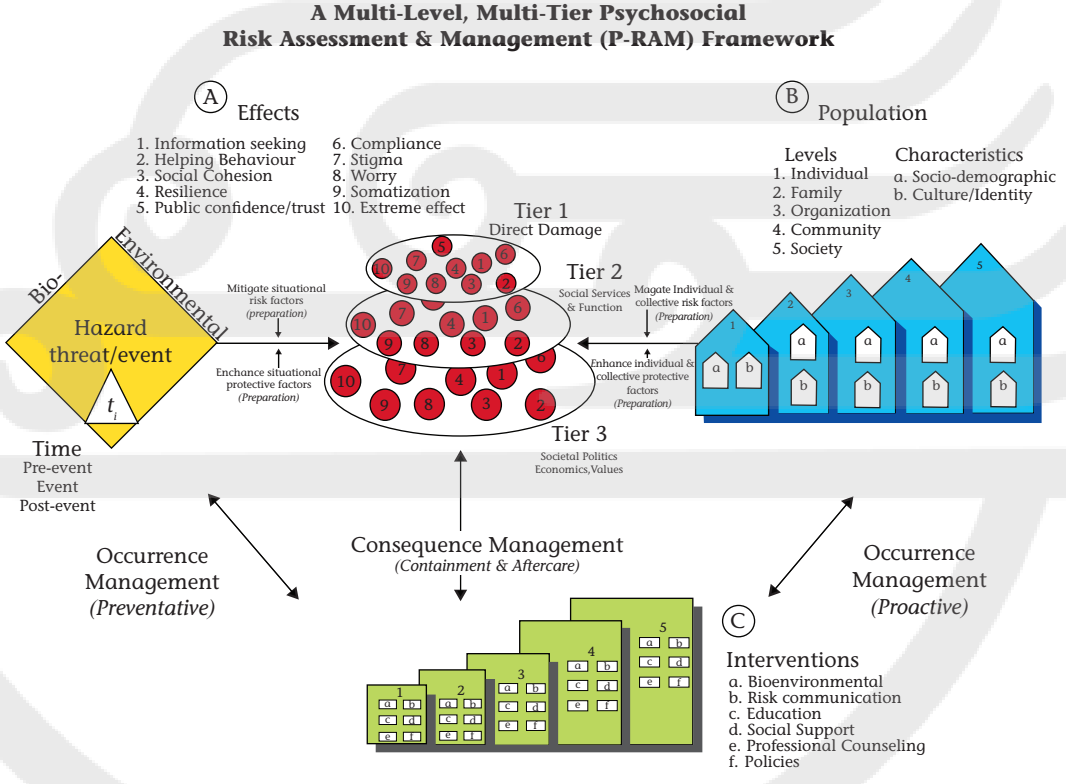


**Figure 16-1: The Psychosocial Risk Assessment and Management framework.**

## Psychosocial Considerations for the Healthcare Environment

Crowd control and management are essential in managing a hospital surge during mass casualty incidents.[7] Triage may be complicated by issues such as victim self-evacuation, large number of expectant or dead victims, mass psychogenic illness, and high levels of uncertainty. There are some important considerations.

1. *Not all patients will be assessed during triage, as victims have a tendency toward self-evacuation.* Patients will arrive by their own means on foot, by car, by taxi, or by public transit, without warning or without having been seen by EMS. Although self-transportation can improve the rate at which the incident scene is cleared, it can result in a kind of unintentional and unavoidable overtriage, in which noncritically injured casualties receive

treatment sooner than is ideal and strain the limited resources, impairing the management of more critically injured persons.[8] Furthermore, self-transportation has important consequences in a chemical, biological, or radiological incident because victims may not undergo decontamination procedures before reaching a hospital. This increases the likelihood of secondary or cross contamination on the way to the hospital and in the hospital itself. This cross contamination became problematic following the release of sarin gas by the cult group, Aum Shinrikyo, Tokyo, Japan, in 1995. Only 7% of the patients were transported to the nearby St. Luke's hospital by ambulance, whereas 35% arrived on foot, 24% arrived by taxi, and 14% arrived with the help of good Samaritans.[9] Self-transportation of victims, a lack of decontamination on scene, and insufficient personal protective equipment combined to cause secondary exposure in St. Luke's hospital workers.[10]

2. *Large number of expectant and dead victims requires dignified palliative care and treatment of bodies*. Mass casualty planning must include dignified treatment of the dead and dying to maintain public trust and to prevent further psychological trauma to the living.[11] Apart from medical intervention in palliative care, psychosocial support is also an important component of palliative care as patients and families may require counseling to process their loss. In a surge situation, social workers, pastoral, and volunteer spiritual caregivers may be used to supplement mental health professionals. This consideration is especially relevant during pandemics, where triage methods may result in a large portion of the sick being denied critical care. By focusing on dignity in medical and psychosocial interventions, healthcare workers will also be partially protected from feelings of helplessness associated with dealing with large numbers of critical patients and deaths.

3. *Effective triage may be complicated by mass psychogenic illness.* Based on past cases, such as the Tokyo sarin gas attacks, it is clear that people will seek medical care regardless of actual exposure.[2] Hospitals will be faced with a surge not only of injured and contaminated individuals but also those suffering psychosomatic symptoms.[12] Moreover, the latter, least injured group may comprise the majority of the surge, clogging up the hospital system as medical personnel separate the severely injured and contaminated from those who are experiencing mass psychogenic symptoms. Unfortunately, differentiating instances of psychogenic or sociogenic illness from the similar symptoms that may present following actual exposure to chemical, biological, or radiological agents can add further complexity to a hospital surge, as these symptoms have a tendency to overlap. Following the radiation event in Gioiana (Brazil), approximately 20% of people presented with symptoms that mimicked exactly those expected in actual exposure.

4. *The impact of mass psychogenic illness on triage is magnified when uncertainty is high.* Mass psychogenic behavior has a tendency to originate with an environmental event, particularly with strong odors, but can be spurred on by rumors and by uncertainty stemming from either imagined or actual events. The uncertainty of traumatic events can contribute to this group behavior, particularly when a hazard is unfamiliar to the general

public. For example, following an unintentional exposure of Cesium 137 in Goiania, Brazil, 112,000 people sought screening at the Olympic stadium for presumed exposure when the actual number of exposed individuals was closer to 250 people.[13] More than 8000 documents were issued to those who underwent screening, to certify uncontaminated status.[14] Although individuals experiencing mass sociogenic illness are sometimes referred to as the "worried well," this term is misleading because many of these people will require counseling or psychiatric care to address acute symptoms of anxiety.[12] Furthermore, the use of this term may lead staff to dismiss them, which serves to increase their insistence and demands for treatment. The clinical picture is also complicated by "true" somatization, that is, actual symptoms caused by the anxiety and stress such as vomiting, diarrhea, chills, and fever.

## Psychosocial Considerations for the Public

Managing bystanders and the public during a hospital surge can be a challenging situation.[7] An influx of helpers and volunteers, including professionals from other locations, as well as media, can also be taxing on hospital systems during a surge situation. Large number of people that will show up cannot be simply turned away. A number of issues become salient when considering such convergence during a mass casualty event including that surges affect the larger public, that help will arrive whether it is wanted or not, that the public can be used to improve surge capacity, and that indirect exposure to trauma can result in anxiety and stress reactions.

1. *Hospital surges affect the public.* The surge will include not only those who are injured but also the family members seeking disaster survivors and regular patient visitors. Advanced disaster planning must consider the increased shelter, communication, and security needs that hospitals will require in dealing with this influx of people. The increased demand of critical patients can strain resources needed to help existing patients with their scheduled appointments, elective surgeries, and chronic illnesses, including at-risk populations who are dependent on medical equipment such as dialysis machines.
2. *Helpers will arrive whether they are wanted or not.*[15] Once professionals and nonprofessionals arrive, they will need coordination to be effective and to make sure that they do not go beyond their capabilities and harm themselves or others.[1] Following September 11, volunteers showed support and solidarity for victims of the terrorist attacks through blood donation in the months following the attacks with a national increase in the number of units donated of over 572,000.[16] However, the perishable nature of blood products led to the destruction of some of these donations, which confused and angered volunteers. The value of volunteers cannot be underestimated or go unrecognized in a mass casualty event, as even search and rescue operations are rarely carried out entirely by professionals; more often such efforts are *ad hoc* and rely on volunteers and survivors.[15] Some challenges arise from the accrued risk linked to lack of proper training, self-exposition to contamination or

*For more information on volunteer management, please refer to Chapter 7.

danger, overwork, and fatigue. Proper coordination of tasks and duties requires distributed leadership and shared governance.

3. *Surge capacity can be expanded with the help of the public.* Early psychosocial interventions may be delivered by nonphysicians in the event of a surge situation.[2] Social workers, psychiatric nurses, and trained volunteers, such as volunteers from the Red Cross, can be of assistance in this regard. Early intervention such as psychological first aid may be protective of long-term negative psychosocial effects. Education, regular sleep and eating patterns, and limiting media exposure can also be protective steps in mitigating transitory psychiatric symptoms.[12]
4. *Media impact will exacerbate anxiety and stress reactions in people who are not directly exposed to trauma.* Physicians and other health professionals must be aware not only of those individuals who are directly affected by traumatic events but also those that are indirectly affected. Although direct exposure may lead to posttraumatic stress disorder (PTSD), depression, or increased alcohol use in some individuals, indirect exposure to trauma is also linked to the development of PTSD, depression, and alcohol abuse, especially in cases where an increased vulnerability or predisposition to mental illness is present.[12,17] Family physicians must be especially vigilant in the months following a traumatic event, as psychiatric disorders brought on by a traumatic experience may present themselves in the form of somatic complaints. In addition to these more acute cases, a larger group of individuals may need reassurance as more individuals may experience an altered sense of safety or a state of hypervigilance following a traumatic event, which can occur in the absence of psychiatric illness. Continuous news coverage, internet, and social media can contribute to vicarious trauma if not monitored for excess viewing of repeated scenes and traumatic imagery.

## Psychosocial Considerations for Staff

The needs of both front- and second-line workers must be considered during a mass casualty event. Issues of absenteeism are best mitigated by adequately addressing staff safety concerns and other practical considerations, whereas stress reactions in staff require interventions such as education, professional counseling, and policies (on limits on number of hours worked, respite, and support).

1. *Absenteeism is rooted in safety fears.* In planning for contagious outbreaks, the issue of absenteeism among healthcare workers can be of concern. The root cause of this absenteeism behavior can be found in the personal safety concerns of front- and second-line staff members, which result in role conflict. Therefore, staff safety concerns must be addressed, including those of medical staff (doctors, nurses, anesthesiologists, and emergency medical technicians) and of support staff (housekeeping, maintenance, administration, and food preparation staff). Concerns for family safety must also be addressed because staff members are more likely to avoid coming to work if it puts their loved ones at risk of infection.[12] Protective equipment must be made available along with vaccines for staff and family, where medically appropriate.[18] Practical concerns such as childcare, eldercare, and pet care must also be addressed, particularly among female

staff members and single parents, who may have more limited support options in the event of quarantine situations.

2. *Stress reactions of staff need to be addressed.* Hospital staff may be at risk for developing feelings of overidentification with the victims that they help.[2] Although this capacity for empathy can be prosocial during the rescue and recovery phases, allowing staff to cope with the tasks required by the job, lingering feelings such as the thought that "it could have been me" can become pervasive and debilitating in some cases. Offering information to the staff about when to seek help can be a mitigating step in this respect. Within the healthcare community, high mortality rates and insufficient resources can become demoralizing, due to an inability to provide adequate care for advanced illnesses or certain exposures.[12] Some staff will experience more extreme effects, including the development of PTSD.[19] Self-care can be important in mitigating stress reactions, including taking care of basic needs and limiting the number of hours worked.[17]

## Psychosocial Considerations for Time Phases

Building surge capacity begins with pre-event planning. Although crisis management is centered on the impact phase and consequence management is focused on recovery and reconstruction, the risk management paradigm requires ongoing monitoring of interventions, beginning in the pre-event stage. Risk management has a wider scope, encompassing all of the time phases, and requires putting the emphasis on predisaster planning (Figure 16-2).

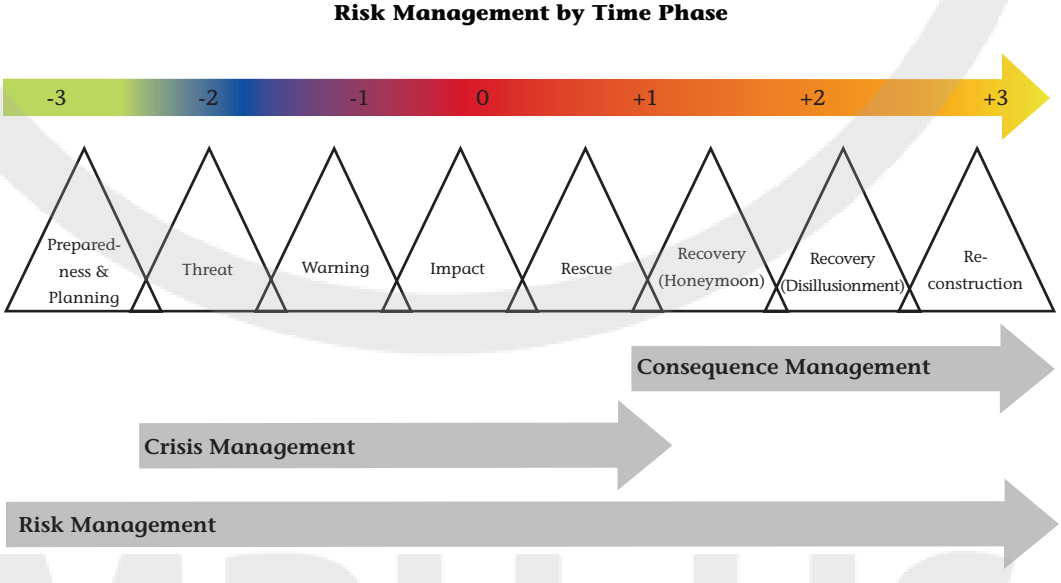


**Figure: 16-2 Risk management by time phase.**

In terms of mass casualty situations, hospital continuity planning is in keeping with this risk management approach. For example, just-in-time delivery of supplies is a key issue, particularly with respect to vaccines and basic personal protective equipment such as masks. An overreliance on just-in-time delivery

can translate into supply shortages in a surge situation. Stockpiles of basic safety supplies, vaccines, antidotes, antibiotics, and palliative care kits, among other essential supplies such as food, can help to prevent shortages, as can predetermined arrangements with suppliers.

## Conclusion

Psychosocial considerations cover a broad range of issues and impact all stakeholders, from patients, families, general public, and staff. Addressing these issues and identifying solutions, assets and strengths require careful pre-event planning and think-through. Prevention and preparedness, through planning, exercises, and sustained capacities, are key elements of effective response.

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# Chapter 17

# Ethics

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# Preface

What are the ethical issues involved in disaster planning and response? Why should those involved in disaster planning and response be concerned with ethics in the first place? In this chapter, we hope to highlight answers to these pressing questions. We will begin by discussing what ethics is or may be and progress to a discussion of why ethics is integral to disaster management. Against this background, we will examine the importance of an explicit articulation of ethical principles that ought to guide disaster planning and response. We will further bolster the view of the fundamental ethical nature of disaster management by highlighting illustrative ethical dilemmas that may arise during a disaster. Finally, we will raise key ethical questions relevant to research during and following a disaster.

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## What is Ethics?

Ethics concentrates on the moral appraisal of actions and dilemmas affecting the lives of individuals and communities in their conduct of day-to-day affairs, both ordinary and extraordinary. It is a discourse devoted to critical reflection, argumentation, and deliberation regarding the goodness, fairness, and justice of human actions and interventions. To this end, it consists of thinking about the moral acceptability of what individuals and institutions ought to do, explaining why we ought to do it, describing how it ought to be done, and evaluating how well it has been done and whether future response ought to be adjusted. In short, ethics seeks to provide moral justification for human actions and interventions.

Ethics as a deliberative undertaking admits to a wide variety of theoretical expression. This simply means that there are multiple ways of understanding how to justify actions. Some theories, such as utilitarianism, focus on consequence as the ultimate means of justifying actions. Other theories, such as egalitarian theories, focus on considerations of justice and fairness. To be sure, ethical theories converge on a fundamental idea: what is congruous to most is a commitment to a coherent set of rules for the justification of action that abjure reliance on tacit and arbitrary reasoning. It is important to note, however, that different theories can come into opposition on basic principles, often provoking further moral conflict. This issue should be taken into account, particularly when considering decisions of priority setting or resource allocation, each capable of grounding decisions on what are ultimately irreconcilable principles.

Saying that there are many ways to justify an action does not entail that all actions are equally justified. Ethical reasoning weighs arguments for or against proposed actions. Rarely is it "algorithmic" or purely deductive, often resisting reduction to simple flow sheets. Rather, ethical reasoning renders decisions that encapsulate factual considerations, reasons, and principles as providing explicit robust rationales to support actions. Even so, justifications can be found to be sound or unsound, well supported or poorly supported.

It should be acknowledged that there are schools of thought that deny the possibility of justified ethical decision-making. Some philosophers have argued that ethical statements are merely reflections of internal emotional states (emotivism) or constitute propositions that do not contain truth value (noncognitivism). For example, postmodern theorists deny the possibility of objective reflection on ethical issues arguing that such discourse obscures power dynamics.

Moreover, ethics is distinct from the law in that laws are enforceable obligations that are codified and subject to adversarial adjudication in courts or tribunals. As is amply demonstrated by history, laws can be unethical. For example, slavery, now widely deemed to be a fundamentally unethical practice, was once legal. As Viens et al. have noted, an action "is not necessarily justifiable *just because* it is carried out under the rubric of the law," meaning that justifying action on legal grounds does not necessarily imply it is morally justifiable.[1] This is because positive law, unlike ethics, does not seek to provide moral justification for actions and interventions but rather renders decisions based on the existing laws that may or may not be ethical. In its quest for justification, ethics brings to bear concepts such as duty, obligation, reciprocity, caring, and solidarity as important normative concepts, each of which being important dimensions of disaster management.

## Why Is Ethics Important to Disaster Planning and Response?

Ethical reasoning is premised on reason-giving accounts and, therefore, may seem at variance to the requirements of top-down, command-and-control driven decision making often required in disaster response. However, we argue that the most important reason for disaster planning and response is ethical—that is to reduce human death and suffering—and that the mitigation of economic and property losses is subordinate to—or at best a corollary of—this imperative to save human life. The response to any kind of disaster is based on our concern for preserving human life, for mitigating damage to human-built environments, and to reducing economic and other (ordinary and extraordinary) disturbances to society. Yet, many ethical norms are commonly tacit and rarely explicitly articulated by those engaged in disaster management. Often, these are implicitly captured in broad terms that are expressed in mission statements and underpinned by overarching concern for either assuring the most benefits for the most people (utility) or the claim that all individuals have unique value as humans (dignity). Thus, although not explicitly stated in disaster thinking, we are concerned with responding to a disaster and mitigating mortality, morbidity, and destruction because it expresses our fundamental value for human life and community.

Viewed this way, the ethical nature of disaster management is inescapable. There are few issues, if any, in disaster planning and response that do not admit an ethical perspective; every practical problem that disaster planners face is fraught with profound ethical dilemmas and every decision that they make is an inherently moral choice.[2] But, more than that, decisions about interventions are often shrouded in uncertainty, especially given the dearth of scientific evidence[1] in the early days of—and at times beyond—a disaster. For this reason, reliance on scientific justifications is at best inadequate; and even where there *are* reliable data to support interventions, scientific accounts remain problematic because the nature of evidence in disaster management inevitably yields varying levels of uncertainty.[3] That decisions are difficult, if not impossible, to reach with any degree of certainty reinforces the fact that fundamental ethical dilemmas lie at the root of disaster management and ethics is the foundation of every decision rendered about interventions.

Moreover, looking for ethical exceptionalism in times of disaster can be exceedingly problematic. This is because rules of thumb and situational ethics are not likely to produce desirable results during a crisis situation.[4] The 2003 SARS (severe acute respiratory syndrome) outbreak and Hurricane Katrina in 2006 are cases in point. In effect, the SARS experience underscored the moral hazard of what can transpire when healthcare systems are ill-prepared for sudden crisis. Being caught off guard unleashed repercussions that would resonate well beyond the outbreak itself —diminished public trust, weakened hospital staff morale, confusion regarding roles and responsibilities, stigmatization of vulnerable individuals and communities, and injudicious risk communication,[5–7] among other factors.

Similarly, many failures of ethical preparedness were clearly demonstrated in the aftermath of the Katrina disaster, particularly when it came to evacuating and admitting victims to and from hospitals. Varying perceptions on triaging

priorities—determining priority to rescue and medical treatment—led to confusion and at times sheer chaos that resulted in poor or inexistent communication and exercises of power differentials. Different factors such as healthcare providers, first responders, and helicopter operators had different intuitions about who should be the first to be removed or admitted; while one gave priority to those most critically ill, another to those least ill, and yet another to women and babies.[4] What was clear is that the process of triaging as they performed it, though seemingly a unified concept, actually admitted to a very nuanced and varied way of thinking.

In his work on triage for scarce resources such as that seen in disaster response and organ allocation for transplantation, Veatch[8] notes that triage itself is a multifaceted concept admitting to a variety of interpretations, and thus, one that is ultimately founded on different justifications. Historically speaking, Veatch shows that, in the English tradition, considerations of utility and efficiency governed the concept of triage, meaning that the first consideration in deciding on the allocation of scarce resources was battle readiness to expedite the return of soldiers to service.[8] However, in the French tradition, triage was determined based on the person who was most in need, even if it was understood to be inefficient. Making triage decisions according to the principle of utility (those most likely to survive) or the principle of vulnerability (those that are sickest) clearly demonstrates that varied ways of thinking about a concept can lead to radically different conclusions about what counts or what matters and what one ought to do. Pellegrino[9] echoes this view: "[t]he solutions we seek to the practical problems of moral choice depend entirely on the conceptual framework we use to define what we think right or wrong, good or bad." Clearly, conflicting principles that have not been explicitly negotiated can have tragic outcomes, pointing to the importance of clarifying the meanings of concepts to create a common ground for policy and practice. An example of this might be predefinition of what care would be delivered in a situation with limited resources.

Most crucially, the lack of a common ground amid rescue efforts in Hurricane Katrina created an impasse as to who sets priorities and who has the legitimate authority to execute orders. So, not only is this disaster a particularly stark example of the importance of clarifying the meanings of concepts but also it points to the idea that careful ethical analysis is essential to create the conditions for genuine agreement. Nagel[10] calls this "a comparable consensus about what important ethical and evaluative questions have to be considered if (a) decision is to be made responsibly." In this vein, one of the major learning goals of this chapter is to illustrate that a key task of ethical reflection in the predisaster period is to make explicit and clear where differences of perspective may lie.

## A Proposed Ethical Framework for Disaster Planning and Response

A key question is how one integrates ethics into disaster response and whether disaster response needs to be distinct, both procedurally and substantively, from dominant ethical principles invoked for usual responses to clinical dilemmas. In other words, what description of ethics is relevant for disaster response?

As Ahmad[11] has argued, disasters are different than everyday dilemmas and are forms of complex emergencies whose considerations do not fit within the established clinical frames of ethics underpinning modern healthcare systems. The lens through which healthcare professionals are asked to understand and respond to dilemmas is usually derived from bioethical frameworks that tend to be individualistic and based on the principles of autonomy, whereas disaster response usually requires more of a focus on a blend of utilitarian and humanistic considerations.

To be sure, bioethics, as the dominant paradigm for clinical medicine, does provide a necessary, though insufficient, foundation for disaster thinking. Berg and King[12] identify 5 ways in which bioethics can contribute to disaster response. First, many diverse concerns of bioethics, such as the ethics of pandemic response, are tightly linked to issues elucidated in traditional bioethics discourse. Second, it can provide a wide set of methodological and analytical approaches to decision making. Third, bioethicists are skilled, as they attest, at "navigating the treacherous terrain of decision making among multiple stakeholders in complex crisis situations" and thus can facilitate the inclusion of nonmedical considerations into planning processes. Finally, bioethics can provide cautionary advice and act as a hedge against rash and unreflective action.

Another contribution of bioethics to disaster thinking is the development and use of ethical frameworks. As Dawson[13] has argued, "the primary role of a framework [is] to aid deliberation by making relevant values explicit" and that these "values are then used to guide or frame decision making." An ethical framework serves as a tool to improve decision-making accountability, which means that it demands, and benefits from, constant feedback and revision. It is intended to inform decision-making by encouraging reflection, argumentation, and deliberation on important values underpinning ethical concerns that require attention in a disaster.

Beyond the role that bioethics can play in disaster management, disasters present distinct ethical considerations in view of its population focus.[14–19] This means that an ethical framework relevant to considerations of disaster management must transcend the common view and practice that "the individual [is] the focal point of moral concern,"[19] that it transcends the prevailing individualistic biomedical framework. A viable example of an ethical framework relevant for a crisis situation is one developed by an interprofessional and interdisciplinary team of practitioners and scholars for pandemic planning, built on the experience of SARS in Toronto.[20] To this end, they crafted an ethical framework that was informed by ethical values and principles as well as guided by ethical decision-making processes.

The first part of the framework identifies the key elements of ethical decision-making processes, adapted from the "accountability for reasonableness" model developed by Daniels and Sabin[21] (see Table 17-1: Ethical processes [listed in alphabetical order]. Adapted from Daniels and Sabin).[22] These processes—accountability, inclusiveness, openness and transparency, reasonableness, and responsiveness—are conducive to enhance the basic accountability to further enhance the substantive ethical quality of decisions. Indeed, those affected by difficult decisions may be more accepting if the decision-making process has, and is perceived to have, ethical legitimacy.

However, it is important to underscore that ethical processes do not guarantee ethical outcomes. Thus, the second part of the framework identifies 10 key ethical values that ought to inform the substantive ethical dimensions

## Table 17-1: Five Procedural Values to Guide Decision-Making

| | |
|---|---|
| Accountable | There should be mechanisms in place to ensure that decision makers are answerable for their actions and inactions. Defense of actions and inactions should be grounded in the 14 other ethical values proposed below. |
| Inclusive | Decisions should be made explicitly with stakeholder views in mind, and there should be opportunities to engage stakeholders in the decision-making process. |
| Open and Transparent | The process by which decisions are made must be open to scrutiny and the basis upon which decisions are made should be publicly accessible. |
| Reasonable | Decisions should be based on reasons (i.e., evidence, principles, and values) that stakeholders can agree are relevant to meeting health needs in a pandemic influenza crisis. The decisions should be made by people who are credible and accountable. |
| Responsive | There should be opportunities to revisit and revise decisions as new information emerges throughout the crisis. There should be mechanisms to address disputes and complaints. |

of decision-making in pandemic planning and, more broadly, disaster planning context (see Table 17-2: Ethical values to guide decision making [listed in alphabetical order]). These values—duty to provide care, equity, individual liberty, privacy, proportionality, protection of the public from harm, reciprocity, solidarity, stewardship, and trust—are intended to provide guidance, understanding that several values may be relevant to a given situation. Indeed, the hallmark of a challenging ethical decision is that one or more values are in tension and that there is no clear answer about which one to privilege in making a decision. This is why, when values are in tension with one another, it is of utmost importance to strive to reach genuine agreement through the engagement of stakeholders.

## Table 17-2: Ten Substantive Values to Guide Decision-Making

| | |
|---|---|
| Equity | All patients have an equal claim to receive the health care they need under normal conditions. During a pandemic, difficult decisions will need to be made about which health services to maintain and which to defer. Depending on the severity of the health crisis, this could curtail not only elective surgeries, but could also limit the provision of emergency or necessary services. |
| Duty to Provide Care | Inherent to all codes of ethics for healthcare professionals is the duty to provide care and to respond to suffering. Healthcare providers will have to weigh demands of their professional roles against other competing obligations to their own health, and to family and friends. Moreover, healthcare workers will face significant challenges related to resource allocation, scope of practice, professional liability, and workplace conditions. |
| Protection of the Public From Harm | To protect the public from harm, healthcare organizations and public health authorities may be required to take actions that impinge on individual liberty. Decisions makers should weigh the imperative for compliance; provide reasons for public health measures to encourage compliance; and establish mechanisms to review decisions. |
| Proportionality | Proportionality requires that restrictions to individual liberty and measures taken to protect the public from harm should not exceed what is necessary to address the actual level of risk or critical needs of the community. |
| Privacy | Individuals have a right to privacy in health care. In a public health crisis, it may be necessary to override this right to protect the public from serious harm. |
| Reciprocity | Reciprocity requires that society support those who face a disproportionate burden in protecting the public good and take steps to minimize burdens as much as possible. Measures to protect the public good are likely to impose a disproportionate burden on healthcare workers, patients, and their families. |

**Table 17-2** *(continued)*

| | |
|---|---|
| Solidarity | As the world learned from SARS, a pandemic influenza outbreak will require a new vision of global solidarity and a vision of solidarity among nations. A pandemic can challenge conventional ideas of national sovereignty, security, or territoriality. It also requires solidarity within and among healthcare institutions. It calls for collaborative approaches that set aside traditional values of self-interest or territoriality among healthcare professionals, services, or institutions. |
| Stewardship | Those entrusted with governance roles should be guided by the notion of stewardship. Inherent in stewardship are the notions of trust, ethical behavior, and good decision-making. This implies that decisions regarding resources are intended to achieve the best patient health and public health outcomes given the unique circumstances of the influenza crisis. |
| Trust | Trust is an essential component of the relationships among clinicians and patients, staff and their organizations, the public and healthcare providers or organizations, and among organizations within a health system. Decision makers will be confronted with the challenge of maintaining stakeholder trust while simultaneously implementing various control measures during an evolving health crisis. Trust is enhanced by upholding such process values as transparency. |

## Ethics in Practice

With an understanding of these ethical values and processes, it would be helpful to frame them in relation to some exemplary dilemmas that are often faced in a disaster. These ethical dilemmas are not meant to represent an exhaustive list of those that may be faced in a disaster, but rather they serve to illustrate how the proposed ethical framework can be used to identify key ethical aspects of decision-making.

### Priority Setting

In a disaster, the demand for healthcare services usually exceeds available resources. And when resources are scarce, tough choices need to be made

about who can be treated and what services can be offered. As such, difficult decisions need to be made about who ought to have access to ventilators, vaccines, antivirals, and other necessary resources in the health sector and in the community. Although clinical criteria can provide some guidance on how to set priorities, these are value-based decisions that cannot be made with reference to clinical criteria alone but can only rely on ethical reasoning. The ethical goals of priority setting are to allocate scarce resources in a legitimate, fair, and equitable manner.[7] This is especially important in the process of determining: whether priority ought to be given to the sickest patients or those most likely to survive, who ought to make these allocation decisions, and which medical services to maintain or place on hold during a disaster.[5]

A particularly salient example of priority setting that arose during the H1N1 pandemic was that of the ethical allocation of antivirals and vaccines. Here, the values of solidarity and protecting the public from harm would have required that priorities be set to maximize the capacity to help society ensure that the ill are cared for during a pandemic. Furthermore, proportionality would have required that decision-makers consider who within the community are most vulnerable to the contagion as well as who are most likely to benefit from immunization. A well-informed public conversant with the values in the ethical framework and aware of the expertise that informed the ranking of priorities for immunization would have been consistent with value of trust and the principle of transparency. This might also apply to standardized triage decisions before patient's arrival at a hospital in a pandemic where it is perceived that these patients can only be treated if there are sufficient resources.

## Communication

Poor communication among public health officials, healthcare workers, and the public was cited as a major factor contributing to the confusion and even spread of the virus during the time of SARS.[23,24] This was recognized by the WHO Global Conference on Severe Acute Respiratory Syndrome when their final report concluded that "information should be communicated in a transparent, accurate, and timely manner."[25] Outbreak communications take place at many different levels—from the physician's office to the municipal, federal, provincial, or international levels. Lack of jurisdictional coordination in communications undermines trust in public officials and redoubles the need for engagement with the public. Outbreak communications that build and preserve public trust can ultimately be an extremely effective public health tool that has a direct impact on mortality and morbidity at the local and the international levels.[26] In order to build trust, communication must be open and honest.[27,28] Information must be complete, accurate, and communicated proactively to the public.[26–30] Being transparent means being open about what is known and what is not known about the situation. Transparency in risk communications is necessary, if not sufficient, to ensure fairness and accountability in the management of a public health crisis.[27] Furthermore, the principle of reciprocity is a correlate principle to that of transparency. In order to encourage the public to be transparent about their own health status, there needs to be an acknowledgment on the part of the State that there are reciprocal moral obligations to ensure that transparency will not have negative consequences.

## Duty to Care

Response to disasters often requires a unified effort from both formal and informal healthcare systems that involve clinical and nonclinical health care workers (HCWs), professional and nonprofessional staff. For this reason, disasters present unique ethical dilemmas for frontline workers who face disproportionate risks of serious morbidity and mortality, particularly during infectious disease outbreaks,[31] such as the SARS outbreak where 95% of those infected in Taiwan were HCWs, or from toxic exposure, such as the sarin gas attack in Tokyo where nearly half of emergency department workers fell ill from cross contamination.[32] This leads us to question the nature of HCWs' obligation to treat patients despite the risk of infection and whether there are limits to this duty to care in a disaster setting. Further exacerbating occupational risks, HCWs may face competing personal and professional obligations to their patients, colleagues, employers, family members, as well as to their own health. Healthcare workers remember the pulmonary disease in fire crews who worked without adequate protection at the Twin Tower buildings. This may explain why 25%–85% of HCWs report being unwilling to show up for work in a pandemic.[33]

From this finding alone, we can argue that the duty to care may transcend individual provider considerations as such considerations are embedded within institutional and social contexts.[34] Indeed, the duty to care is not necessarily rooted in the professional virtues, self-sacrifice, and altruism of individual workers, as it has been traditionally understood. Rather, it arises from a social response to what values our society hold as important, how we are all vulnerable to infection and illness, and that this shared vulnerability underscores the importance of solidarity and reciprocity.[35] However, important documents such as Codes of Ethics and professional directives are not clear in stating the precise level of acceptable risk for HCWs to assume—and hence how ought the duty to care be circumscribed during a disaster.[31,*]

## Cultural Sensitivities

Cultural issues are exceptionally important and ethically germane in disaster response. Natural disasters and other forms of catastrophic events are natural magnets for media attention. However, as Bhan[36] pointed out, there is a failure to respect privacy of victims, as well as the concern of cultural appropriateness of the visual depiction of casualties. Bhan[36] argues that "health professionals and administrators can and should control media access to hospitals, clinics, and disaster sites on the grounds that the public's right to information should not outweigh the rights of victims to privacy, confidentiality, and dignity." So, while the media can play an important role in galvanizing public opinion and relief efforts, they can also infringe on the privacy of families when they are emotionally shattered, thus causing disrespect to both survivors and victims.

*For more information on the legal issues regarding safety in the workplace, please refer to Chapter 9, Scene Safety.

## Research in Disaster Management

It is important to evaluate the role of research during a disaster. There is often an imperative for novel research to be conducted during and following a disaster in order to effectively respond to the outbreak while minimizing morbidity and mortality as well as inform and enhance response for future disaster planning efforts. Indeed, much can be learned from research that is conducted during or following disasters. One study indicates that the knowledge derived from research following a natural disaster has helped psychologists predict how individuals and groups will react in these situations and how it has shaped the development of interventions to help people recover following a disaster.[37] Such results indicate that human subjects research conducted during and following a disaster may increase the understanding of the human response to trauma and further explicate ways in which the negative effects of disaster on individuals can be mitigated,[38] which, it has been well documented, can have acute and chronic effects on individuals and populations, including physical, mental, and economic effects. To this end, the protection of human subjects in research is facilitated by the review and monitoring by oversight bodies such as research ethics boards (REBs) or institutional review boards (IRBs). Although these committees conventionally balance potential benefits and harms to human subjects while adhering to core ethical principles to evaluate and approve research protocols, they are guided by limited discourse regarding the protection of human subjects during a disaster.[39]

This has led many to question whether the extenuating circumstances seen in a disaster setting justify the adjustment of the ethical standards afforded in ordinary research.[40] This may be necessary in view that the recognition that certain individuals and populations may be particularly vulnerable as participants of research following a disaster. This poses an ethical challenge because some survivors of trauma may be unable to anticipate the distress that will accompany research participation, as the process of investigation may evoke potentially disabling memories of emotionally painful experiences.[41,42] Another ethical challenge is that of research ethics governance in a disaster, for example, the research ethics review processes that must balance the urgency and necessity of having a timely response relative to the level of immediate threat to the public without compromising due process. Furthermore, we must be aware of redundant proposals for research that may potentially oversample a given population during a disaster, which may require mechanisms to coordinate the review of research proposals.[39] Finally, depending on the severity of the outbreak, research ethics committees may be unable to meet in person or research may be contemplated in jurisdictions where no functioning oversight exists. All of these complications do not negate the importance for appropriate oversight, but rather that innovative governance processes may need to be contemplated to efficiently and ethically conduct research in disasters.[43] So, while some strongly support the view that additional attention must be paid to ensure the proper protection of human subjects[44] and management of research, one may also pose the question: what are the ethics of *not* conducting research to answer the profound questions that we face during disasters?[45]

Protecting human subjects is not the sole ethical challenge in research surrounding disaster planning and response. In disaster situations, it is also imperative that both researchers and research ethics committees carefully balance their duty to research participants with their duty to fellow researchers and, more broadly, the pursuit of scientific integrity.[41] Due to the magnitude and time sensitivity of disaster response, research involving tissue and public health data is often conducted on a large scale, requiring significant resources over time. Thus, in an influenza pandemic or other infectious disease outbreaks, for example, there is an impetus to coordinate efforts among scientists to acquire knowledge pertaining to novel infectious agents, modes of transmission, and the effectiveness of preventive measures and other interventions. But while under nonpandemic situations, researchers enjoy intellectual property rights protection over the data and results obtained from their research, specific moral questions arise regarding the obligations of researchers during a pandemic. For instance, while the open sharing of data or tissue samples may enable researchers and public health authorities to better contain a virus or prevent unnecessary suffering, conflict may arise when intellectual rights of researchers are required to be balanced with the greater societal interest to do everything possible to protect the public during a pandemic or disaster. This tension was seen in the race to patent the SARS virus which brought to light, as Rimmer[46] discussed, "the tension between securing private patent rights and facilitating public disclosure of information and research."

Within this context, some have even suggested that prepublication of data sharing ought to be promoted not only by the researchers but also by the scientific journal editors to give rapid exposure to findings of a time-sensitive nature. More broadly, others have advocated that mechanisms need to be in place to ensure that the sharing of tissue samples and data is mutually beneficial to researchers and society, and such mechanisms ought to be transparent to engender a sense of trust among different stakeholders.[47] But the sharing of data would necessitate significant buy-in from global scientific communities and governments who operate within a well-entrenched system that only rewards ownership of proprietary data.

This consideration is true and very pertinent to the 7/7 bombings in London, England where publication of data relating to the incident was very sensitive from the survivors perspective. There is a survivors group who still meet regularly. Similarly, the Marchioness Disaster in 1989 on River Thames created much ethical anxiety in relation to the publication of Coroners reports.

Although the ethical issues presented here focus mainly on the issues related to generating descriptive epidemiological, virological, or clinical data, important questions also exist regarding affected communities and how research can be utilized to provide immediate or future benefit to those populations. Furthermore, as the recent controversy surrounding the H5N1 virus specimens from Indonesia demonstrates, affected parties may need to be adjusted from considering the inequity between the researcher and the community, to consider inequities between industrialized and developing countries.[40] This question of benefit sharing presents unique ethical challenges that not only affects how research is conducted during a disaster but also questions the paradigm of scientific investigation in its conveyance of benefit.

## Conclusion

A significant insight learned from the SARS experience and subsequent disasters, was that in times of crisis, "where guidance is incomplete, consequences uncertain, and information constantly changing, where hour-by-hour decisions involve life and death, *fairness is more important, rather than less* [emphasis added]."[6] Considerations of fairness are important in both procedural and substantive ethical frameworks. This is because there is a need for fair decision-making processes as well as equitable distributions of scarce human and material resources[48] because when resources are scarce and decisions must be made with limited information, a fair process is critical to establish the legitimacy of allocation decisions and to preserve trust among those affected.

We hope that no disaster will end civilization. Such a cataclysmic event would render ethics and, indeed, all human affairs moot. That said, it is more likely that no disaster will result in the complete and utter destruction of human life, which means that there will also be those who survive these situations and reflect on the fairness, justice, and adequacy of the response to the disaster. In other words, evaluation will always occur in the aftermath of a disaster and questions of accountability and responsibility will be inevitably raised.

With that in mind, there is no question that ethics plays a fundamental role in disaster preparedness, disaster response, and in the evaluation of response to disasters. For this reason, it is important that ethical learning be incorporated into disaster planning and that it be an important part of the assessment, response, and evaluation phases. Most crucially, it is fundamentally important to have a clear and explicit discussion of the ethical principles underpinning human actions and interventions. Finally, it is incumbent on disaster planners to provide the space and opportunity for first-line disaster responders to reflect on their own ethical perspectives, as well as to develop by consensus an explicit ethical framework to guide response. For a while, an ethical framework in no way guarantees outcomes, it provides, at the very least, evidence of foresight and attention to complex and difficult decisions affecting the fate of individuals and communities.

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Chapter 18

# Medico-Legal Issues

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# Preface

Hospitals and other healthcare facilities function in an environment of ever-increasing accountability and transparency. In Ontario, hospitals are subject to reporting requirements for critical incidents and hospital-acquired infection rates and are required to disclose this information on hospital websites. Some infection rates for hospital-acquired infections are also published on the Ontario Hospital Association's (OHA) myhospitalcare.ca website, which allows members of the public to compare performance indicators for Ontario hospitals, including hospital-acquired infection rates and wait times for certain procedures. Since the SARS crisis in 2003, there has been increased scrutiny by the public and by healthcare workers of the occupational health and safety precautions and staff support systems implemented by healthcare facilities for their staff.

One of the key responsibilities of the board of directors of any organization is to identify the principle risks and implement systems to manage those risks. Disaster planning is part of this responsibility. In the context of disaster planning for healthcare organizations, there are a myriad of issues that arise including occupational health and safety issues, employment and labor issues, public health reporting requirements, issues relating to regulated healthcare professionals and their duty to care, privacy concerns, and consent to treatment issues. Healthcare organizations should take a proactive approach to anticipating risks. As urged in the SARS Commission report, "we should be driven by the precautionary principle that reasonable steps to reduce risk should not await scientific certainty."[1]

This chapter gives an overview of medico-legal issues relevant to healthcare practitioners and healthcare facilities in the event of a disaster such as an outbreak of a communicable disease. Although the general issues are mirrored in other provinces, the legislation referred to in this chapter is Ontario focused. Legal advice should always be sought from counsel qualified to practice in the appropriate jurisdiction, as this chapter is not intended to replace the need for legal advice.

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## Occupational Health and Safety Legislation

It was reported that during the SARS crisis in 2003, "of the almost 375 people who contracted SARS in Ontario, 72 percent were infected in a healthcare setting. Of this group, 45 percent were healthcare workers."[2] Occupational health and safety measures are evidently a key component of any risk management strategy for a healthcare organization.

Occupational health and safety legislation imposes obligations on employers, including hospitals, long-term care and other healthcare facilities and clinics, to establish measures and procedures for the health and safety of their workers and to protect, inform, and train their workers. These obligations include preparing the workplace and workers, including physicians, for disasters.

Under the *Occupational Health and Safety Act*[3] (OHSA), employers in Ontario have a duty to take every precaution reasonable in the circumstances to protect their workers.[4] In addition, employers must

- establish and implement a written occupational health and safety policy, to be reviewed at least annually,
- ensure that measures and procedures prescribed by the legislation are carried out in the workplace,[5]

- provide and maintain protective devices (such as masks) and ensure their proper fit and use,[6]
- inform, instruct, and supervise workers to protect their health and safety.

Under the OHSA, there is a specific regulation relating to healthcare and residential facilities. This regulation establishes a general duty of employers to develop, establish, and put into effect measures and procedures for the health and safety of their workers, in consultation with the joint health and safety committee or health and safety representative. Employers are required to prepare written health and safety measures and procedures, covering a list of required topics, including safe work practices and conditions; proper hygiene practices; the control of infections, immunization, and inoculation; the use of antiseptics, disinfectants, and decontaminants; the hazards of biological, chemical, and physical agents; and the use of personal protective equipment.[7]

If a worker has an occupational illness, including healthcare-associated infection due to workplace exposure, this must be reported by the employer to a director appointed under the OHSA, to the Joint Health and Safety Committee or health and safety representative, and the worker's trade union.[8]

In addition, the issue of a worker's right to refuse to work in unsafe conditions arose in the context of SARS, as well as in connection with H1N1.[9] Employers should be aware that under the OHSA, a worker may refuse to work or do particular work where he or she has reason to believe that any equipment, machine, device, or thing the worker is to use or operate is likely to endanger himself/herself or another worker, or if he or she is likely to be endangered by the physical condition of the workplace or the part of the workplace in which he or she works.[10] The worker may also refuse to work if any equipment, machine, device, or thing he or she is to use or operate or the physical condition of the workplace (or the part he or she works in) is in contravention of the Act or the regulations, and such contravention is likely to endanger himself/herself or another worker.[11] The right to refuse to work would not apply if the danger is inherent in the worker's work or is a normal condition of employment or the worker's refusal would endanger the life, health, or safety of another person.[12] This is discussed further under section "Duty to Treat."

- Conduct risk assessments in consultation with the Joint Health and Safety Committee or health and safety representative, as applicable.
- Establish and ensure frequent review (at least annually) of occupational health and safety policies and procedures.
- Schedule regular orientation for employees with respect to occupational health and safety policies and procedures.
- Consider whether requiring staff to be immunized is appropriate for your organization and establish an immunization policy and procedure for employees and volunteers. Ensure that employees and volunteers are educated in advance about the organization's immunization policy (see the discussion below relating to immunization policies).
- Ensure proper maintenance and storage of personal protective equipment and other safety devices.

- Ensure proper initial and ongoing training of employees with respect to the hygiene, the control of infections, the use of antiseptics/disinfectants/decontaminants, and the use of personal protective equipment.
- Document training sessions (who attended, when the session was held, materials and topics covered, etc.).

## Public Health Legislation

Each province and territory has enacted public health legislation. *Ontario's Health Protection and Promotion Act* (HPPA)[13] states that its purpose "is to provide for the organization and delivery of public health programs and services, the prevention of the spread of disease and the promotion and protection of the health of the people of Ontario."[14] To carry out this purpose, the HPPA establishes reporting obligations for individual health practitioners, as well as hospitals and other institutions, and empowers medical officers of health to make orders affecting hospitals and other institutions relating to reportable or communicable diseases. At present, reporting requirements under the HPPA relate only to those reportable and communicable diseases that are listed in regulations made under the HPPA.[15]

The HPPA imposes reporting requirements on physicians and other healthcare providers to report patients, outside of the hospital setting, who may have a reportable disease.[16] Physicians and extended class nurses also have a similar requirement to report persons who are infected or may be infected with an agent of a communicable disease[17] and any persons who refuse or neglect to continue treatment for a communicable disease.[18] Physicians and all nurses also have obligations to make a report in the event they sign a death certificate where a cause of death was a reportable disease.[19] In addition, physicians, nurses, and pharmacists must make a report to the medical officer of health in the event they witness certain adverse reactions to immunization.[20]

Hospital administrators and superintendents of institutions also have reporting requirements with respect to patients who have or may have a reportable or communicable disease.[21] In addition, laboratories must make a report to the medical officer of health if a positive laboratory finding is made in respect of a reportable disease.[22]

Hospitals and other institutions should also be aware of the broad powers given to medical officers of health under public health legislation to make orders with respect to communicable disease outbreaks at a hospital or institution and to request orders from the courts to order a patient into isolation or for treatment and detention in a hospital or other facility.[23] Under Section 22 of the HPPA, a medical officer of health can make a written order requiring a person to take or refrain from taking an action in respect of a communicable disease where a communicable disease exists, may exist, or there is an immediate risk of an outbreak of a communicable disease; the communicable disease presents a risk to the health of persons in the health unit; and the requirements in the order are necessary to decrease or eliminate the risk to health posed by the communicable disease.[24] An order may include requiring the owner or occupier of premises to close the premises; requiring a person to isolate himself or herself; requiring the person to submit to an examination by a physician and deliver a report as to whether he or she has a communicable disease or is infected with a communicable disease agent; requiring the person to place himself or herself

under the care and treatment of a physician; or requiring the person to conduct himself or herself in such as way as to avoid exposing others to infection.[25] An order may be directed to a person who resides or is present in the health unit, owns or occupies any premises, owns or is in charge of any thing, or is engaged in or administers an enterprise or activity.[26]

Where a person fails to comply with an order of a medical officer of health in respect of a communicable disease that is a virulent disease, a judge of the Ontario Court of Justice can order the person into isolation, to submit to examination by a physician, to place himself or herself under the care and treatment of a physician, and to conduct himself or herself in such a manner as to not expose another person to infection.[27] In such an order, the judge may order that the person be taken into custody and detained in a hospital or other facility and be examined by a physician to determine whether the person is infected with an agent of a virulent disease, and if so, to be treated.[28] A judge may make an order for detention in a hospital or facility if he or she is satisfied that the hospital or facility has the ability to provide detention, care, and treatment for the person.[29] These powers have been tested in the courts and were upheld, for example, in *Medical Officer of Health (City of Toronto) v McKay*, where the Medical Officer ordered that the detention of a person suffering from tuberculosis be extended for four months on the basis that the person's release into the community would "present a significant risk to the health of the public." [See Endnote]

In addition, the minister has the ability to order any publicly owned premises to be used for public health purposes and any privately owned premises to be used as a temporary isolation facility. The Minister may seize medications and supplies, including antivirals, antitoxins, vaccines, immunizing agents, and antibiotics in the event that there exists or may exist an immediate risk to the health of persons anywhere in Ontario, the premises are needed for use for public health purposes in respect of the immediate risk of an outbreak of a communicable disease, the outbreak of the communicable disease or the immediate risk to the health of persons, the medications and supplies are necessary to address the risk, and regular procurement processes are unable to meet the needs of Ontarians.[30]

- Review applicable legislation for reporting and other requirements with legal counsel, including the information that must be included in a report and the timelines for submitting a report.
- Establish protocols for reporting communicable and reportable diseases to the medical officer of health.
- Organize education sessions for staff regarding reportable and communicable diseases and reporting requirements.

## Emergency Management Legislation

The Federal *Emergency Management Act* (FEMA)[31] sets out the duties of the various ministries to establish, maintain, test, and implement emergency management plans.[32] FEMA allows the government to declare emergencies, including public welfare emergencies, and to take certain temporary measures in the event of an emergency for safety and security.

Federal institutions may not intervene in a provincial emergency, unless help is requested by the province or there is an agreement in place that requires or permits assistance.[33] Each of the provinces and territories has emergency

management legislation in place. For example, the Ontario *Emergency Management and Civil Protection Act* sets out the requirements for emergency management programs of provincial ministries and municipalities and vests the power to declare an emergency in the Lieutenant Governor in Council or the Premier.

## Public Hospitals

The vast majority of hospitals in Canada are public hospitals. In Ontario, these are governed by the *Public Hospitals Act* (PHA).[34] The PHA imposes obligations on the Board and hospital administrator, which are relevant to disaster planning.

Hospitals' boards of directors are required under the PHA to ensure that contingency plans and procedures are in place in the event of a disaster and that appropriate health and safety mechanisms are established. Under the PHA, boards must ensure that the administrator, medical staff, chief nursing executive, staff nurses, and nurse managers develop business continuity plans to anticipate increased demand on hospital services, disruptions to hospital routines, and the risk that service providers will not be able to provide needed services during an emergency.[35] Mechanisms for ongoing oversight of health and safety must also be established. Specifically, hospital boards must ensure that the by-laws establish a committee for infection control[36] and establish and provide for the operation of an occupational health and safety program.[37]

In addition, hospital boards must also establish and provide for the operation of a health surveillance program, including a communicable disease surveillance program in respect of all persons carrying on activities in the hospital,[38] including not only employees and professional staff but also service providers who carry on activities on the hospital's premises and volunteers. The communicable disease surveillance program must include the tests and examinations set out in the applicable communicable disease surveillance protocols jointly developed by the OHA and Ontario Medical Association (OMA) and approved by the Ministry of Health and Long-Term Care.[39] There are currently 17 such protocols, including protocols for influenza and tuberculosis, as well as a template for medical directives. Intended as a minimum standard and to supplement the hospital's existing processes, the protocols are reviewed and updated from time to time. Current copies of these protocols may be downloaded from the OHA website (www.oha.com) for reference.

Hospitals have both internal reporting obligations within the organization and external reporting obligations to the Minister of Health and Long-Term Care that may be relevant in a disaster. Within the organization, physicians, oral and maxillofacial surgeons, or midwives who admit a patient who is or may become dangerous to himself/herself or other persons must notify the administrator of the hospital immediately.[40] An attending physician, dentist, midwife, or extended class nurse who knows or suspects his or her patient is suffering from an infectious disease or condition must immediately notify the administrator and either an infection control officer or an infection control nurse.[41]

Hospitals are also required to report hospital-acquired infections to the minister and to disclose such information on the hospital's website including *C. difficile*. The OHA myhospitalcare.ca website also discloses hospital-acquired infection rates for *C. difficile* and wait times for certain procedures for Ontario hospitals. Although hospitals are bound by their various reporting obligations,

there is no concomitant legal liability for failing to prevent an outbreak. In *Eliopoulos v Ontario (Minister of Health and Long-Term Care)*, the Ontario Court of Appeal held that public health authorities did not owe a private law duty of care to an individual who contracted West Nile Virus, because the risk was faced by the public at large and the risk was not created by the public health authorities who were duty bound to respond to it. [See Endnote] Similarly, in *Healey v Lakeridge Health Corporation*, the Ontario Court of Appeal held that "psychological injuries" suffered by a class of individuals who received notice that they may have been exposed to TB was not compensable in law because they did not amount to a "recognizable psychiatric illness". [See Endnote]

Many of the health and safety requirements set out in the PHA are required by the PHA to be codified in the hospital's by-laws, including the requirement for the establishment and operation of the occupational health and safety and health surveillance programs.[42]

Boards are also responsible for appointing the professional staff of the hospital on an annual basis and for ensuring that the by-laws of the hospital set out the criteria for appointment and reappointment to the professional staff.[43] Many hospitals are now including in their by-laws the requirement that applicants to the professional staff provide evidence of their immunization status in compliance with the communicable disease surveillance protocols and disclose any health issues that may affect safety or the applicant's ability to practice.

- Review the organization's communicable disease surveillance program and adopt the practices that meet or exceed the standards set out in communicable disease surveillance protocols for your jurisdiction.
- Develop a business continuity plan to anticipate potential disruptions (involving personnel, supplies, transportation, utilities, etc.) and schedule a review of the business continuity plan at least annually
- Ensure new staff are oriented to their reporting obligations and schedule regular education sessions for staff on reporting obligations, infection control, and other occupational health and safety issues.
- Ensure that by-laws and credentialing forms reflect best practices and comply with the requirements of the PHA.
- Develop a communications strategy in case of pandemic or other disaster.

## Private Hospitals

In Ontario, regulations under the *Private Hospitals Act* include requirements for testing employees for tuberculosis within 30 days of their employment. Employees testing positive will not be permitted to work, and the superintendent must report the case to the medical officer of health. Legally qualified medical practitioners who believe or suspect a patient has tuberculosis must make a report to the superintendent. In addition, employees who are detailed to care for a patient with tuberculosis must first receive training into how to protect himself or herself and others from infection, and where possible, the employee shall be a reactor to tuberculin. On ceasing to be employed, every employee shall receive an x-ray of his or her lungs.[44]

## Long-Term Care Facilities

At present, there are 3 pieces of legislation that govern long-term care homes in Ontario: the *Nursing Homes Act*, the *Homes for the Aged and Rest Homes Act*, and the *Charitable Institutions Act*. A new piece of legislation that will replace these 3 acts, the *Long-Term Care Homes Act, 2007*, received Royal Assent in 2007, but has not yet been proclaimed in force.

Each of the *Nursing Homes Act*, the *Homes for the Aged and Rest Homes Act*, and the *Charitable Institutions Act* contains requirements for the licensee with respect to the protection of the health and safety of residents and implementation of communicable disease protocols. Each of these 3 acts sets out a resident's bill of rights that includes the right of residents to live in a safe and clean environment. Facilities governed by one of these 3 acts must also. The *Long-Term Care Homes Act, 2007* (LTCHA), contains specific requirements with respect to infection prevention and control. It includes the broad requirement that every licensee of a long-term care home ensure that the home is "a safe and secure environment for its residents."[45] Beyond this general requirement, the act contains specific requirements for an infection prevention and control program,[46] emergency plans for relocating and evacuating residents and staff, and orientation of staff and volunteers to infection control and emergency procedures.[47]

The LTCHA and its regulations require the infection prevention and control program to include daily monitoring to detect infection in residents and measures to prevent the transmission of infection.[48] Under the regulations, the infection prevention and control program must include the implementation of any communicable disease protocol provided to the licensee by the ministry,[49] and the establishment of an outbreak management system and a written plan for responding to infectious disease outbreaks.[50] A staff member with appropriate education and experience must be designated to coordinate the program.[51] Licensees are also required to provide appropriate personal protective equipment, a hand hygiene program including access to point-of-care hand hygiene agents, and training for staff at least annually in routine infection prevention and control practices.[52]

The LTCHA also requires that licensees establish emergency plans to deal with emergencies and procedures for evacuating residents and staff and relocating residents in the event of an emergency. Emergency plans must be tested annually or at least once every 3 years depending on what the plan is related to, evaluated, updated and reviewed at least annually[53] In addition, orientation of staff must include fire prevention and safety, emergency and evacuation procedures, and infection prevention and control.[54] Volunteers must also be oriented on fire safety and universal infection control practices.[55]

Regulation 79/10 under the LTCHA also includes requirements for screening and immunization of staff and residents.[56]

- Establish infection prevention and control program and outbreak management program and schedule regular reviews of the programs.
- Plan regular orientation sessions and training for staff and volunteers regarding infection prevention and control, emergency and evacuation procedures, and fire prevention and safety and maintain documentation of the sessions, when they were held, attendees and materials and topics covered.

- Review communicable disease protocols regularly and ensure implementation and compliance with protocols as a minimum standard.
- Ensure appropriate supply and maintenance of personal protective equipment and hand hygiene supplies.

## Accreditation Canada

In Canada, many organizations participate in a voluntary accreditation process administered by Accreditation Canada. To receive accreditation, an organization must demonstrate compliance with the standards established by Accreditation Canada, including those relating to infection prevention and control. These standards were developed based on best practice and standards of the Public Health Agency and the Community and Hospital Infection Control Association of Canada. Infection control and risk assessment is also one of 7 required organization practices identified by accreditation Canada, although passing the accreditation process does not in and of itself provide confirmation of disaster preparedness.

## Employment Standards Legislation and Special Legislation (e.g., SARS)

Employers must be prepared for a significant number of staff absences during a disaster. Despite the fact that the H1N1 pandemic of 2009 had a relatively low morbidity, the Ontario government has estimated in the Ontario Health Plan for an Influenza Pandemic (OHPIP). Brief that "during the period of peak activity in a pandemic wave during a moderately severe pandemic, about 20% to 25% of the workforce will be absent from work for at least half a day" and that "regardless of the severity of the pandemic, there will be an illness attack rate of 35%, which means that over the course of a pandemic about 35% of the population will be sick enough with influenza to take at least a half-day off work." The OHPIP also estimates that "during a pandemic, the public health and healthcare workforce could be reduced by up to 25% due to illness, concern about disease transmission in the workplace, and family caregiving responsibilities."[57] In addition, during the SARS outbreak, Toronto quarantined about 30,000 people.[58]

Employment standards legislation in the provinces and territories provides statutory requirements for emergency and personal leave for employees. In Ontario, the *Employment Standards Act* (ESA)[59] provides for emergency leave during emergencies declared under the EMCPA, where the employee is subject to an order under the EMCPA or an order under the HPPA or is required to provide care to certain relatives.[60] Employees are also entitled to personal emergency leave for illness, injury, or medical emergency, as well as in the event of death, illness, injury, or medical emergency or urgent matters concerning certain listed family members.[61]

In response to the SARS outbreak in 2003, the *SARS Assistance and Recovery Strategy Act, 2003*,[62] was passed and included emergency leave entitlements in addition to those provided for in the ESA. The act provided for additional

unpaid leave for employees who were unable to work because he or she was under medical investigation, supervision, or treatment related to SARS; subject to an order certain sections of the HPPA; quarantined or isolated in relation to SARS; directed not to work by the employer out of concern that the individual would expose other individuals in the workplace to SARS; or was required to care for a person because of a SARS-related matter.

Employers should be aware that it is possible for the government to enact special legislation that may impact on employee rights in the event of an outbreak or other disaster.

- Establish policies consistent with the ESA for emergency leave and prepare contingency plans for the absence of key personnel.
- Establish Human Resources policies for employee absences.
- Establish support services for employees during a pandemic or other disaster, including counselling.

## Immunization of Employees and Access to Antivirals and Vaccines for Staff

The Influenza Surveillance Protocol for Ontario Hospitals jointly developed by the OHA and the OMA provides minimum standards for influenza surveillance in hospitals. As part of the stated rationale for the protocol, the OHA and OMA referred to the views of the National Advisory Committee on Immunization:

> The National Advisory Committee on Immunization considers the provision of influenza vaccine for health care workers who have direct patient contact to be an essential component of the standard of care for the protection of their patients. Health care workers who have direct patient contact should consider it their responsibility to provide the highest standard of care, which includes undergoing annual influenza vaccination. In the absence of contraindications, refusal of health care workers who have direct patient contact to be immunized against influenza implies failure in their duty of care to their patients.[63]

The protocol provides that hospitals should establish a policy for annual influenza surveillance, immunization, and outbreak control and use of a neuraminidase inhibitor antiviral agent, such as Oseltamivir, for unvaccinated healthcare workers. It recommends that documentation should be kept by the hospital of each person's status, including any refusal of vaccination. A healthcare worker who receives vaccination should be managed as unvaccinated until 14 days after the date of vaccination. Unvaccinated healthcare workers working in the outbreak area or unit should be required to take antiviral prophylaxis in the event of an outbreak, and unless contraindicated, the vaccine should be provided. Unvaccinated healthcare workers who are not receiving antiviral prophylaxis must be excluded from patient care and activities that have potential to acquire or transmit influenza. A healthcare worker may resume work as soon as antiviral prophylaxis is started and it should be continued for 2 weeks after the vaccine is provided (i.e., until immunity develops) or until the outbreak is over, whichever is shorter. If there is a mismatch between the vaccine strain and the outbreak

strain of influenza, antiviral prophylaxis must be offered to all healthcare workers regardless of their vaccination status. A healthcare worker who does not provide documentation of their vaccination status should be managed as unvaccinated.[64]

As discussed earlier, healthcare and residential facilities are required to develop, establish, and put into effect measures and procedures for the health and safety of their workers, which can include immunization and inoculation against infectious diseases.[65] Many hospitals and healthcare institutions have implemented immunization programs for their employees, given the increased risk of exposure for healthcare workers, and the vulnerability of the patients to whom they provide care.

Through their unions, healthcare employees have challenged the legitimacy and reasonableness of employers' policies requiring that nonimmunized workers remain off work without pay during an outbreak, on the basis that the policies infringe on rights to security of the person or interfere with economic rights. Generally, the cases have considered the underlying purpose and rationale for the policy, the options and accommodation available to employees, the content of the collective agreements in place, and the balancing of employees' rights with patients' rights and have upheld the mandatory immunization program.

In one Ontario case, however, a labor arbitrator found that the hospital's immunization policy violated employees' rights to security of the person. In that case—*St Peter's Health System v Canadian Union of Public Employees, Local 778 (Flu Vaccination Grievance)*—following an outbreak of influenza, the hospital suspended 15 employees who chose not to be vaccinated or take medication in accordance with the hospital's flu policy. The employees filed a grievance. The union raised the issue that "with neither statutory or collective agreement authority, the hospital has no right to impose as a condition of employment forced medical treatment either by virtue of a flu shot or the requirement to take medication, and therefore this is the most serious form of invasion of privacy, because it gives the employer a right to invade the person."[66] In turn, the hospital argued that the policy is part of the core of sound infection control and that the hospital was acting with good faith and for bona fide patient care reasons to reduce transmission of flu in a high-risk population.[67] In allowing the grievance, the labor arbitration board found that suspending employees for refusing to undergo medical treatment is a violation of their common law Section 7 rights under the *Charter of Rights and Freedoms* (Charter). The board noted that in virtually all cases, enforced medical treatment is an assault if there is no consent.[68] It also observed that it was unusual given the seriousness of what was being asked of employees that the hospital did not seek statutory authority to do so through the Ministry of Health and Long-Term Care or attempt to bargain for it.[69]

In contrast, in *Health Employers Assn of British Columbia v British Columbia Nurses' Union*,[70] the arbitrator found the employer's immunization policy to be reasonable and not in violation of Section 7 of the Charter. In contrast to the *St Peter's* case, in this instance, the provincial medical health officer had issued a direction requiring health employers to implement a policy that required nonimmunized staff to be excluded from work in the event of an influenza outbreak within the facility. The British Columbia Interior Health Authority implemented such a policy. In dismissing the grievance, the arbitrator distinguished the case from the *St Peter's* case, noting that the *St. Peter's* case had not considered the question of the protection of economic rights under Section 7 of the Charter and that it had been framed as an "assault/battery" case

instead. The arbitrator held that that the implementation of the policy had not caused the deprivation of the liberty or security of a person such that Section 7 of the Charter is engaged.[71] In reaching this conclusion, the arbitrator observed:

> It is not evident that a loss of a number of days or weeks of work during the flu season would meet the threshold set out above to reach the conclusion that there had been a loss of liberty or security protected under Section 7 of the Charter. . . . It is not evident the economic consequences of failing to become immunized are so severe that they effectively deny an individual choice over her body.[72]

Furthermore, the arbitrator found that the leave was not considered disciplinary.[73] In addition, the arbitrator found that the rationale for the policy—to assist in preventing the spread of influenza among a vulnerable population—is clear, and furthermore, the employees had the choice of refusing the vaccine and/or the antiviral medication.[74]

In *Trillium Ridge Retirement Home and Service Employees Union, Local 183*,[75] the arbitrator also reached the conclusion that the employer's influenza vaccination policy was reasonable and designed to meet the employer's legitimate and crucial objectives. In that case, the employer's policy provided staff with a choice to be immunized; to be immunized in the event of an outbreak and to wait 2 weeks for the acquisition of immunity; or to take antiviral medication and be able to report for work within 48 hours. If neither option was chosen, the staff member would be granted time off work without pay. Employees who had a medical contraindication (allergy, pregnant/nursing, or other sound medical basis) would be exempted from the requirement to be immunized or to take antiviral medication. Staff were encouraged to seek advice from their own physician, and in addition, the employer took steps to educate staff through notices and phone calls of the options available to them, and to advise that nonimmunized staff would not be permitted to work. The policy was also in keeping with recommendations from the Medical Officer of Health.

The arbitrator concluded that the policy was not mandatory in requiring employees to be immunized or take the antiviral medication. The employee could choose to refuse either measure, although there was a cost to such refusal in that the employee could not attend at work and be paid during an outbreak.[76] The arbitrator further found that the policy was not arbitrary or unreasonable and did not violate the collective agreement. Leave without pay was not considered a disciplinary penalty or constructive lay off. Moreover, the cost did not vitiate consent to immunization or the administration of antiviral medication. The arbitrator further recognized that in a long-term care setting, employees must realize that special measures may be needed to safeguard the health and safety of the frail elderly population they serve.[77] This objective was found to be of sufficient importance and the serious consequences of ineffective immunization on residents were considered sufficiently grave that the policy was reasonable and not arbitrary in the circumstances. Finally, the arbitrator advised that the policy should be posted in accessible locations in all departments of its facility to ensure there would be no misunderstanding about the content or application of the policy.[78]

Employers who provide immunization and antiviral medication for their employees and/or their family members should ensure that they have appropriate consent documentation and waivers for this purpose.

- Review immunization policy and collective agreement with legal counsel.
- Consider posting copies of policy in accessible locations in the hospital.
- Schedule education sessions for staff to explain the immunization policy in advance and include the policy in orientation materials for new staff members.
- Review consents and waivers relating to immunization or provision of antiviral medication.

## Ontario Human Rights Code

The Ontario *Human Rights Code* (Code) protects against discrimination in employment on certain prohibited grounds. Section 5(1) of the Code provides: "Every person has a right to equal treatment with respect to employment without discrimination because of race, ancestry, place of origin, color, ethnic origin, citizenship, creed, sex, sexual orientation, age, record of offences, marital status, family status or disability."[79]

The Ontario Human Rights Tribunal has held that a worker's bronchitis, for example, is not a disability under the Code, as it is commonly experienced by many and does not impact on the individual's ability to fully participate in our society.[80] In its decision, the Tribunal referred to the decision of the Board of Inquiry in *Ouimette v Lily Cups Ltd* in which it held that the flu, a temporary illness, was not a disability under the Code and that to include commonplace illnesses under the ground of disability would have the effect of trivializing the Code's protections.[81] The Tribunal further observed that "even where the courts have applied a broad and contextual definition to the notion of disability, everyday illnesses have been excluded."[82] In *McLean v DY 4 Systems*, however, the Tribunal held that tuberculosis is a disability under the Code because, once contracted, it remains with the individual, and can become active at any time. As such, it is not a minor or transitory illness. [See Endnote] In consequence, healthcare organizations are required to accomodate (to the point of undue hardship) any healthcare workers that test positive for TB in the event of an outbreak. In doing so, however, healthcare organizations may properly assert that it is a *bona fide* occupational requirement that frontline workers not be TB positive. Further, under the regulations of the *Private Hospitals Act*, it is mandated that no employee found suffering from active TB shall be permitted to work in the hospital. [See Endnote]

## Privacy

The federal *Personal Information Protection and Electronic Documents Act* (PIPEDA) applies to organizations that collect, use, or disclose personal information, including personal health information, in the course of commercial activity. Tracey Bailey et al. report that Industry Canada's view is that PIPEDA does not apply to hospitals, but would apply to physicians in private practice and laboratories.[83] A number of provinces have enacted their own private sector legislation and/or legislation to deal specifically with the collection, use, and disclosure of personal health information. Where provincial privacy legislation has

been declared to be "substantially similar" to PIPEDA, it takes precedence.

Ontario's *Personal Health Information Protection Act, 2004* (PHIPA) has been determined to be "substantially similar" to PIPEDA, and therefore, the collection, use, and disclosure of personal health information are governed in Ontario by PHIPA. With respect to personal health information, PIPEDA applies in Ontario only in relation to extra-provincial and international disclosures.

Under PHIPA, the individual's consent must be obtained for the collection, use, or disclosure of his or her personal health information.[84] Health information custodians, such as hospitals, clinics, and physicians, must comply with PHIPA when dealing with patient's personal health information.

In an emergency, there may be instances where obtaining the patient or substitute decision maker's consent for the collection, use, and disclosure of personal health information will not be possible.[85] In certain circumstances, a health information custodian may disclose personal health information to certain other health information custodians.[86] These circumstances include when disclosure is in the public interest or there is a grave hazard to the public; where the disclosure would reduce or eliminate a significant risk of serious bodily harm to a person(s)[87]; disclosure for a public health purpose[88]; compassionate circumstances; to allow a family member of deceased person to make decisions about their own health or to identify the deceased[89]; and finally, where consent cannot be obtained in a timely manner and disclosure is reasonable necessary for the purpose of providing health care.[90]

The HPPA also creates an exception for medical officers of health to collect, use, and disclose personal information, subject to any conditions in the regulations, for the purposes of the HPPA or for purposes related to the administration of a public health program or service that is prescribed in the regulations.[91]

- Privacy policies should be reviewed to ensure that emergency exceptions are addressed and that staves are aware of when these exceptions apply.

## Regulated Health Professionals and the Regulatory Colleges

Regulated health professionals should familiarize themselves with and follow the guidelines and policies of their regulatory colleges, including those with respect to emergencies, pandemics, influenza, delegation, scope of practice, and discontinuing or withdrawing care. Both the College of Physicians and Surgeons of Ontario (CPSO) and the College of Nurses of Ontario (CNO) have policies in place relating to expectations of their members during an emergency, which we discuss further later.[92]

The colleges may also issue helpful practice guidelines to assist their members with respect to infection prevention and control. See for example, the CPSO's practical guide to Infection Control in the Physician's Office and the CNO's practice standard on Infection Prevention and Control.[93]

Regulated health professionals should also comply with licensing and registration requirements with respect to health disclosure to their colleges and ensure they provide up to date information regarding their immunization status and health concerns to the hospital/employers, as may be required by the by-laws and/or policies of their facility.

Some colleges may institute emergency registration procedures to address human resources shortages in the event of a disaster. Under the Registration regulations under the *Medicine Act*, physicians may be registered for a short duration, under supervision, for the purpose of providing services that would not otherwise be available due to a lack of persons to provide them.[94] Similarly, the CNO has created a Special Assignment Class for registration in the event the CNO's Executive Director declares an emergency.[95] In a declared emergency, the CNO can expedite the registration of new members from other jurisdictions by registering them temporarily in the Special Assignment Class for a maximum of 60 days.[96]

- Regularly canvas College websites for new policies and updates to existing policies.
- Set up education sessions for health professionals relating to College policies.

## Duty to Treat

Following the SARS outbreak in 2003, the issue of the duty of healthcare practitioners to provide care in an emergency came to the fore. Healthcare workers found themselves weighing their duties to their families and their own well-being, with their professional duties to provide care to others in an emergency.

A study of the Joint Centre for Bioethics at the University of Toronto regarding the duty to care in communicable disease outbreaks demonstrated a lack of clarity and consensus among healthcare providers regarding the duty to care. The study notes that their findings "are in accordance with a study of family physicians who felt their duty and ability to care is contingent on an implicit duty of government to provide appropriate education, training and supply of equipment,"[97]

The traditional view was that there is no legal duty to provide care to a person with whom there was no pre-existing physician–patient relationship.[98] A British Columbia Supreme Court decision, however, suggests that this view has evolved.[99] In that case, a physician declined to attend to a patient awaiting emergency care and whom he had been advised was experiencing a possible myocardial infarction. The court held that the physician had been informed that the patient may be suffering from a life-threatening condition and that the nurse had requested that he treat the patient, and that while the physician was not on call, he was still on duty in the hospital. The court found that he knew or ought to have known that the physician on-call and all other physicians were otherwise engaged in the operating room and that the code of ethical conduct of the medical profession required him to assess the patient. In those circumstances, although it ultimately declined to find there was causation for the patient's damages, the court found there was sufficient proximity between the physician and the patient to support a duty of care to the patient.[100] *It should be noted, however, that this case occurred in the emergency room setting where there may be a greater duty to provide care then in a pandemic or mass emergency scenario.*

In addition to the potential to find a legal duty to provide care, there is support for an ethical duty to provide care based on the Canadian Medical

Association (CMA) *Code of Ethics* (updated 2004), the Code of Ethics of the Canadian Nurses Association (CNA), and college policies. Members of the regulated health professions should familiarize themselves with the guidelines available from their professional associations and regulatory colleges with respect to expected conduct during an emergency.

The CMA *Code of Ethics* provides that physicians ought to consider the well-being of society in matters affecting health. They must not discriminate against any patient based on the patient's medical condition, and they are expected to provide whatever appropriate assistance they can to any person with an urgent need for medical care. Finally, physicians must also "recognize the profession's responsibility to society in matters relating to public health, health education, environmental protection, legislation affecting the health or well-being of the community and the need for testimony at judicial proceedings.[101]

Similarly, the CNA Code of Ethics applicable to registered nurses in Canada states clearly that "during a natural or human-made disaster, including a communicable disease outbreak, nurses have a duty to provide care using appropriate safety precautions."[102] The CNA recognizes that there are situations where the duty to provide care may result in an unreasonable burden:

> Nurses also encounter personal risk when providing care for those with known or unknown communicable or infectious disease. However, disasters and communicable disease outbreaks call for extraordinary effort from all heath-care personnel, including registered nurses… A duty to provide care refers to a nurse's professional obligation to provide persons receiving care with safe, competent, compassionate and ethical care. However, there may be circumstances in which it is acceptable for a nurse to withdraw from providing care or to refuse to provide care. Unreasonable burden is a concept raised in relation to the duty to provide care and withdrawing from providing or refusing to provide care. An unreasonable burden may exist when a nurse's ability to provide safe care and meet professional standards of practice is compromised by unreasonable expectations, lack of resources or ongoing threats to personal well-being.[103]

There is a disciplinary case that supports the existence of an ethical duty to provide treatment in an emergency, based on the Quebec Code of Ethics applicable to physicians. In that case, the College des Médécins du Quebec sanctioned a physician for turning away a patient who was en route to the hospital's emergency room by ambulance. Although the physician was aware that the patient had suffered a heart attack, because the emergency room had just closed for the evening, the physician followed hospital policy and informed the dispatcher for the ambulance that they would need to divert the ambulance to the next closest emergency room, which was some distance away.[104] The patient died in the ambulance on the way to the second hospital. The Discipline Committee found the physician guilty of failing to come to the assistance of a patient in contravention of the Code of Ethics, notwithstanding the physician had followed the hospital's policy.

College policies also support an ethical duty to provide care. The CPSO, the licensing and regulatory body for physicians in Ontario, released a policy entitled "Physicians and Health Emergencies" in September 2009.[105] The policy sets out the CPSO's expectation that physicians will provide medical care during a health emergency, in accordance with any federal, provincial, and local emergency plans. Although the policy notes that physicians also have obligations to themselves and their families, which may need to be balanced with their

obligation to provide care to patients, the CPSO leaves the balancing of these obligations to the physician's professional judgment.

Similarly, the CNO policy on preparing for an influenza pandemic[106] states that it expects nurses to actively assume their obligation as self-regulating health professionals by providing nursing care during an epidemic.[107] The CNO further "expects nurses to fulfill their commitment to clients, the profession and the public during an influenza pandemic by providing nursing care within their individual professional competencies. It also expects nurses to keep informed about pandemic plans and public health communication systems."[108]

Regulated health professions should also familiarize themselves with the professional misconduct regulations made under the various health professions acts. These regulations make in an act of professional misconduct to withdraw or refuse to provide care, except in limited circumstances.

Regulated health professionals in Ontario are protected from liability under the *Good Samaritan Act, 2001* for providing emergency healthcare services or first aid, when such care is provided voluntarily and without reasonable expectation of compensation. The protection only applies to care that is provided outside of a hospital or other place having appropriate healthcare facilities and equipment.[109] An individual who is not a member of a regulated health profession who provides first aid assistance to a person who is ill, injured, or unconscious as a result of an accident or other emergency is also protected, if the individual provides the assistance at the immediate scene of the accident or emergency.[110] A number of other Canadian jurisdictions have also enacted similar legislation for providing first aid in an emergency.

Healthcare facilities, whether hospitals, long-term care facilities, clinics, or medical offices, must recognize that if there is a duty to treat by healthcare professionals, there is a concomitant duty on the healthcare facilities to keep the healthcare professionals well-informed and provide them with appropriate protective devices and training. The CNA Code of Ethics states:

> Nurses have a right to receive truthful and complete information so that they can fulfil their duty to provide care. They must also be supported in meeting their own health needs. Nurses' employers have a reciprocal duty to protect and support them as well as provide necessary and sufficient protective equipment and supplies that will "maximally minimize risk" to nurses and other healthcare providers.[111]

- Establish a policy for obtaining up-to-date information and communicating with healthcare professionals on staff in an emergency.
- Ensure appropriate personal protective devices and other emergency equipment are provided and maintained and that regular training is provided.
- Schedule education sessions for professional staff regarding College policies and applicable Codes of Ethics.

## Scope of Practice Issues

In an emergency, regulated health professionals may be required to render care in an area that is outside their normal scope of practice, training, and expertise. Several of the regulatory colleges have issued policies to guide their members when they are required to act outside of their normal scope of practice.

The CPSO's policy states that a physician should only practice outside his or her area of expertise during a health emergency if the care needed is urgent, a more skilled physician is not available, and not providing the care would lead to worse consequences than providing it.[112] The physician should not practice in the new area once the emergency is over.[113]

The CNO states that:

> The RHPA allows members of the public and regulated healthcare providers to perform controlled acts without authorization when providing first aid or temporary assistance in an emergency. Emergency procedures that are performed within a healthcare facility technically meet the emergency exception. The College maintains, however, that in situations in which it is anticipated that emergencies will likely occur, such as in a hospital or long-term care facility, it is necessary to have a standardized process to enable nurses to attain and maintain competence in performing emergency procedures that are outside the controlled acts authorized to nursing. This process includes the:
>
> - education and ongoing assessment of competence with the involvement of a health professional authorized and competent to perform the procedure;
> - documentation of the process;
> - written criteria to select appropriate clients and identify treatment parameters; and
> - necessary authority and/or resources to manage client outcomes.
>
> Such a process helps to ensure that nurses have the necessary preparation to perform a procedure that carries a risk of harm. This process is in keeping with the intent of the controlled acts model and the College's mandate to protect the public.[114]

Individuals who are not members of a regulated health profession may also be called on in an emergency to perform acts that normally must be performed by authorized regulated health professionals. The *Regulated Health Professions Act* contains an exception that allows persons to perform controlled acts reserved to certain health professions in emergency situations, if the act is performed while rendering first aid or temporary assistance in an emergency.[115]

## Consent Issues

In providing medical care to a patient, physicians and other healthcare practitioners must obtain their patient's consent to the treatment or procedure or the consent of their substitute decision maker. Touching a patient without consent may amount to battery. In the event of an emergency, however, the patient may be unable to provide consent and in limited circumstances, a physician or healthcare practitioner may be permitted to proceed without obtaining the patient's consent.

The *HealthCare Consent Act*[116] (HCCA) defines an emergency as occurring when "the person for whom the treatment is proposed is apparently experiencing severe suffering or is at risk, if the treatment is not administered promptly, of sustaining serious bodily harm."[117] The HCCA provides that

treatment may be administered without consent to a person who is incapable with respect to the treatment, if the practitioner is of the opinion that there is an emergency and that a delay in treatment will prolong the suffering that the person is apparently experiencing or put the person at risk of sustaining serious bodily harm.[118] Treatment without consent to a person who is apparently capable is also permitted where there is an emergency; there is a language barrier that prevents communication needed to obtain consent; reasonable steps have been taken to find a practical means to enable such communication without success; the delay necessary to find such a practical means would prolong the suffering that the person is apparently experiencing or will put the person at risk of sustaining serious bodily harm; and there is no reason to believe the person does not want the treatment.[119] Such treatment can only continue for as long as reasonably necessary to find a practical means of enabling the communication necessary to obtain the patient's consent.[120] Examinations and diagnostic procedures may also be permitted without consent, in certain circumstances, as set out in the HCCA.[121] The Act also contemplates that emergency treatment may be administered contrary to the wishes of a substitute decision maker, where there is an emergency and the substitute decision maker did not comply with the principles for giving or refusing consent set out in Section 21 of the HCCA.[122]

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