Public health response and medical health needs in Asian natural disasters

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"Veritas vos liberabit"

Declaration of Originality

The work contained in this thesis is completely original. It has not been submitted to fulfill the requirement for any other academic degree. I am also the principal author of all academic papers published in this thesis and was responsible for the conception, study design, funding solicitation, data analysis, result interpretation, thesis writing and manuscript revision.

For the Pakistan studies, data collection was conducted during field assessment commissioned by HelpAge International (HA). The author received tremendous assistance from key members of the assessment team, Mr. Vincent Gainey (team leader), Mr. Aftab Parwaz, Mr. Asif Iqbal (A.I.), Dr. Maung (Merlin Muzzafarrabad medical coordinator), Mr. Raja Muhammed Rafique (Muslim Hand) and various local research helpers for translations and field assistants. It was important to mention the support and facilitation of Mr. Bill Grey, director of emergency (HAI), JF Briere, Merlin's country director, Paula Sansom, Merlin's country Health Director, Lloyd Donaldson, Jon Ward, Christine Wilson, Bushra Shezadi and Dr. Abdul Haleem. Technical advice from Prof. Egbert Sondorp of London School of Hygiene and Tropical Disease was also sought during the study design process. The data analysis and manuscript preparation also benefits from the assistance of Ms. Jackie Kim who served as a research assistant post field based assessments(2008-2010) in some of these presented studies.

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PRECIS to the Thesis

Title: Public health response and medical health needs in Asian natural disasters

Background

Natural disasters cannot be prevented but their human impact can be mitigated. The ability of the medical community to respond effectively and efficiently requires good understanding of patient profiles, risk factors, health and medical needs post disasters. Although acute physical injuries are the leading cause of human mortality and morbidity in natural disasters, a significant proportion of deaths may result from poor hygiene and sanitation, inadequate nutrition as well the destruction of health care structures and resources to cope with both infectious and chronic diseases prevalent in the affected area. Whilst Asia is ranked as the most natural disaster-prone region worldwide, there is a paucity of published scientific literature of patient profiles, epidemiological disease patterns and public health responses to natural disasters in the region. Specifically, a literature gap exists in examining the burden of chronic disease and population aging on medical and public health relief post natural disasters.

The content of this thesis includes research results of nine international peer-reviewed published papers, 11 international conference presentations and seven disaster related discussion papers during 2005-2010. Based on principles of public health, emergency and humanitarian medicine, disaster epidemiology and policy studies, the core theme of this thesis is to apply disaster epidemiological techniques to the analysis of patterns of health needs and medical relief responses to two major Asian earthquakes post millennium, namely the 2005 Pakistan-Kashmir earthquake and the 2008 China Wenchuan earthquake. Implications of research findings on

medical and public health preparedness, medical service provision and public health policy gaps are analyzed and discussed.

Study objectives

In this thesis, original disaster epidemiological research studies will be used to examine patient profile, health risk factors, clinical outcomes and issues related to health relief service provision and policies post disaster. Specifically, implications of the burden of non-communicable disease and of an aging population on disaster relief response post are evaluated and discussed. The six key research questions are as follows:

1. What types of patients were likely present to medical relief clinics during various stages of response to Asian Earthquakes?

2. What were the characteristics of and utilization differences by medical service users in different clinic care settings: urban versus rural clinics; official versus unofficial internal displaced camps; stationary versus mobile clinics?

3. What were the main health needs of the disaster affected populations in various types of settlements?

4. Did chronic medical conditions constitute an important clinical burden post earthquake?

5. Why were the needs of disaster-affected-populations of older age and with chronic medical conditions forgotten by health care providers post natural disasters?

6. What are the emergency preparedness implications for doctors and medical relief workers regarding management of chronic diseases and older people post disaster?

Methodology

Study Setting

Research studies of two major earthquakes in Asia post millennium were included in this thesis.

2005 Pakistan-Kashmir Earthquake: Measuring 7.6 on the Richter scale, the earthquake occurred on October 8th 2005 and struck Pakistan's autonomous state of Kashmir and part of Indian-administrated Kashmir. Destruction in the region closest to the earthquake's epicentre was close to 100% and the official death toll in Pakistan was 79,000 and nearly 1,400 in Indian-administered Kashmir. Field based information was collected in February 2006 in the Neelum Valley of Kashmir Pakistan, four months post earthquake. Study sample population consisted of disaster affected individuals, clinical relief providing organizations and patients/attendees of various relief clinics around the Neelum Valley, Kashmir Pakistan. Ethics approvals were sought and obtained from the London School of Hygiene and Tropical Medicine and from relief organizations: Merlin, HelpAged International and Muslin Hand. Verbal consent was also obtained from the participants. Four Pakistan-Kashmir related studies were included in this thesis.

2008 China Sichuan Earthquake: Measuring 8.0 on the Richter scale, the earthquake occurred on May 12th 2008 and caused more than 80,000 casualties. Study sample population consisted of disaster affected individuals who were rescued to a helicopter relief tent-based clinic. Ethics approval was sought and obtained from the School of Public Health and Primary Care, Chinese University of Hong Kong. Two 2008 China Sichuan related studies were included in this thesis.

Study design, sample population and data collection tool

This thesis presents studies which draw from a range of research study methodologies. These include: literature review, retrospective clinical and medical record based study, cross-sectional face-to-face survey, semi-structural qualitative stakeholder interview study and narrative, action based research study. A brief summary of each of the study design, sample population, data and data collection tools are described in the following section.

Study (1): Differences in demographic and epidemiological profile of patients between rural and urban post disaster clinics in Kashmir Pakistan Earthquake.

a) Study Design: A retrospective clinical record-based, medical service utilization comparative study.

Sample Population: Attendees of rural clinic located at Sarli Sacha that provided service for a cohort of 30,000 rural population who sparsely resided in the Pakistan/India border. The matched control site is an internal displaced person (IDP) camp clinic 45 miles from Muzzafarabad city organized by a local NGO, Muslin Hands, at Chella Band which served 382 displaced people. The two study sites were the only clinical treatment facilities available in the area during the initial four months post earthquake, so it was assumed that health needs were captured by clinic attendance during the study period.

Data and Data Collection Tools: Clinical records of 2942 and 392 consultations from the mountainous clinic (Site 1) and the IDP medical services (Site 2) were reviewed respectively during the defined study period, January 21 - February 20, 2006. Clinical records were manually reviewed, relevant information recorded on the pre-set information table and all basic calculations were performed on-site.

b) Study Design: A cross-sectional, systematic sampling, face-to-face interview based survey study.

Sample Population: 125 patients attending clinics during the study days (85 in the mountainous clinic and 40 in the IDP camps).

Data and Data Collection Tools: The survey included questions regarding demographic background, past medical and drug history, self-reported health status, current and past symptoms, mental health, healthcare access and utilization, and post-earthquake livelihood related issues. A mini-mental health test and physical health indicators (such as weight, height, mid-arm circumference, spot blood glucose, spot blood cholesterol level, blood pressure) were also collected to detect potential underlying medical conditions that were not captured during previous clinical consultations. An information table was also designed to record retrospective clinical information from clinic medical records during the defined study period. Case number, date of clinic attendance, gender, age, diagnosis and medication/treatment given were recorded in the information table.

Data Collection: The questionnaires were translated into Urdu from English and was piloted and validated. Gender-specific health care workers fluent in Urdu and English were employed to administer the questionnaires and the assessment team provided training to ensure consistency in data quality. Since illiteracy rates are high in the region (80%), verbal instead of written consent with witness verification was obtained from patients before interviews and physical examinations were conducted. Patients attending the consultations were invited to participate to the study and were re-assured that their participation of the study would be independent of their eligibility to receive medical care/treatment. If the patient agreed to participate, a research team member conducted the survey interview while the patients were waiting for their consultation. All physical examinations and indicator measurements were performed by the assessment team physician. Due to the instability of

electronic appliances in high altitude and extreme temperature, all medical and health records were handwritten.

Study (2): Differences in demographic and epidemiological disease profile of residents in unofficial and official displaced camps in the Kashmir Pakistan Earthquake.

Study Design: A cross-sectional, cluster sampling, face-to-face household-based survey.

Sample Population: The study sample consisted of residents (n=2628) of all self-settled camps with less than 50 households in the study area. Camps were categorized to three groups according to number of households and cluster sampling was randomly selected from each cluster size and a total of three unofficial camps were invited to participate in this study. Household response rate post invitation was 98% and a total of 85 "unofficial camp" households were included in this study. For the final analysis, the "unofficial camp" sample included 49 households (392 residents) for the 31-49 household cluster, 28 households (238 residents) for the 16-30 household cluster, and 8 households (66 residents) for the 1-15 household cluster. To serve as a baseline comparison and to identify potential differences between official and small unofficial self-settled camps, a rural "official" registered IDP camp with 276 households (1932 residents) was also invited to participate in the study. Through snow-ball sampling, 82 households (30% of the official camp) were recruited and interviewed.

Data collection: Face-to-face structured interviews were conducted in February 2006 to collect information related to demographic characteristics, earthquake damage, self-reported health outcomes of study participants in physical, mental, and social health status, and expressed needs post disaster. Survey questionnaire was designed in English and translated by bilingual speakers (Urdu and English). Gender specific interviewers were used for obtaining information and all interviews were done by interpreters and health care workers who spoke both languages. The questionnaires were piloted and reliability of the tool was

tested. The reported information was crosschecked with local heath care workers to ensure the quality of translation. Since illiteracy rates were high in the region (80%), verbal instead of written consent with witness verification were obtained from all patients interviewed during the field assessment.

Study (3): Differences in demographic and epidemiological profile of patients between remote mountainous stationary clinic and a mobile helicopter outreach clinic in Neelam Valley, Kashmir Pakistan Earthquake.

Study Design: A retrospective clinical record-based, medical service utilization comparative study.

Sample Population: Clinic attendees of two remote clinics in Neelam Valley, Kashmir Pakistan. The two study sites were the only clinical treatment facilities available in the area during the initial four months post earthquake, so it was assumed that health needs were captured by clinic attendance during the study period. In addition, relief clinical services in the two study clinics were set up and provided by the same relief organization during the acute phase (the first eight weeks after the earthquake). Similar treatment provision standards and management were ensured.

Data and Data collection: Two sets of data from two remote clinic were collected for these studies post disaster. Data set 1 was collected from a mountainous border clinic at Sarli Sacha and Data set 2 was solicited from outreach clinical services serving three rural areas (Zabbar, Konka and Telegra) around Neelam Valley reachable only by helicopter post earthquake. Five episodes of helicopter clinic sessions were made during the study period. In total, 3097 (site 1) and 145 (site 2) clinical records were available for analysis. After review, 5% (site 1) and 2% (site 2) were excluded due to illegible handwriting and missing information. For the final analysis, 2942 (95%) and 142 diagnoses (98%) were included. A total of 2942 and 142

consultation records from the mountainous clinic (site 1) and the remote area outreach medical services (site 2), respectively, were reviewed and analyzed in this study. Clinical records were reviewed and data were entered anonymously into a manually input information table which recorded clinic operation dates and patient information. Patient data included patient case code, age, gender, distance of area of residence from clinics (by hours), and main diagnosis. The data did not show evidence of selection bias in the recording of diagnoses and any non-recording was assumed to be random.

All basic calculations were performed on-site. Information collected was categorized into various variables for analysis. Four age categories: <5, 6-44, 45-64, >65 were constructed. Patient gender was reported as a binary variable. Proximity to clinic was grouped into 4 groups: <30 minutes, 30 minutes to 1 hour, 1 hour to 4 hours and > 4 hours. Clinical diagnosis was divided in four main groups namely: trauma/injury (earthquake related and non-earthquake related), infection (wound, respiratory, gastrointestinal related, skin), chronic conditions (diabetes mellitus, hypertension, heart related conditions, arthritis, pain), as well as unspecific medical complaints. Descriptive statistics and chi-square significance comparisons were conducted to examine and compare patient profiles and disease patterns between the two remote clinics. Pakistan national data were also obtained from a public database to compare demographic characteristics and disease profile. Data entry, management, and analyses were conducted using Windows Microsoft Excel and statistical packages EPI Info and STATA 10.0.

Study (4): Why are the chronic medical needs of disaster-affected-populations forgotten by health care providers after natural disasters?

Research Design: A cross-sectional, semi-structured stakeholder interview based study.

Study population: Health/medical relief agencies of three different types of organizational natures (international non-government organization (INGO), national organization and local/community group) were invited and agreed to participate in the study. Except for the nature of the organization, the identity of the organization would remain anonymous to ensure confidentiality.

Data Collection: The data collecting tool was a structured interview questionnaire, developed according to the Help Aged International guidelines for best practices for older people in disasters and humanitarian crises. The questionnaire had three subsets of questions that assess i) organization operational background (5 questions); ii) general awareness and planning of older people issues (5 questions) and iii) information related to the provision of geriatric related clinical services (7 questions).

Study (5): What were the health and medical needs during the acute phase of an earthquake in Asia?

Study Design: A cross-sectional descriptive, epidemiological study.

Sample Population: All 182 patients who presented at the acute relief clinic from Day 3 to Day 21 post 2008 China Sichuan Earthquake.

Data Collection: Demographic, clinical and basic laboratory information and discharge diagnosis was collected in a pre-designed data recording template.

Study (6): What were the medical humanitarian relief policy and public health response implications of the Sichuan Earthquake?

Study Design: A narrative, action based research study

Study time period and location: During acute phase of disaster (Day 3 to Day 24) at the medical relief triage center (SSHC) at Guanghan area in Sichuan Province.

Results

Study findings presented in this thesis will be organized according to the three research questions.

1. What types of patients were likely present to medical relief clinics during various stages of response to Asian Earthquakes?

The older age group was the predominant users of post disaster health services in both acute and non-acute phases in all settings in both of the studied earthquakes. Gender disparities were found in service utilization.

2. What were the characteristics of and utilization differences by medical service users in different clinic care settings: urban versus rural clinics; official versus unofficial internal displaced camps; stationary versus mobile clinics?

Findings indicated that health needs and relief health service utilization varied by age, gender, disease type and post disaster clinical service delivery settings. Specific demographic and epidemiological clinical needs were identified.

Urban versus Rural

Men were predominant users of services (70%) in the clinics. Older traditional women were less likely to receive medical services, but medical utilization by older women was inversely related to the travel distance to the clinic (i.e. the use of services was greater the shorter the

distance from home). Treatment cost was not reported as a major issue for access to health/medical services for the respondent. An important unintended barrier to service access that was reported by both urban and rural respondents was a reverse discrimination service delivery pattern e.g. men had no access to psychosocial support because most programs were targeted exclusively to women and children. Of note, a recurrent theme found amongst men during discussion in both clinics (rural and urban) was that "a feeling of limited access to international relief service because they are for the 'vulnerable groups: women and infant'. On the other hand, another barrier to access for older women in rural areas was found to be related to the gender of service providers. Clinic attendance records in mountainous clinic showed that during days when clinical services were provided solely by male doctors, medical service utilization decreased by 30%.

Whilst medical records showed similar disease patterns, comparison of self-reported health status between older people in remote mountainous areas and IDP camps showed significant differences. Although neither respondent group in the study setting sustained any injuries due to the earthquake, twice as many older people (68%) in the remote mountain area self - reported that their health was worse than those in the IDP camp post acute phase of disaster. Chi-Squared comparison indicated that remote mountain respondents complained of higher frequency and severity of clinical symptoms such as headache (40% versus 23%, P=0.04), psychosocial distress (72% versus 44%, $P < 0.001$) and sleeplessness (65% versus 45%, $P < 0.001$) when compared with affected individuals living in the IDP camps. In terms of specific physical complaints, older people from mountainous areas were more likely to report dental, hearing, eating and visual difficulties when compared with their IDP counterparts. The severity of dental problems was further confirmed in reports of weight loss (75% versus 50%, P-value < 0.001) and eating problems (87% versus 50%, $P < 0.002$) among older people.

Stationary versus mobile clinic

When comparing patient service utilization for mobile and stationary clinics, older age, female gender, proximity to clinics, patients with earthquake related trauma, wound infections, and gastrointestinal conditions were found to be more significantly associated with mobile clinic users. Meanwhile, users of stationary clinics tended to be younger, living closer to the clinic sites, and having disease profiles which were predominantly chronic in nature.

The average age of stationary clinic users (38 years old) was slightly higher than those at mobile clinics (35 years old). While 44% of stationary clinic users were from the extreme of age (<5 and >45 years old) as compared to 32% in the mobile clinics, mobile clinics had twice as many patients older than 65 years old (stationary (3%) versus mobile (6%), *P* value = 0.03). 56% of mobile clinic users were female compared 30% in stationary clinics (*P* value<0.011). Travel distance was also found to be significantly longer at mobile clinics than stationary clinics (*P* value <0.01 in all categories), with 20% of mobile clinic users living in areas more than 4 hours away as compared with 10% in the stationary clinic group. Except for respiratory disease, which was the largest single diagnosis group and constituted 20–22% of caseload in both clinics, disease patterns were different between the sites. Mobile clinic attendees tended to have more earthquake-related trauma [mobile (18%) versus stationary (10%), *P* value<0.01], wound infections [mobile (15%) versus stationary (5%), *P* value <0.01], and gastrointestinal diseases [mobile (15%) versus stationary (5%), *P* value <0.01]. Meanwhile, stationary clinics had tripled the number of patients presented with chronic conditions than mobile clinics. Arthritis [stationary (13%) versus mobile (3%), *P* value=0.01] and various forms of pain (including stomach, head and back) were found to be significantly different between the two sites [stationary (17%) versus mobile (4%), *P* value=0.01]. In addition, more unspecific medical conditions were presented at stationary clinisc as compared with mobile clinics [stationary (8%) versus mobile 3%), *P* value=0.02].

3. What were the main health needs of the disaster affected population in various types of settlements?

Unofficial versus Official Camps

Significant differences were found in settler's demographic characteristics. Health outcome varied according to the size of unofficial internal displaced camps. Whilst larger unofficial self-settled camps appeared to have similar characteristics and health outcomes to official camps, smaller camps were found to cater for the most vulnerable population.

Households in the smaller unofficial camps also tended to be headed by females (In order of smallest to largest self-settled camp: 55%, 45%, 30%), had larger family sizes (average family size, in order of smallest to largest self-settled camp: 9,8,7), had larger percentage of older population than the larger camps (60% vs. 50% vs. 50%, respectively), and originated from local areas (in order of smallest to largest self-settled camp: 60%, 35%, 30%). Smaller camps were also more likely to be the first settlement for residents four months post-disaster (first settlement in order of smallest to largest self-settled camp: 80%, 48%, 40%), received the least assistance and resources to sustain livelihood, had less access to information, medical service and chronic disease medication for underlying medical problems, and had the worst self reported physical, mental and social health outcomes.

Residents of the largest self-settled camps were nearly twice as likely to report better well-being as those resided in the smallest camp (60% vs. 35%, $p=0.01$). No statistical difference for earthquake related injury incidence rate was detected among different self-settled camps (30-35%) although the official camp reported a lower incidence of earthquake injury. When comparing self-rated health status before and after the disaster, 50% of the smallest self-

settled unofficial camp residents claimed their health had worsened when compared to 35% in the largest unofficial self-settled camp.

Although infectious disease patterns were comparable among small unofficial self-settled camps, when compared with official camps, detailed differential analysis showed that residents in smaller unofficial self-settled camps experienced more gastrointestinal infections (smallest camp 65% vs. official camp 45%, $p<0.01$) and wound infections (smallest camp 45% vs. official camp 20%, $p=0.07$) after the earthquake. Whilst the proportion of population with chronic conditions were similar across these studied camps, 85% of residents in the smallest unofficial camp had no available drugs to manage their chronic medical conditions as compared to their counterparts who resided in larger rural unofficial (40%) and official camps (25%).

With regard to psychological health, there were significant differences in reported psychological symptoms when comparing between rural official and unofficial camps. Whilst complaints of sleeplessness (50%) were similar among residents of various camp types, more residents in rural unofficial small camps were found to be depressed (45% in smallest camps vs. 30% in official camp, $p<0.01$), felt helpless (50% in smallest camps vs. 20% in official camp, $p<0.01$), anxious (45% in smallest camps, vs. 35% in official camp 35%, $p<0.01$) and experienced poor appetite (50% in smallest camps, vs. 30% in official camp, $p<0.01$) post earthquake. Furthermore, residents in smaller camps reported to have more fear of another disaster (55% in smallest camps, vs. 30% in official camp, $p<0.01$).

For social health and well-being, whilst settlers in the largest unofficial rural camp were comparable to those in official camps in terms of establishing post disaster contact with family (for both: 65%), only 20% of settlers in the smallest camp were in contact with other

family members. In addition, only 55% of the smallest rural camp residents reported to feel supported by network and community when compared with the larger unofficial rural (70%) and official camps (75%). Expressed needs were also studied and found to be different among respondents of the different camp types. For the smallest unofficial camp, medical, financial and access to information were regarded as the most immediate needs four months after the earthquake (33% reported for each). Meanwhile, the second smallest unofficial camp requested for household utensils (45%); the largest rural unofficial camp cited psychological service (55%) and the official rural camp reported psychological (45%) as well as utensils (45%) as the most important needs that may support their well-being in the study time period.

4. Did chronic medical conditions constitute an important clinical burden post earthquake?

In Pakistan Kashmir Earthquake, results also indicated increased disparities in access to care for chronic medical conditions among population groups post-earthquake. In Pakistan Kashmir, before the disaster only 35% of older people living in mountains received medical management for their underlying chronic medical problems, compared to 70% of the older people lived near the city IDP camp. Post-earthquake, among those who had chronic medical treatment prior to the disaster, 80% of those living in remote mountains reported losing access to chronic medical treatment, compared to 40% of those who were living near the city IDP camp.

Chronic diseases constituted 42% of caseload in the stationary clinic, which was double that of the mobile clinic (21%). 'Acute conditions' consisted of trauma/injury (earthquake related and non earthquake related) and infection (wound, respiratory, gastrointestinal related, skins), whereas 'chronic conditions' included diabetes mellitus, hypertension, heart-related

conditions, arthritis, and pain. Non specific medical complaints were grouped as 'uncertain group' within the figures. In general, although more chronic conditions were presented in the stationary clinics than the mobile clinics, descriptive results indicated that diagnosis of acute conditions remained as the majority cause of clinical visits (approximately 50–75%) for both clinics during the post acute phase of the disaster.

In China, 30% of clinical burden during the acute phase of disasters were related to chronic non-communicable conditions.

5. Why was the disaster-affected-populations of older age and with chronic medical needs forgotten by health care providers?

Among the respondents, 73.3% (11 out of 15) of responding agencies had direct health/medical/mental health components in their relief programs. Nine of the 15 agencies claimed to provide services that were nondiscriminating with respect to age. Interestingly, while 93% regarded older people as a vulnerable group, only 6.6% of responding providers had relevant planning/considerations in their program implementation related to older peoples' needs. The findings showed discrepancies between provider perception, awareness and actual clinical service/program provision for older people, the major population subgroup with chronic diseases post natural disasters. Despite drug availability (as a result of basic primary care drug procurement for basic treatment of common chronic medical problems), the lack of technical expertise and awareness of older people's health needs rendered this population subgroup invisible in relief settings. Some may argue that the small patient load does not justify the provision of specific clinic days for older population, it is nevertheless important to ensure older people have equal access to all mainstream services.

In terms of capacity, none of the agencies provided geriatric-specific clinical services within their emergency programs. While none of the providers had medical staff trained in geriatric subspecialties, 40% of the responding agencies had trained staff to manage chronic medical needs. In addition, 60% and 20% of the clinical service providing agencies had drugs that were useful to treat common geriatric morbidities as well as mobility aids to support injured people. While none of the respondents were providing geriatric-specific clinical services or psychological care during the study period, some respondents explained that their general clinical services and outreach services should have covered general medical needs for older people. Paradoxically, results revealed that the international non-government organizations (INGOs) fared the worst among all provider subcategories on the provision of age and gender sensitive clinical programs. In addition, 80% of INGOs had the relevant drug supplies, but none of them provided-geriatric specific services and mobility aids. On other hand, local (20%) and national (40%) counterparts provided mobility aids and 80% of the local groups reported having programs which were more gender sensitive when compared with INGOs (40%).

Discussion

6. What are the implications for clinicians and medical relief workers regarding chronic disease management and older people post disaster?

Chronic medical burdens and health needs of earthquake-affected populations were found to be affected by various types of post-disaster settlements in the studies presented in this thesis. The greatest gap in health services at all sites was that non-communicable disease management was inadequately provided during non-acute post disaster medical care. Of note, clinical records reviewed in all study locations showed a systematic absence of documentation of common chronic diseases. Specifically, records showed that only acute medical complaints were managed in these clinics. There was little or no record of common

cardiovascular conditions (e.g. hypertension, cardiovascular accidents, or diabetes mellitus) or nutritional status of the older age groups in either the mountain clinics or the IDP camps unless it was reported as a chief complaining symptom of the consultations (e.g. hypertension). Chronic conditions such as diabetic mellitus and hypertension and basic anthropometric data such as body mass index (BMI) were not recorded. On the other hand, findings of self-reported health surveys illustrated that 25-38% of the respondents were aware of the existence of at least one unmanaged underlying medical problem. The 3-day on-site physical examination in the mountainous clinic further confirmed this finding by revealing that 38% of the examined patients (31 out of 85 patients) had at least one type of underlying chronic condition. Furthermore, the most common under-diagnosed or under-managed chronic condition found during on-site physical examination was diabetes mellitus (22%).

Overall, study results indicated differences in population characteristics and health needs among residents of different types of settlements. Vulnerability, in terms of extreme of age, access to assistance, information, medication, and various health outcomes is inversely related to the size of the internal displaced camp post natural disaster. The most vulnerable population subgroups were found in remote settings and the smallest rural unofficial self-settled camps. Unfortunately, due to various policy and logistic reasons, major relief groups had frequently focused their relief efforts on official camps. Disaster affected populations in the small unofficial relief camps are frequently not eligible for official assistance. As a result, these marginalized groups were often left to fend for their own relief resources and health assistance. For instance, this study had identified that residents in the smallest unofficial camps were four times less likely to obtain medication to manage their underlying chronic medical illnesses four months post earthquake when compared with their counterparts living in official camps. Given the demographic characteristics, limited access to assistance, chronic medical conditions, and lack of information in smaller unofficial IDP camps, disaster

response efforts should include service modalities (e.g. health information dissemination and outreach clinics) that cater the health needs of the population in these unofficial self-settled camps.

Findings highlighted specific health needs and issues related to long term chronic disease management. In addition to mortality and morbidity resulted from direct impact, natural disasters also resulted in indirect human toll through disruption of the provision of health care service. Specifically, death or injury mortality of medical personnel and destruction of drugs and health care structures would lead to disruption of any regular medical service. Frequently, the health of the population with underlying chronic medical conditions would be threatened as a result of the lack of medication and treatment. The implications of non-treatment of chronic disease are that there might be increased disabilities resulting from disease complications (e.g. diabetes retinopathy, stroke) which may hamper the quality of life for patients and potentially the livelihood of some households.

In the recent Sichuan earthquake, more than 70% of the earthquake survivors had some form of management to their underlying chronic conditions during the emergency phase.
However, many issues complicated the decision on whether chronic disease services should be offered during disaster relief. Whilst most frontline practitioners agree that life-saving treatment should be given, some are hesitant to provide regular and potentially long term medication to patients with chronic conditions especially in locations where pre-disaster medical treatment for chronic disease was limited or non-existent.

Important issues were identified when questioning why older people's why needs were forgotten by medical providers. They included the need to sensitize relief and health workers about older people health needs post disaster, the development of relevant clinical guidelines

for chronic disease management post disaster and the advocacy of building-in geriatric related components in natural disaster medical relief programs. In order to effectively address the vulnerability of older people, it is important for governments, medical relief agencies and local partners to include and address these issues during their relief operation and policy planning.

Limitations

The main limitations for this study series, as for all other natural disaster health related studies, were the extreme and unstable environmental context, population mobility and the fluidity of health relief services. These disaster contextual circumstances have often rendered data collection with standard research methodologies challenging. For instance, the field study in Pakistan was affected by difficult high mountain terrain, weather uncertainty, constant landslides and unstable political climate with major demonstrations protesting against the Danish cartoon incident that was taking place across the Muslim world during the study period. There were several occasions when our assessment team encountered potential security risks of inciting sentiments with the sight of foreigners inside a motor vehicle. In China, during the acute phase, safety concerns resulted from frequent aftershocks. Non-standardized patient re-deployment policies also made the population extremely mobile. There were limited opportunities to follow up the internal displaced population for the study.

There were a number of other limitations for disaster-related studies such as recall bias especially related to acute post-disaster experiences and selection bias related to study sampling. Specifically, this study series did not include vulnerable population subgroups such as those living in urban enclaves, residing within their household post disasters and those who have no access to services because they are too old, too fragile or too remote in their location. In addition, information bias might have stemmed from clinical diagnostic

inaccuracies due to the limited clinical expertise of relief workers in developing countries, the lack of relevant diagnostic equipments (e.g. blood glucose monitoring), potential equipment instability (subzero temperatures) and unawareness of the importance of good audit data collection and record keeping of medical information. For instance, even though user comparisons were made during the same study period and these clinical services had no competitors, the stationary clinical service was made available five weeks post earthquake and the helicopter mobile unit was only available after eight weeks because of concerns of access of the secluded area. It was unclear how this may have affected attendance and ultimately user characteristics. Last but not least, with limited published literature on this topic, no comparison could be made to the findings of emergency clinical service delivery in the post acute phase of natural disasters.

Conclusion

This thesis presents findings which indicated that although public health and medical care needs varied in time, type and size of temporary settings, chronic conditions were one of the dominant health care needs post earthquake. Currently, healthcare provision following disasters usually focuses on the treatment of acute conditions (such as injuries, diarrhea and respiratory infections) and more recently on psychosocial and mental health services. Clinical provision for chronic diseases was rarely seen as a priority, and study findings showed how needs of old age population or those with chronic diseases were systematically "forgotten" post earthquake. The absence or disruption of treatment for chronic diseases (like diabetes, high blood pressure, mental illness and HIV/AIDS) is not only life-threatening for vulnerable groups, but may also give rise to complications (e.g. stroke, retinopathy) and result in worsened quality of life, livelihoods due to the cost of treatments and avoidable deaths. Given population aging and the frequency of natural disasters in Asia, it is important to strengthen public health preparedness and medical capacity to respond to disasters.

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List of Abbreviations

BMI	Body Mass Index
CDC	Communicable Disease Centre (China)
CI	Confidence Interval
CJFD	Chinese Journal Full-Text Database
CRED	Centre for Research on Epidemiology of Disasters
DALYS	Disability-Adjusted Life Year
DM	Diabetes Mellitus
EMDAT	Emergency Events Database
ELDIS	Online Database of Institute of Development Studies, Sussex
EPHPP	Effective Public Health Practice Project
GI	Gastrointestinal
HAI	Help Aged International
HT	Hypertension
IDP	Internal Displaced Population/People
INGO	International Non-Governmental Organization
LSHTM	London School of Hygiene and Tropical Medicine
NCD	Non-communicable Disease
OR	Odd Ratio
PLA	People's Liberation Army
PTSD	Post Traumatic Stress Disorder
Qol	Quality of Life
RMB	Renminbi (Monetary currency in PRC China)
SPHERE	Humanitarian Charter and Minimum Standards in Disaster Response
SSHC	San Shiu Health Clinic
TB	Tuberculosis
URTI	Upper Respiratory Tract Infection
UNHCR	United Nations High Commissioner of Refugees
WHO	World Health Organization

SECTION I

INTRODUCTION, BACKGROUND and LITERATURE REVIEW

"Ab actu ad posse valet illation"

From the past one can infer the future

Chapter 1 Introduction

Whilst disasters cannot be prevented, their adverse human impact may be mitigated. Although disasters tend to have the heaviest human toll on the most vulnerable population subgroups in society, good understanding of patient profiles, risk factors, health and medical needs post disasters will enhance the medical community's capacity to respond effectively and efficiently.

For the past decade, aging of the global population has occurred as a result of medical advancements that increase life expectancy and socio-economic development which had led to a lower fertility rate in the population. The demographic changes together with model urban lifestyles have also changed disease patterns. Chronic diseases, which are usually associated with aging and modern urban lifestyle, have become the major cause of death and disease burden globally. Asia has the world's most populous countries, China, India, Indonesia and Pakistan, and is also regarded also as the world's most natural disaster-prone region (CRED, 2010). For the past few decades, these countries have become middle income developing countries. Whilst there is scientific literature that has examined how patient profiles and health needs might have been affected by natural disasters in developed high income countries such as US, Japan and Italy, there is currently a scientific literature gap to

understand how chronic disease and population aging might have affected natural disaster responses and relief efforts in developing, middle income countries.

Based on theoretical principles of disaster epidemiology, public health, emergency and humanitarian medicine, this thesis presents a series of studies that examine the impact of demographic and epidemiological transitions on the patient profile, health needs and disaster responses following natural disasters in large population, middle income countries in Asia.

Thesis related studies were conducted at the time of two post millennium earthquakes in Asia, namely the 2005 Pakistan-Kashmir earthquake and the 2008 China Sichuan earthquake. The Pakistan-Kashmir Earthquake, measuring 7.6 on the Richter scale, occurred on October 8th 2005 in Pakistan's autonomous state of Kashmir and part of Indian-administrated Kashmir. Destruction in the region closest to the earthquake's epicentre was close to 100% and official death toll was 79,000 in Pakistan and nearly 1,400 in Indian-administered Kashmir. The China Wenchuan Earthquake, measuring 8.0 on the Richter scale, occurred on May 12th 2008 and claimed 80,000 casualties.

Six main research questions are examined in this thesis. These include: i) What types of patients were likely present to medical relief clinics during various stages of the response to

Asian earthquakes? ii) What were the characteristics and utilization differences of medical service users in different clinic care settings: urban versus rural clinics; official versus unofficial internal displaced camps; stationary versus mobile clinics? iii) What were the main health needs of the disaster affected population in various types of settlements? iv) Did chronic medical conditions constitue an important clinical burden post millennium earthquakes? v) Why were the needs of disaster-affected-populations of older age and with chronic medical conditions forgotten by health care providers? and vi) What are the finding implication for health and medical emergency preparedness regarding chronic disease management and older people?

This thesis is organized into three main sections and thesis contents include a presentation of key findings of nine international peer-reviewed papers, 11 international conference presentations and seven disaster related discussion papers published during 2005-2010.

Section I includes three chapters that give the background, explain the underlying principles and examine current knowledge related to public health, emergency and disaster medicine. Chapter 1 provides an overview of the thesis content. Chapter 2 delineates the theoretical background and key principles used in this thesis. Chapter 3 consists of three literature reviews. Part I presents a historical understanding of the public health consequences of

earthquakes. Part II reports the key findings of a literature review of known health impacts of earthquakes in China during 1906-2007. Part III reviews the literature on the current understanding of the burden of chronic diseases in disaster responses before 2008.

Section II has three chapters which outline the aims, objectives, research questions, study context and methodologies of the thesis related study. Chapter 4 explains the aims and study objectives of each studies. Chapter 5 describes the study context and research questions. Chapter 6 summarizes study designs, data collection methods, data collection tools and data management.

Section III consists of four chapters. Chapter 7 reports the key findings of each study. Chapter 8 discusses how the findings address the research questions. Chapter 9 examines policy and future research implications. Chapter 10 presents a conclusion of the entire thesis. The **Appendix** includes a summary of a bilingual literature review of the health impact of earthquakes in China, a sample of the service provider survey questionnaire and the nine original published papers that are heavily referenced in this thesis.

Chapter 2 Background

This chapter describes the theoretical principles which are used in this thesis. Specifically, the definitions of disasters, types of disaster, global burden of disasters, definition of health, public health, hierachy of prevention, pathway of care, epidemiologic and demographic transition on general health outcomes, non-communicable disease burden in developing countries, disaster medicine and disaster epidemiology, health and public health impact of disasters, the disaster response cycle and the impact of demographic and epidemiological transition in disaster medical relief and humanitarian response are discussed.

Definition of Disaster

Depending on the academic discipline, the term "*disaster*" can has many definitions (Shaluf, 2003). For public health researchers, Lechat (1984) provided the following definition:

> "A disaster is a result of a vast ecological breakdown in relation between humans and their environment, a serious and sudden onset event (slow such as drought) on such a scale that the stricken community needs extraordinary efforts to cope with it, often with outside help/international aid." (*Lechat, 1984)*

In 2008, a revised definition has been adopted by the WHO Collaborating Center for Research on the Epidemiology of Disasters (CRED, 2010):

> A disaster is "a situation or event, which overwhelms local capacity, necessitating a request to a national or international level for external assistance; an unforeseen and often sudden event that causes great damage, destruction and human suffering." (*CRED. 2010.)*

Despite the slight difference between the two definitions, both versions contain three elements when discussing disasters. These include: i) damage involving humans, ii) characteristics of the event, & iii) the need for external assistance. **Table 2.1** shows a comparison of the definition of disasters as proposed by public health researchers.

Table 2.1 Comparison of the definition of disasters as proposed by public health researchers

Key Elements	1984*	2009**
Damage involving humans	A vast ecological breakdown in relation between humans and their environment	Great damage, destruction and human suffering
Characteristics of the event	A serious and sudden onset event (slow such as drought)	An unforeseen and often sudden event
The need for external assistance	On such a scale that stricken community needs extraordinary efforts to cope with it, often with outside help/international aid	Overwhelms local capacity, necessitating a request to a national or international level for external assistance

**Lechat, 1984, ** WHO Collaborating Centre for Research on Epidemiology of Disaster(CRED) The OFDA CRED International Disaster Database, Université Catholique de Louvain, Belgium" 2010*

Types of Disaster

Although there are many different types of disasters, according to the WHO Collaborating Centre for Research on Epidemiology of Disaster (CRED, 2010), disasters can be categorized three main groups namely, natural, man-made and complex emergencies. As each of these disaster subtypes has its distinct etiology, human impact and response challenges, disaster relief planners and responders will have to address the specific characteristics which are peculiar to disaster subtypes. **Table 2.2** describes the various types of disasters and their possible etiologies.

Table 2.2 Various types of disasters and their possible etiologies

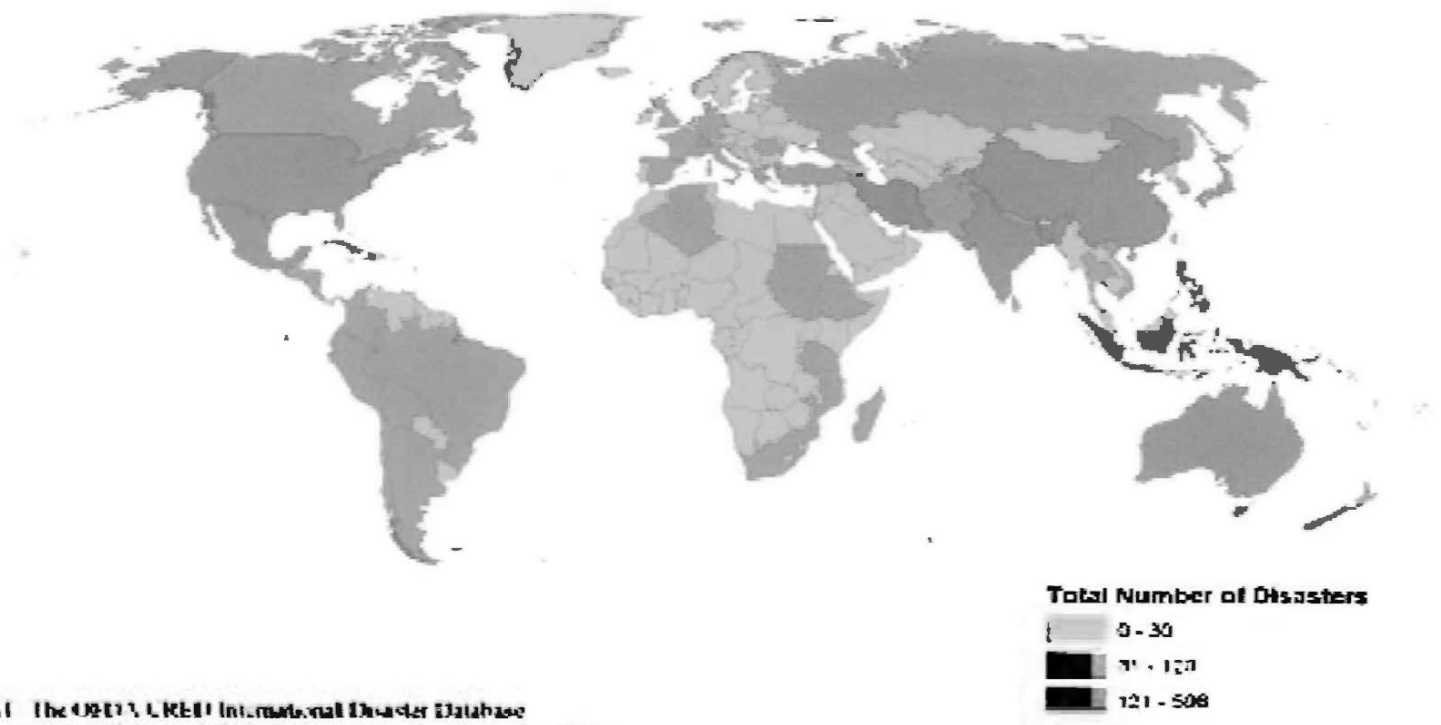
Disaster Subtypes	Possible etiologies
Natural Disaster	Climatological, hydrological, meteorological, geophysical, and biological
Man-made Disaster	Industrial-based, transport-based, biological/chemically-based
Complex Emergencies	Disputes, conflicts, wars

WHO Collaborating Centre for Research on Epidemiology of Disaster The OFDA CRED International Disaster Database. Université Catholique de Louvain. Belgium" 2010

Global burden of natural disasters

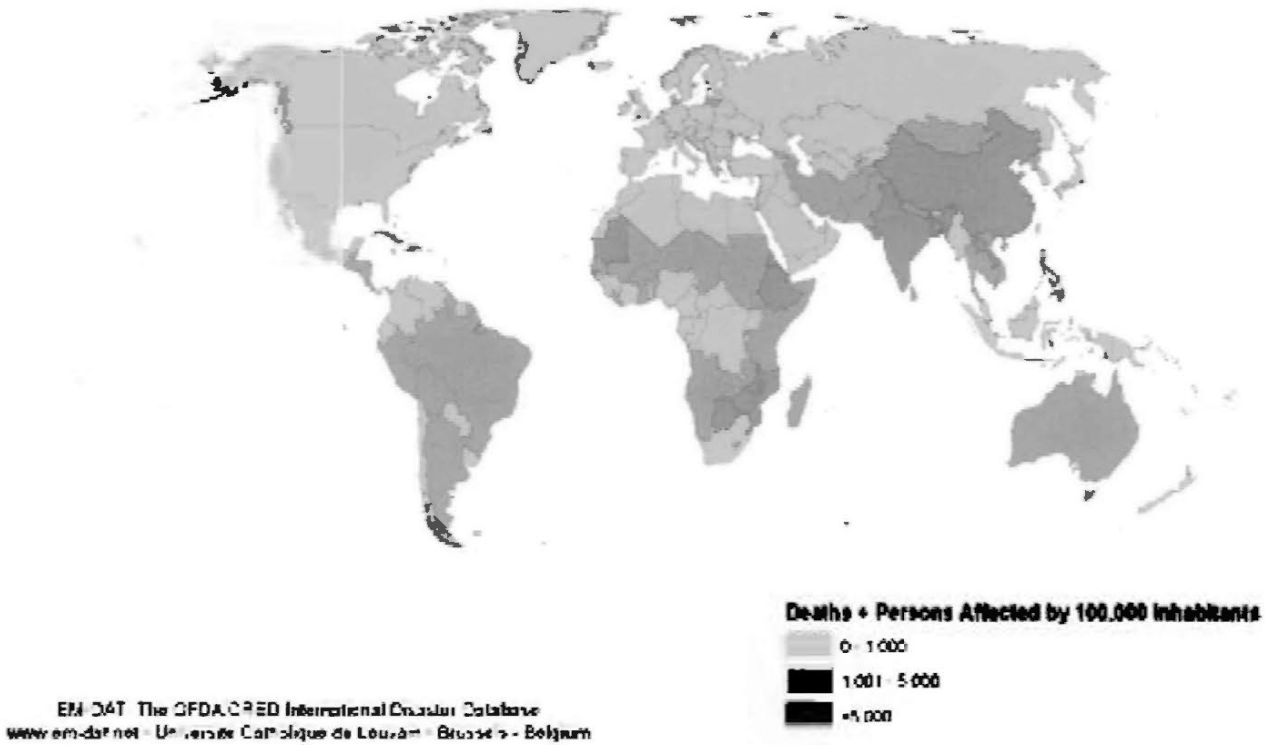
Globally, the number of natural disasters has increased by nearly two-thirds during the past two decades (EMDAT, 2010). As many countries have become increasingly populated, the human impact of disasters will also escalate significantly. **Figure 2.1** shows the total number of natural disaster events by countries during 1974-2003 (Guha-Sapir et al., 2004). **Figure 2.2** highlights the total deaths and people affected by natural disasters during 1974-2003 (Guha-Sapir et al., 2004). As illustrated in these figures, developing countries in Asia, which were characterized by high population density and with limited disaster responding capacities during this period, were the most disaster affected countries in the world. China and India, the two most populated countries in the world, have had the highest number of natural disaster in the past three decades.

Figure 2.1 Total number of natural disaster events by country: 1974-2003



Source: The OFDA/CRED International Disaster Database
www.emdat.net - Université Catholique de Louvain - Brussels - Belgium

Figure 2.2 Total number of deaths and people affected by natural disasters by 100,000 inhabitants: 1974-2003



Source: EM-DAT: The OFDA/CRED International Disaster Database.

Among the various types of natural disasters, earthquakes remain as the least predictable and most lethal among all natural disasters (Guha-Sapir et al, 2004). **Table 2.3** shows the mortality related to major earthquakes around the world from 1906-2007.

Asia has had twice as many earthquakes as other continents. Within the region, China experienced the three most lethal earthquakes of the 20th century. For instance, the 2008 China Sichuan earthquake resulted in one of the most severe human death tolls globally in the past century. Whilst China has experienced the highest global mortality rates from earthquakes, there has been no in-depth analysis of the published literature to examine the human health impact of earthquakes in China. A better understanding of health needs and evidence-based practice related to disaster relief will improve emergency preparedness and relief effectiveness.

Table 2.3 Mortality related to major earthquakes around the world from 1906-2007*

Country	Date	Killed
People Republic of China	27-Jul-1976	242,000
People Republic of China	22-May-1927	200,000
People Republic of China	16-Dec-1920	180,000
Japan	1-Sep-1923	143,000
Soviet Union	5-Oct-1948	110,000
Italy	28-Dec-1908	75,000
Pakistan	8-Oct-2005	73,338
People Republic of China	26-Dec-1932	70,000
Peru	31-May-1970	66,794
Pakistan	31-May-1935	60,000

**Created on Jul-19-2007 - Data version v06.05 Source "EM-DAT: The OFDA/CRED International Disaster Database, Université Catholique de Louvain, Brussels, Belgium"*

Definition of health, public health, hierarchy of prevention and pathway of care

Health

> "Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity." *World Health Organization*

According to the WHO (1946) definition of health, health includes physical, mental and social aspects of well-being. Traditional disaster response programs have placed a major emphasis on physical health. In recent years, although psychological program has gained recognized and the "mental and social aspects of health" has been included in the minimal standards of health service in disaster response, the social aspect of health has often been overlooked and limited research has been conducted on the subject.

Public Health

> "The science and art of preventing disease, prolonging life and promoting health through the organized efforts of society"` *Sir Donald Acheson*

Public health medicine is a domain of medicine that emphasize on prevention, protection and improvement on health of population (Griffiths & Halsam, 2000). The underlying principle of public health is to address health of populations and takes into account of all the factors which may influence the health of both individuals and groups of people (Hill & Griffiths, 2007). The discipline answers to health issues with a population, life-course approach. It focuses on prevention and protection and aims to reduce health disparities through evidence based, cost effective solutions. Disaster response is an important element in public health practice (Lechat, 1979) and as disaster affects every segment of the society, effective disaster mitigation and response programs might protect population from adverse impact of calamities.

Hierarchy of prevention

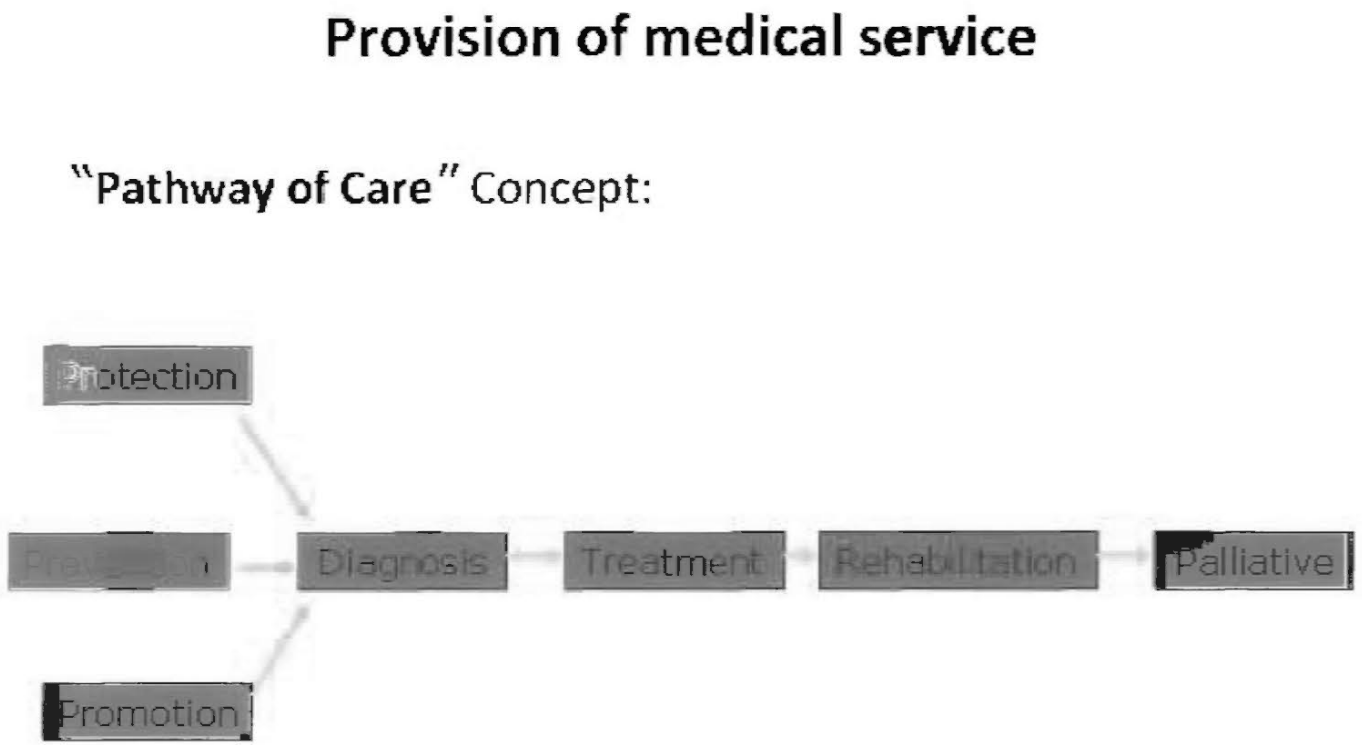
There are three levels of health prevention, namely, primary, secondary and tertiary (Leavell, 1958; HKSAR DOH, 2008). *Primary prevention* concerns with measures that prevent the onset of disease. Strategies may include health protection and health promotion. Health protection can be carried out through the establishment of health policy, regulations, and vaccinations while health promotion mainly involves health education. *Secondary prevention* refers to the stopping of the progression of disease after its occurrence. It aims at early disease detection, thus increasing the opportunity for intervention to prevent disease progression and the emergence of symptoms. Screening is one classic example of secondary prevention. *Tertiary prevention* focuses on the rehabilitation of patients with an established disease to minimize residual disabilities and complications. It aims to restore bodily functions that have been impaired by the disease. Services in this category include treatment, rehabilitation and palliative care. The application of these prevention concepts in establishing disaster mitigation strategies, response programs and post disaster recovery policies may enhance individual survival and protect communities from adverse health outcomes in natural disasters.

Pathway of Care

The pathway of care concept highlights health care services are not limited to only diagnosis and treatment of a patient. "Care" contains a spectrum of activities that range from protection, prevention, promotion, diagnosis, treatment, rehabilitation to palliative care. This concept reminds health care practitioners that health programs can be diverse and health related services can be made available in any segment of

society even with limited resources. **Figure 2.3** illustrates the pathway of care in health and medical services.

Figure 2.3 Pathway of care in health and medical services



Epidemiologic and demographic transition on general health outcomes

Epidemiology is the study of disease distribution in a population, and the factors affecting the distribution and progression of diseases. Demography is the study of population structures that might be affected by birth, death and migration. Over the past few decades, the demographic changes have occurred in many countries and this change in composition of a population has affected public health and health services needs considerably. The following paragraphs will provide an overview of the concept of demographic and epidemiologic transitions and how these patterns might affect disaster responses.

Age-structure - Demographic Transition

In simple terms, the theory of demographic transition states that "societies that experience modernization progress from a pre-modern regime of high fertility and high mortality to a post-modern one in which both are low" (Lee, 2003). This transition was first observed in Europe in 1800. During the pre-transition period, life was short with high birth rate and death rate (Wahdan, 1996). Beginning around 1800, the transition began in Europe with declining mortality, which was contributed by reductions in infectious diseases and improvements in nutrition (Kirk, 1996). Whilst the transition did not start in many low-income countries till the twentieth century, this transition progresses rapidly in a short course of time in these communities.

The second stage of demographic transition in the classic model involves the decrease of population mortality. As a result, there is population growth as mortality decreases but fertility remains high. This is a stage in transition as the growth in population cannot

be sustained in a society with limited resources and is constrained by the cost of raising a family. When family size begins to grow, it becomes more costly to maintain a household. Social development, in particular the advancement in technology, also plays a role in increasing the opportunity cost of rearing children (Kirk, 1996). Although it remains debatable, the availability of contraceptive methods may also facilitate the transition of this demographic stage to the next (Kirk, 1996).

Of note, prior to this stage of transition, most people die at a young age. The initiation of this transition stage is reflected in the presence of older people in the population and a higher dependency ratio. As mortality declines, more infants survive through childhood while there is persistant high fertility. There are more children per household. At this stage of transition, young people still comprise a large proportion of the population.

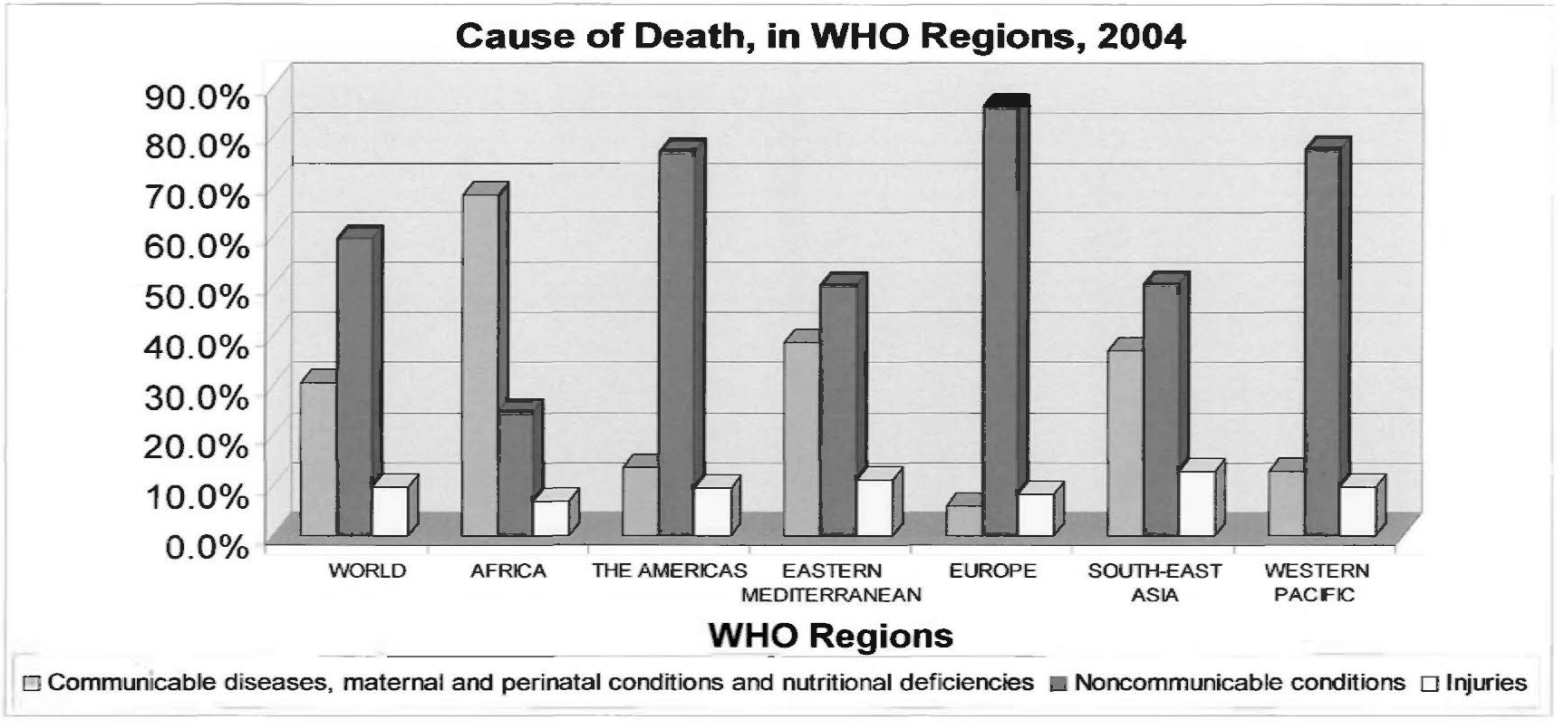
The beginning of the third stage in transition is marked by a decrease in fertility. Families begin to have fewer children as the conditions for child development improve and child mortality declines. Markets and government policies also contribute to diminishing the value of children as the opportunity cost increases when technological development makes labor more productive (Lee, 2003). Mortality may continue to decrease with continual advancements in medical technology. When the reduction in fertility reaches an equilibrium with mortality, population growth stabilizes back to a constant level. The population growth usually continues to rise for a period of time due to the lag time between the drop in mortality and fertility. If fertility drops to a low level (such as below the replacement level) meanwhile life expectancy increases, the population shifts to an older average with slow replacement from the young generation.

Disease Pattern – Epidemiological Transition

Epidemiological transition is usually referred to "the general shift from acute infectious and deficiency diseases characteristic of underdevelopment to chronic non-communicable diseases characteristic of modernization and advanced levels of development" (Shaluf, 2003). It can generally be observed when non-communicable, chronic conditions become the predominant disease profile as development evolves. Specifically, in this transition process, there is a period when a country is still being burdened with communicable diseases, while non-communicable, chronic conditions begin to climb.

Figure 2.4 illustrates the differences in main cause of death in various WHO regions in 2004. In general, Western countries have a much larger proportion of deaths from chronic illness than communicable diseases and injuries. On the other hand, communicable diseases category comprises the largest proportion in the cause of death in Africa region, which is the only WHO region with a higher proportion of death from communicable diseases category than non-communicable conditions. The second largest burden of communicable diseases category are Eastern Mediterranean region and South-East Asia region. Meanwhile, injuries, on the other hand, have less variation across the WHO regions, and are responsible for approximately 10% of the world's mortality.

Figure 2.4 Main causes of death in WHO regions, 2004 estimates



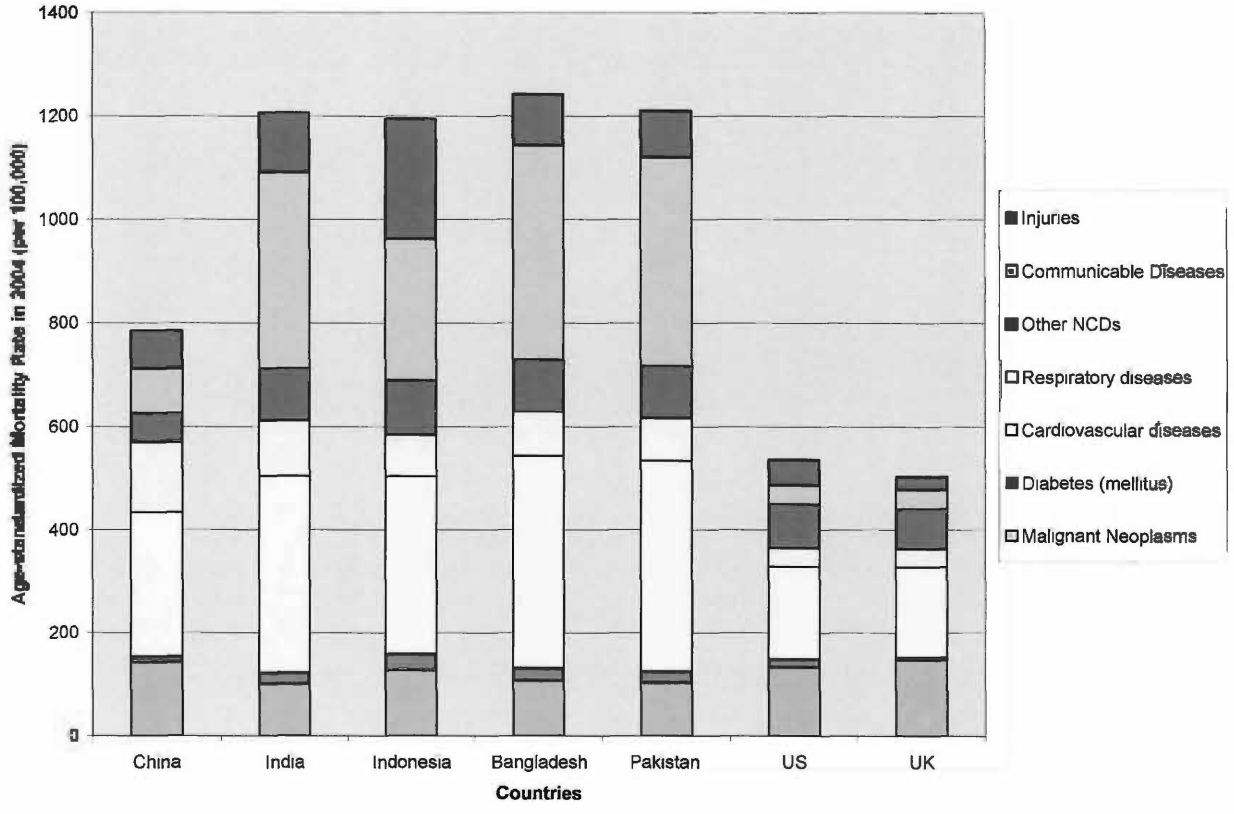
Source: WHO Disease and injury regional estimates for 2004

The Non-Communicable Diseases Burden in Developing Countries

By the mid 2000s, the cause of death globally was no longer predominated by communicable diseases. Over 60% of all deaths were caused by chronic diseases (Beaglehole et al., 2008). **Figure 2.4** suggests the disease burden in developed countries is mainly from chronic, non-communicable diseases, more than 80% of the deaths caused by chronic diseases happened in low-income and middle-income countries (Abegunde et al., 2007).

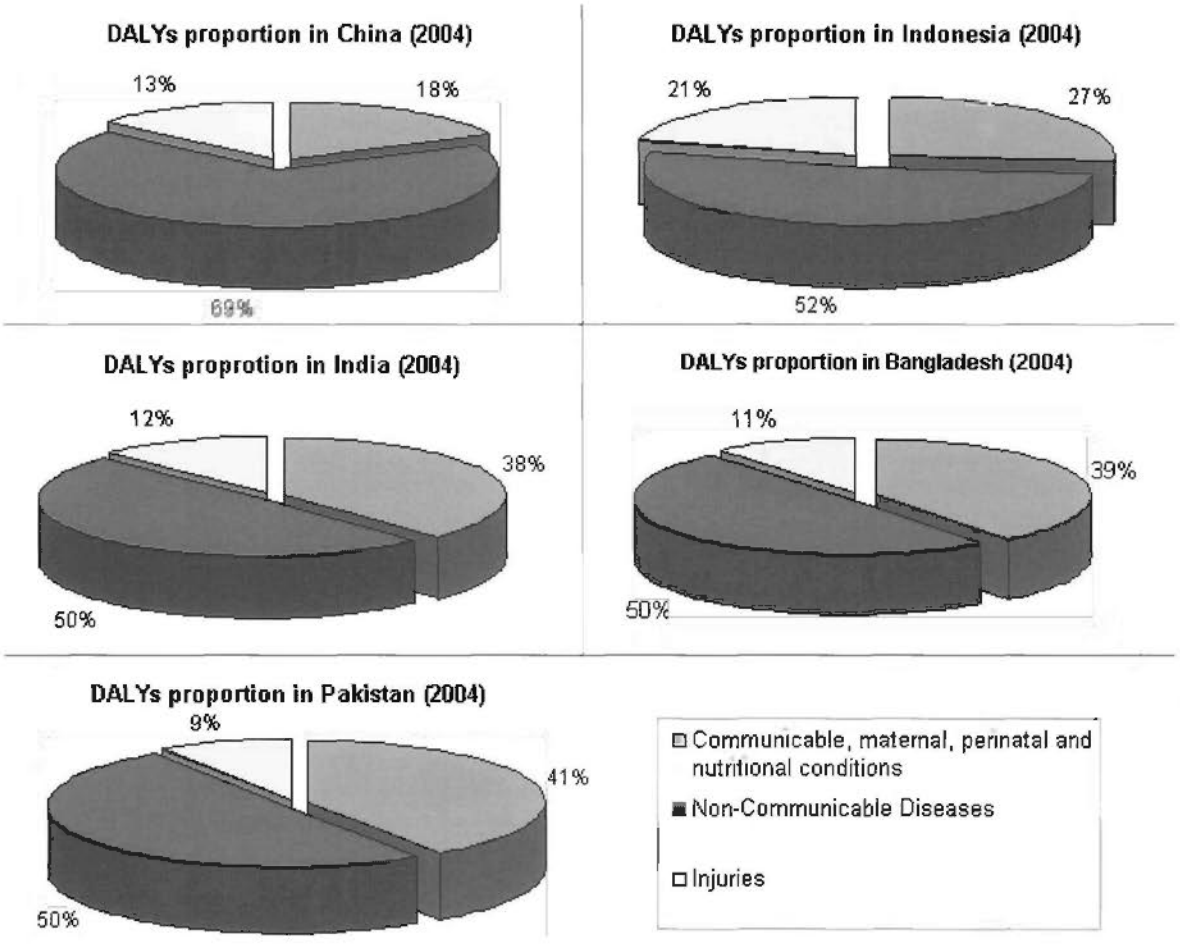
For the 21st century, the burden of non-communicable diseases is predicted to be on an increasing trend with aging populations, urbanization and the growing prevalence of behavorial health risk factors in many developing countries (Beaglehole et al., 2008). As shown in **Figure 2.5** and **Figure 2.6**, non-communicable diseases are responsible for about half of the mortality and morbidity in several highly populated developing countries. The age-standardized death rates for chronic diseases in the selected 15 low and middle income countries were higher than that in high-income countries (Beaglehole et al., 2008).

Figure 2.5 Estimated age-standardized mortality by cause in selected countries (2004)



Source: Global Burden of Disease. WHO, 2009.

Figure 2.6 DALYs proportion in some developing countries (2004)



Source: WHO Global burden of disease 2004 update

In spite of the general trend in the change of disease patterns, it is important to note that the epidemiological transition is not time-bound and unidirectional but a dynamic process, integrated by changes and the interactions between demographic, socioeconomic, environmental and biological factors (Abegunede et al., 2007). For example, although the classic epidemiologic transition progress with the decline of infectious diseases and the rise of non-communicable/ degenerative diseases, the large burden of AIDS and the re-emergence of evolving drug-resistant TB pose significant health threats to many developing countries and even developed countries.

Disaster Medicine and Disaster Epidemiology

Disaster medicine can be considered as the sub-specialty branch of clinical medicine which combines theory and concepts of public health and emergency medicine (Ciottone et al., 1992; Graham, 2011). It provides a technical framework to facilitate evidence based clinical treatment, health services planning and response in crisis and disasters.

Disaster epidemiology is the study of time, place and person in a disaster. This is a branch of epidemiology which aims to quantify the human health impact of disaster (Lechat, 1990; Lechat, 1991; Noji et al., 1991; Lancet, 1990; Lillibridge et al., 1993; Graham, 2011). The underlying principle of disaster epidemiology assumes post disaster adverse health outcomes do not occur randomly within a population but rather in a predictable pattern. (Noji, 1997) Disaster epidemiologists will play essential role to provide informed advicesabout probable future health effects of disasters. This branch of science will help to establish priorities and guide resource allocation for vulnerable populations in extreme settings (Binder & Sanderson, 1987; Noji, 1997).

Direct and Indirect Health Impacts of Disasters

Depend on the type of disaster and the magnitude of the event, different types of disasters have may have their specific health and public health effects (Lechat, 1990; Noji, 1991; Noji, 1997; Redmond et al., 2006). In general, health impacts can be classified as direct and indirect. Direct health effects include health outcomes sustained during a disaster. Common effects include mortality, physical health problems such as injuries and psychological impacts such as post-traumatic stress disorder. Indirect health effects refer to health outcomes attributable to the presence of a crisis. Typical indirect health effects include malnutrition due to food scarcity, unintentional injuries, transmission of infectious diseases and manifestation of non-communicable diseases, as well as social health impacts. Of note, depending on resources availability, the rate of recovery and resilience of the population, the indirect health effects may be sustained long after the occurrence of the disaster. **Table 2.4** describes some possible public health consequences of disasters (Noji, 1997).

Table 2.4 Possible public health consequences of disaster

Disaster impact	Possible Public Health Consequences
Caused unexpected number of deaths, injuries or illness in affected community.	Exceeding the therapeutic capacities of the local health services and requiring external assistance.
May destroy local health infrastructures (such as hospitals), routine health services and preventive activities.	Lead to long term health consequences in terms of increase morbidity and mortality.
May have cause adverse effects on environment and population	Lead to increase potential risk for communicable diseases and environmental hazards. These might lead to long term health consequences in terms of increase morbidity, premature death and diminished quality of life.
Affect psychological and social behaviour of the stricken community.	Increase of psychological disturbances (e.g. PTSD, depression, anxiety, panic, neuroses etc)
Cause shortage of food with severe nutritional consequences (such as starvation)	Health morbidities and death
Cause large, spontaneous or organized population movements, often to areas where health services cannot cope with the situation.	Poor sanitation and contaminated water in displaced camps (Toole & Waldman, 1990) Cause increase risk of communicable diseases
Long term consequences (e.g. nuclear accidents)	Morbidities and premature death

Noji (1997). Adapted from Chapter 1. The nature of disaster: General characteristics and public health effects. In Noji. E.K edited: The Public Health consequences of disasters. Oxford University Press. 1997

Earthquakes cause high mortality and morbidity. These human tolls often result from building collapse, falling debris and entrapment. Entrapment may lead to suffocation, hypothermia and associated survival risk such as gas leak, smoke, drowning, and electrocution. Most successful rescue is carried out by the immediate actions of survivors during the first phase, when the change of survival is highest. Earthquakes destroy transportation and communication systems, and they place many burdens on the health system with the large amount of injuries. On the other hand, water sources are not contaminated in many cases and there is no evidence of unburied dead causing the spread infectious diseases. Unlike flooding, disease outbreak is not a major concern.

Despite the destruction of public infrastructure and public health services, there continues to be a significant health risk through potential outbreaks of infectious diseases in disaster affected areas and in many cases, the health needs in those communities are also heavily influenced by the health conditions of the population pre-disaster.

Public health response to disaster

The public health response to any disaster or crisis has three basic principles (Bolton, 2006). These include to: i) secure the basic resources that human beings require to maintain health, ii) determine current and likely health threats to the affected community, give the local environment and community resources, knowledge and enable health maintaining behavior, & iii) find and provide resources required to address (i) & (ii).

Basic requirements to maintain health will include clean water and sanitation, food, nutrition, shelter and clothing and health services (SPHERE, 2004) and information. The most important element in public health approach in disaster and crisis is the proactive, preventive and multidisciplinary nature of its response actions. Health needs assessment post disaster will potential improve chance for survival for disaster affected population. Such assessment should include collection of information related to demographic characteristics and size of the population, current health problems, condition of the environment, security issues, identify special needs of vulnerable population and health system and disaster response capacity (Bolton, 2006, Landesman, 2001).

Disaster Response Cycle

In principle, disaster response should be planned and implemented according to the stages of disaster and its associated needs (Chan & Sondorp, 2007). **Figure 2.7** shows the five stage disaster response cycle.

Figure 2.7 The disaster response cycle

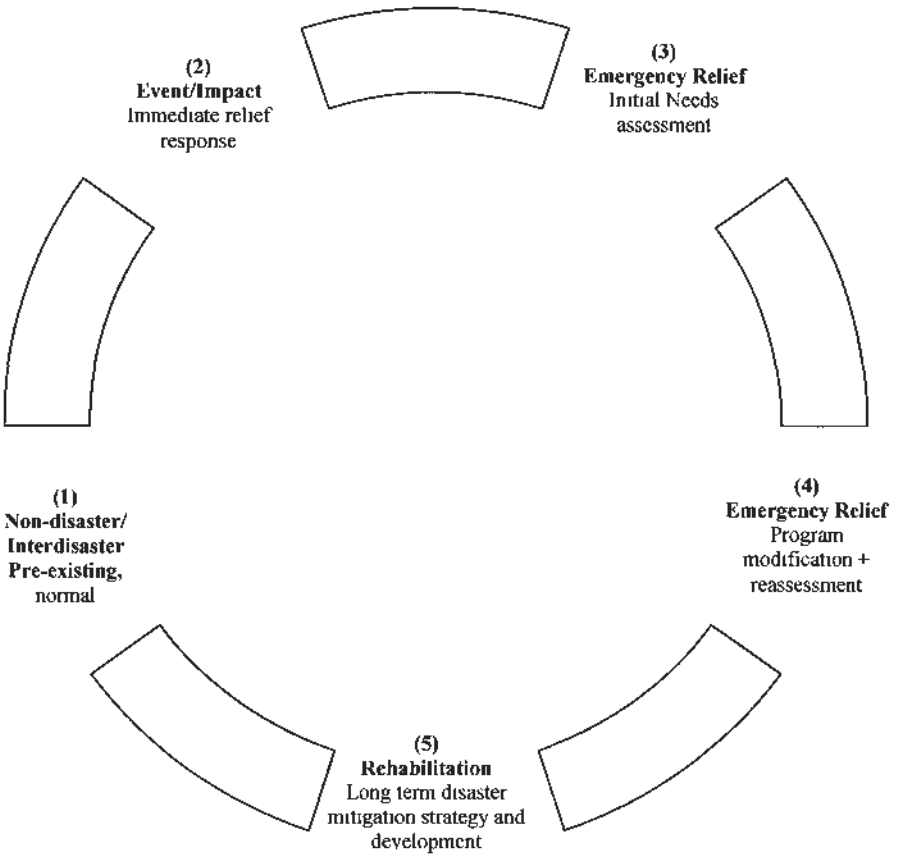


Diagram adapted from Chan, E Y , & Sondorp, E (2007) Medical interventions following natural disasters missing out on chronic medical needs Asia Pacific Journal of Public Health, 19 Spec No 45-51

The impact of demographic and epidemiological transition in disaster medical relief and humanitarian response

The transition in disease patterns has multiple-level impacts on disaster response. Direct health impacts might include the higher operation complications risk for disaster affected population with chronic conditions. Indirect health needs may be created due to the lack of access to service of chronic disease patients as a result of the disruption of routine medical care during disasters, exacerbation of pre-existing disease as a result of environmental pollution (dust resulted from the disaster) and the inability of health service providers to adapt to resource constraints to deal with chronic disease management in disaster field settings. There is a gap in the current literature to understand these demographic and epidemiological changes on disaster responses and policy.

How are these principles related to this thesis?

The study series presented in this thesis intends to address this literature gap. Disaster epidemiological studies were conducted in two major earthquakes in Asia post millennium to examine how patient and disease profile might have changed according to these technical principles.

Chapter 3 Literature review of health impact of earthquakes and burden of chronic diseases in disasters responses

This chapter consists of three parts. **Part I** presents a historical understanding of the public health consequences of earthquakes. As China has the highest number of earthquakes and associated mortality, **Part II** presents a literature review of published literature related to the health impact of earthquakes in China during 1906-2007. **Part III** reviews the literature on the current understanding of the burden of chronic diseases in disaster responses.

Part I Historical understanding of public health consequences of earthquake

More than a million earthquakes occur each year- an average about two episodes per minute (Hays, 1990). Earthquake strength (in Richter magnitude scale), topographic factors (e.g. local soil condition), meteorological factors (coincide with storm), associated disasters (such as volcanic activity, tsunami etc) and human generated factors (e.g. filling of large water impoundments, deep well injection, underground explosions of nuclear devices and the collapse of underground mine-workings (Stratton, 1989) etc) are all factors that may be affecting earthquake occurrence and severity (Noji, 1997).

Historical perspective of public health impacts of earthquakes

Most available research literature on health impact of earthquakes was conducted in developed, high-income countries such as the United States, Japan and Italy.

Earthquake related death can be instantaneous (injuries of vital organs), rapid (asphyxia from dust inhalation or chest compression, shock or environmental exposure) or delayed (dehydration, hypothermia, crush syndrome, wound infections or post operative sepsis) (Pretto et al, 1994; Noji, 1997). Research studies indicate human mortality in earthquakes is mainly due to mechanical injury such as being crushed by falling debris (Coburn, 1992). Collapsed building structures and non-structural elements such as fixtures, glass, furniture and chemical substances may all contributes to mortality and morbidity (Rahimi & Azevedo, 1993).

There are three groups of factors affecting human health outcomes (Noji, 1997) following disasters. These are: i) natural factors such as landslides, tsunami, aftershocks, local weather conditions and time of the day, ii) human generated factors such as hazard materials, fire risks, dams, structural factors and non-structural factors (staircase (Durkin, 1992), furniture (Rahimi & Azevedo, 1993)), and iii) individual risk factors such as demographic characteristics, entrapment, occupant's location within a building, occupant behaviour and time until rescue.

A recent review of mortality pattern in earthquake indicated that the extremes of age, and poor anti-seismic capacity of buildings and high population density were the leading causes of death. Entrapment was found to be a significant mortality risk factor. Deaths were found 67 times higher for people who were trapped in the 1988 Armenia earthquake (Noji, 1999) and 30 times higher in the 1990 Philippines (Roces et al., 1992). Occupants of motor vehicles during a disaster were also experience higher mortality risk in the United States (CDC, 1989; NSC, 1989). A dose-response pattern was also found for the risk of injury associated with building floor where people were in during the earthquake (Armenian & Noji, 1992). In addition, burns

and smoke also constitutes two important health outcomes predictors post earthquake (Coburn, 1992). Long-term problems faced by victims include renal problems, mental health issues and even lower cognitive function from babies in the second or third trimester during the earthquake (Chan et al, 2011).

Studies reported that clinical needs following earthquakes include lacerations, contusions, fractures, hypothermia, secondary wound infections, gangrene, adult respiratory distress syndrome (ARDS), multi-organ failure and crush syndrome. The burden of acute care of non-surgical problems such as myocardial infarction, exacerbation of chronic diseases such as hypertension and diabetes mellitus and mental health problems and respiratory conditions caused by dust.

In terms of health service management, studies published on the disease pattern and hospital evacuation in urban settings of developed, high income countries found contusions and lacerations increased threefold and were the largest category of attendances after the 1994 Northridge earthquake in the United States (US Geology, 2010). Increases in gynaecological complications (Salinas et al., 1998) and cardiovascular mortality (Kloner et al., 1997) were also reported. Nevertheless, the increase was short-lived, with levels returning to baseline two days after the earthquake (MacAuthur et al., 2000).

Schultz *et al* (Schultz et al., 2003) examined the decision-making process for 92 acute based hospital evacuations after the Northridge earthquake. Results indicated less than 10 % of the hospitals evacuated and 75% of these hospitals decided to immediately evacuated hospitals because of concerns in non-structural damage such as water damage and loss of electrical power. Two hospitals delayed their evacuation

as whilst initial inspections showed no damage in these hospitals, later structural evaluation confirmed the need for building demolition to ensure safety (Schultz et al., 2003). These authors also investigated the relationship between the distance from the epicentre and the hospital damage, and found that the peak ground acceleration to be a better indicator of hospital damage than the distance from epicentre (Schultz et al., 2007).

Summary

Overall, the literature review has considered previous studies and identified epidemiological patterns of earthquake. Nevertheless, most of these studies were conducted in developed, high income countries where pre-existing health system and disease patterns might be different than those of developing, middle income countries in Asia.

Part II: Literature review of health impact of earthquakes in China

Part of the discussion of this chapter was published in Chan Ying Yang Emily; Gao Yang and Griffiths Sian Meryl. " Literature review of health impact post-earthquakes in China 1906-2007". Journal of Public Health 2009; doi: 10.1093/pubmed/fdp078. 2009.08.04

According to CRED, four of the ten earthquakes with the highest death tolls occured in China (CRED, 2010). The aim of this literature review is to examine the health impact of China through published evidence. Publicly-available information describing human impact of earthquakes in mainland China was obtained from the following sources: 1) the publicly accessible EM-DAT database which provides descriptive information about earthquakes in China, including dates of occurrence, geographic distribution and impact on human lives, 2) academic databases which include full-text databases of local Chinese journals [Chinese Journal Full-text Database (CJFD) and Wanfang Database] and English international databases (PubMed, Medline, and ELDIS), and 3) Google internet.

EM-DAT

Since 1988, the WHO Collaborating Centre for Research on the Epidemiology of Disasters (CRED) has maintained the Emergency Events Database - EM-DAT, created with the initial support of the WHO and the Belgian Government. EM-DAT is accessible online to provide core data on the occurrence and effects of over 12,800 mass disasters in the world from 1900 to the present. The database is compiled from various sources, including UN agencies, non-governmental organizations, insurance companies, research institutes and press agencies. Disasters are defined as events that

result in more than 10 deaths, more than 100 people affected, or a request for international assistance after the declaration of a state of emergency (EMDAT, 2010). The EM-DAT database contains information about earthquakes in China. I have chosen to start the literature search from 1976 as there is limited information in China before this time due to political reasons. Of note, whilst the 1976 Tangshan earthquake had caused the greatest loss of life in the 20th century, there was likely to be an under-reporting of the human impact of this earthquake as Chairman Mao, at the time of the earthquake, was on his deathbed dealing with a furious succession battle with the Gang of Four and diverting press attention away from the suffering caused by the quake.

ACADEMIC DATABASES AND INTERNET

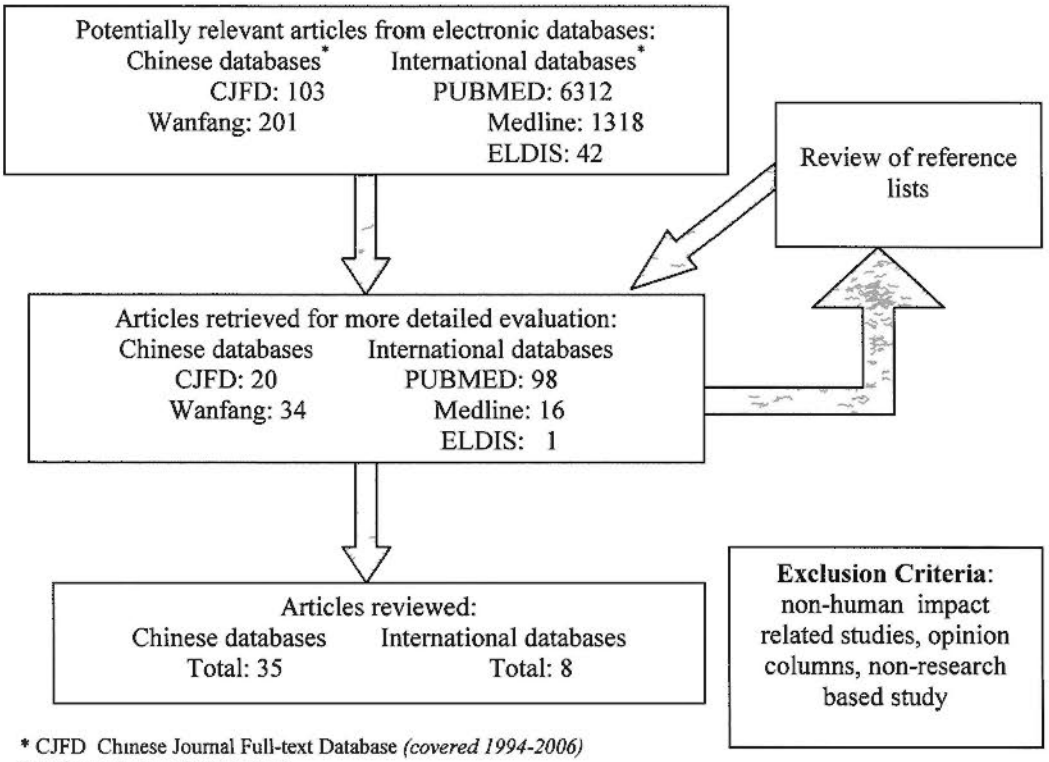
A literature search was conducted in May 2008 and again in December 2008. It included relevant articles from two local Chinese full-text databases [Chinese Journal Full-text Database (CJFD) and Wanfang Database], three English international databases (PubMed, Medline, and EIDIS), and Google internet. A search algorithm was developed to identify literature on the health impact of earthquakes in China. Earthquake-related keywords included earthquake 地震, after earthquake, and disaster 災害, whilst keywords for health impact included mortality (rate) 死亡, death (rate) 死亡, injury (rate) 伤患, morbidity (rate), quality of life 生活质量, mental (health) 精神, psychological (health) 心理, socio-psychological (health) 社会支持与心身健康, and post-traumatic stress disorder (PTSD) 创伤后应激障碍. In addition, in international database searches, the location of the earthquake was limited to mainland China. Scientific studies (both original articles and literature reviews), field

reports, and documents from organizations providing medical disaster relief were reviewed in this study.

Based on the exclusion criteria, non-human impact related studies and opinion articles were excluded. Two of the project members (EC, YG) conducted independent literature searches in the databases and findings were compared to determine the final list of papers to be further evaluated. All relevant papers were then independently read and examined by EC and YG to elicit relevant information regarding human health impact and lessons learnt in emergency medical responses post earthquake in China (1906-2007). The quality of evidence of each identified paper was examined using the hierarchy of evidence (Merlin et al., 2009; Evans, 2003) and critically appraised with "EPHPP Quality Assessment Tool for Quantitative Studies" developed by the Effective Public Health Practice Project (EPHPP) of McMaster University School of Nursing. (EPHPP, 2009) Please refer to **Appendix II** for a sample of the critical appraisal framework.

Figure 3.1 shows search results in both Chinese and English databases. Articles published after 1976 were selected and a limited number of articles were found related to earthquakes in China (only eight written or translated into English) and most of them were published after 1990.

Figure 3.1 Diagram of bilingual literature search



* CJFD Chinese Journal Full-text Database *(covered 1994-2006)*
Wanfang *(covered 1998-2006)*
English database covered publications since mid-50's to 2006
Search conducted in May 2008

Two major reasons for the limited number of articles and publications before 1990 could be that: (i) available Chinese local journal databases only covered publications after 1994 and (ii) the "Open Door Policy", the opening up of China to the international community, only began to have an effect after the 1980s. Before the "Provisions of the People's Republic of China on the Disclosure of Government Information" came into force on May 21, 2008, information related to earthquakes was regarded as a national secret and therefore publishing such information was restricted. Of note, a specific search using Google Scholar (among biology, life sciences and environmental publications) located 338 articles for "China and earthquake". After reviewing the Google Scholar results, we decided not to include them as they mainly focus on building engineering and earthquake prediction and were insufficiently rigorous or relevant for this review.

From the search of EM-DAT, 108 earthquakes were described in China from 1906 to 2007. Based on the search results, earthquakes regularly rattled the vast Tibetan plateau including Tibet and the far west regions of Xinjiang and Qinghai provinces. They were also common in southwest Yunnan province. Earthquakes were relatively rare in central China and along the eastern seaboard, but the northwest was frequently hit by tremors. **Table 3.1** shows the mortality and chronology of some of China's biggest earthquakes since Tangshan in 1976.

Table 3.1 Mortality related to the major earthquakes in China 1976-2007*

Location	Date	Killed	Richter scale**
Tangshan, Pek.,Tientsin	27/Jul/1976	242,000	7.8
Lancang, Menglian counties (Yunnan province)	6/Nov/1988	939	7.6
Lishui, Ninglang, Haping counties (Lijian prefecture), Zhongdian (Diqing prefecture), Heqing, Jianchuan (Dali precture), Lanping (Nujiang prefecture) - Yunnan Province	3/Feb/1996	309	7.0
Jiashi (Payzawat), Bachu, Yuespuhu, Yingjisha, Maigati, Shule, Shufu, Kashi districts (Xinjiang region)	24/Feb/2003	268	6.4
Sichuan province	24/Jan/1981	150	6.9

**Created on Jul-19-2006 - Data version v06 05 Source "EM-DAT The OFDA/CRED International Disaster Database Université Catholique de Louvain Brussels Belgium"*
*** A logarithmic scale ranging from 1 to 10 used to express the total amount of energy released by an earthquake In this scale an increase of 1 represents a 32-fold increase in released energy*

According to historical data, China's most devastating earthquake in recorded history hit northern Shaanxi province in 1556, killing an estimated 830,000 people. (Hu, 2005) During the 20th century, the Tangshan earthquake which occurred on 27 July 1976 claimed the highest toll in human lives of some 242,000 people. (EMDAT, 2006) This earthquake registered 7.8 on the Richter scale, and its destruction was equivalent to 400 Hiroshima bombs. (GFSE, 1996) In the three decades since Tangshan, there have been 83 reported earthquakes in China that resulted in human casualties. China's state media has reported that more than 610,000 people were killed by these earthquakes. **Table 3.1** shows that Tangshan, along with two other earthquakes in China in the 1920s, rank top of the ten most devastating earthquakes in the world for loss of human life between the years 1906 and 2006.

Tables 3.2 and **3.3** list the Chinese and English articles found and reviewed. Please refer also to **Appendix I, Table 7** and **Table 8** for detailed descriptions of the named papers.

Table 3.2 Titles of Chinese articles* reviewed for human impact of earthquakes in China (please also refer to Appendix Ia for detailed descriptions of these references)

Code	Article Title: Chinese (translated English Titles*)	Year
W14	唐山大地震对母孕期胎儿情绪障碍的远期研究 Long term study of perinatal impact of Tangshan earthquake on emotional disorders *	2005
W31	河北唐山地震后孤儿的心理变异及其社会化治理 Psychopathology and Socialized Direction of Orphans in the Tangshan Earthquake	2002
W38	母孕期经历唐山大地震的青少年认知功能远期研究 Long term study on perinatal impact of Tangshan earthquake on teenage cognitive outcomes*	2001
W43	唐山大地震孤儿远期心身健康的调查研究 Long term implication on physical and mental health on Tangshan earthquake orphans*	2000
W49	巴拉考特地震灾区发病状况分析 Disease pattern analysis study on Pakistan earthquake*	2007
W70	中国大陆百年(1901～2001 年)浅源强震活动及生命损失回顾与分析 Retrospective analysis off earthquake damage and impact on human lifes for the past century in China*	2005
W82	1954 年山丹 71/4 级地震概述 Outline of the Shandan Earthquake of Ms 7 ¼ in Gansu Province on February 11, 1954	2005
W91	辽宁海城 7.3 级地震死亡人数-年龄分布的分析 Mortality analysis of 7.3 Richter Scale Haicheng Earthquake in Lianning province*	2004
W97	2003 年 12 月 1 日新疆昭苏县 6.1 级地震与救灾 2003 6.1 Richter Scale Xinjiang Earthquake and disaster response*	2004
W101	河北省张北地震震害初探 Hebei Province Earthquake Study*	2004
W104	唐山大地震远期神经症抽样调查和病因学探讨 Randomized pathology study of long term neurological impact resulted from Tangshan Earthquake*	2001
W106	2003 年 12 月 3 日四川道孚 4.8 级地震烈度调查与损失评估 2003 Sichuan Earthquake investigation and damage estimation*	2004
W133	2003 年 8 月 16 日内蒙古 5.9 级地震概述 Overview of 2003 August 16 Inner Mongolia*	2003
W137	新疆乌恰 2002 年 12 月 25 日 5.7 级地震灾害损失评估 Damage estimation study of 5.7 Richter Scale Xinjiang earthquake on December 25th 2002*	2003
W138	新疆巴楚-伽师 6.8 级地震灾害损失评估 Xinjiang Bachu - Jiashi 6.8 earthquake damage assessment	2003
W144	2003 年 2 月 24 日新疆巴楚-伽师 6.8 级地震 Earthquake of M 6.8 Occurring in Bachu-Jiashi Region,Xinjiang Uygur Autonomous Region on February 24,2003	2003
W156	2001 年 5 月 24 日四川盐源 5.8 级地震灾害及损失评估 Damage estimation study of 5.8 Richter scale May 2001 Sichuan earthquake*	2002
W163	内乡 -镇平 4.7 级地震及震后应急 The Neixiang-Zhenping, Henan, M4.7 earthquake and the post-earthquake emergency response	2001

W179	中国的地震灾情及其区域分异 Geographic and Disaster profile analysis of China earthquakes*	2001
W188	1998年8月27日伽师6.6级地震宏观烈度与震害 Overview study on 6.6 Richter Scale JiaShi Earthquake*	2000
W194	1999年11月29日辽宁省海城-岫岩5.6级地震震害统计和损失评估 Disaster impact and damage estimation study 5.6 Richter Scale 1999 November Haicheng Earthquake in Lianning province*	2000
W196	新疆喀什地区乡村地震人员伤亡矩阵与对比研究 A comparison study of mortality and morbidity pattern in rural population from Kashgar, Xinjiang Earthquake*	2000
C2	唐山地震孤儿21年后的心理健康状况 21 years later: Study on tangshan earthquake orphans mental health status*	2000
C11	大地震创伤后应激障碍患者的心理与神经内分泌变化 A study on mental, neurological and endocrine changes in PTSD victims post Great Earthquakes*	2002
C31	唐山大地震所致慢性创伤后应激障碍临床研究 Study on chronic PTSD patients of Tangshan earthquake*	2005
C58	唐山地震26年后幸存脊髓损伤患者的社会调查 A social survey of patients with spinal cord injury 26 years after Tangshan earthquake	2006
C60	唐山地震幸存脊髓损伤患者心理及婚姻状况调查 Survey of marriage and mood of patients with spinal cord injury survived after Tangshan earthquake	2005
C63	唐山大地震所致孤儿心理创伤后应激障碍的调查 A study of post-traumatic stress disorder in Tangshan earthquake orphans	2000
C81	胎儿期经历唐山大地震的青少年心理状况 Psychological status in adolescents who experienced Tangshan earthquake during fetal period	2006
C84	唐山大地震所致截瘫患者远期心身健康状况调查研究 Long term effects of Tangshan earthquake on psychosomatic health of paraplegic suffers	2002
C85	张北尚义地震后创伤后应激障碍随访研究 Longitudinal Study of Earthquake-related PTSD in North China	2000
C89	唐山大地震所致截瘫患者社会支持和生活质量与心身健康的对比研究 Life style and psychosomatic health in paraplegic suffers of Tangshan earthquake	2002
C92	地震后17个月受灾青少年PTSD及其相关因素 Prevalence and Correlated Factors of PTSD in Adolescents 17 months after Earthquake	2001
C99	唐山地震21年后截瘫者的心理状况及生存质量 Twenty one year follow up psychological survey of patients with paraplegia caused by Tangshan earthquake	2002
C100	唐山地震25年截瘫病人死亡原因调查与分析 Retrospective Mortality Analysis of paraplegic patients resulted from Tanghshan Earthquakes	2001

*W: Wanfang; C: CJFD. * These English titles were not available and weres translated for easy referencing in this study.*

Table 3.3 Titles of English articles reviewed for human impact of earthquakes in China (please also refer to Appendix Ib for detailed descriptions of these references)

Code	Article Title	Year
P3	Prevalence of psychiatric disorder following the 1988 Yun Nan (China) earthquake--the first 5-month period	2003
P15	Post-earthquake quality of life and psychological well-being: longitudinal evaluation in a rural community sample in northern China	2000
P19	Longitudinal study of earthquake-related PTSD in a randomly selected community sample in north China	2000
P20	The health effects of earthquakes in the mid-1990s	1996
P39	A renal function survey in paraplegic patients of the Tangshan earthquake	1989
P88	Study on environmental health strategy after earthquake	1989
P92	Medical support in the Tangshan earthquake: a review of the management of mass casualties and certain major injuries	1987
P96	A physical interpretation of the Haicheng earthquake prediction	1977

Table 3.4 highlights the literature findings according to study focus and categories. The review literature indicates that more studies were conducted on mental health outcomes than physical health. Studies related to outcomes of the 1976 Tangshan earthquake dominated the available literature before December 2008. In addition, the quality of evidence were suboptimal as most evidence was from IIIb or IV level study (please refer to the **Appendix** for a detailed description).

Table 3.4 Literature findings according to the study focus

	Chinese database	English database
Clinical/Health Topics		
Overview (Human health/life impact, health/response policy related)	14	2
Physical	8	3
Mental/Psychosocial health	13	3
Specific Earthquake studies		
Tangshan Earthquake Related studies	18	2
Sichuan	2	0
Xinjiang	6	0
Lianning	2	1
Other	1 (Gansu), 1 (Henan)	1 (Yunnan)

Adapted from results Chan Ying Yang Emily, Gao Yang and Griffiths Sian Meryl. (2009). " Literature review of health impact post-earthquakes in China 1906-2007." Journal of Public Health. Vol 32, No 1 pg 52-61.

Findings indicated that 50% of global earthquake-related life-loss occurred in China in the last century. Of note, 50% of natural disaster-related mortality in China was due to earthquakes in China (Yuan et al., 2001). Overall, greater human life loss accumulated from earthquakes on the eastern side of China when compared with western provinces. This pattern may have been associated with population density and the level of economic and social development. The estimated ratio of economic loss when compared between eastern and western provinces ranged from 5:1 to 10:1. Most study results from the 1976 Tangshan earthquake show that the causes of deaths from earthquakes of magnitude between 6.5 and 7.4 in China were similar to earthquakes of that scale outside China (Alexander, 1996).

Most earthquake related death occurred in the first six hours. Though there were significantly increased numbers of deaths at the extremes of age, only limited studies have reported on vulnerable groups such as children and older individuals following disasters. (Jia & Gao., 2004) Children were particularly vulnerable and suffered the highest death rate, mostly due to burns and cold, occurring among infants and children under 4 years old. For older people (72-89 years old), most deaths resulted from an exacerbation or complication of underlying chronic diseases. There are no available studies on indirect mortality after earthquakes, although several studies on earthquakes in Japan have shown that chronic medical problems account for medium to long term post-earthquake mortality (Kario, 1997). Physical and structural environmental reasons were major causes of injuries that lead to mortality. One study analyzing principal causes of death from earthquakes (6-9 on the Richter scale) in rural Karshi area (Xinjiang) from 1955-1998 showed that poor anti-seismic capacity

of buildings was the leading cause of death in lower seismic earthquakes, whereas population density was the leading cause in higher seismic zones (Li et al., 2000).

Most post-disaster studies have been reported as clinical specialty research articles that examined 1976 Tangshan earthquake related health outcomes. One study on the long-term heath impact of disaster-affected individuals showed that renal complications were the main physical morbidity post-earthquake (Liu, 2001). Another study investigated high school students (aged 18 years old or above) who were fetuses during and after the Tangshan earthquake and observed lower cognitive function among those whose mothers carried them during the earthquake. The effect was especially pronounced among those in utero in the second (3-6 months) and third (6-9 months) trimesters during the earthquake (Wang et al., 2001).

There is limited information on other morbidity patterns. A study on earthquake-related post-traumatic stress disorder (PTSD) and mental health in northern China in 1998 found that the Chinese population, based on DSM-IV criteria, had comparable prevalence of PTSD to that of other countries (Wang et al., 2000a). Another study of quality of life (QoL) post-1998 Hebei earthquake found that exposure to the earthquake was associated with multi-dimensional impairment of QoL. Victims suffered significantly more psychological distress including depression, somatisation, and anxiety (Wang et al., 2000b). Meanwhile, no studies of physical injury patterns or burden of non-communicable diseases post-disaster were found during the study period.

Overall, there is limited published research-based literature in the public domain on the human impact of earthquakes in China before 2007. This is partly due to the

limited availability of information before the mid-1980s when reporting was restricted and perhaps there was a general lack of interest in research related to the health impact of disasters in China. In addition, according to the hierarchy of evidence (Merlin et al., 2009; Evan 2003) the quality of evidence found for the study topic was found to be generally low. There has been no meta-analysis or randomized controlled trial related to post-disaster interventions.

This study focuses on the published literature before the 2008 Sichuan Earthquake and highlights gaps in the understanding of the characteristics, morbidity, injury patterns, and long term rehabilitation of survivors of Chinese earthquakes. Whilst more health impact related research is expected to emerge after the 2008 Sichuan earthquake, published literature before 2007 can still offer some important lessons and insights about earthquake response in China.

First and foremost, lessons learnt in China regarding emergency health response to earthquakes were compatible to related studies from other countries during the study period. Previous studies in other developing countries such as Armenia (Armenian et al., 1997; Armenian et al., 1992), Guatemala (Glass et al., 1977), Turkey (Ceciliano et al., 1993) Philippines (Roces et al., 1992) and Italy (De Bruycker et al, 1990) during the time period indicated that specific risk factors such as building types and response management might have had a major impact on population survival.

Furthermore, there were major gaps in the published literature regarding the health impact of earthquakes. Of note, there was a lack of study of older populations and management of chronic diseases (Chan & Sondorp., 2007; Chan & Sondorp., 2008) a major health challenge for China in the 21st century. In a study of health concerns in 100 households following earthquakes in El Salvador, 79% of households included a

member who had experienced exacerbation of a chronic disease (Woersching & Synder., 2003; Woersching & Synder., 2004a, Woersching & Synder., 2004b). Experience from Japanese earthquakes(Matsuoka et al., 2000) found a strong link between the extent of damage due to a catastrophic earthquake and morbidity rates for both acute (pneumonia and peptic ulcer) and acute chronic disease (such as asthma). *Tomita* (Tomita et al., 2005) reported that asthma worsened after the Tottoir-Ken Seibu earthquake in 2004. Among the 156 asthmatic patients studied, the acute asthma attack rate increased within the first week after the earthquake and 11% had an exacerbation within one month after the earthquake. Following the Great Hanshin Earthquake in 1995, more patients were admitted with acute-on-chronic respiratory failure and acute exacerbation of bronchial asthma. (Maeda et al., 1996) With an aging population and increasingly heavy burden of chronic diseases in China (China MOH, 2008), understanding post-earthquake needs of those with chronic diseases will be important to address in future disaster-relief efforts.

In addition, the review analysis highlighted how preparedness and rapid early response may help to decrease morbidity and mortality. For example, the case study report from Qinglong County during the Tangshan earthquake (GFSE, 1996) suggested that emergency preparedness and appropriate response decreased the adverse impact of natural disasters on the health of the affected community. As citizens were given warnings and time to prepare for the disaster, despite more than 180,000 buildings being destroyed, according to records, only one person died. Since the mid-1990s, the Chinese government has set goals to pass laws and develop policies to improve disaster response and local preparedness. Meanwhile, there has been a lack of longitudinal, follow-up studies of survivors as well as studies regarding the effectiveness of donations and relief action. No study adequately described the

population affected by earthquakes in remote communities in China. More research in this area should be undertaken.

Implications of the project findings for public health practice

The implication of findings will be discussed according two main areas, namely: a) medical and public health relief responses; and b) policy implications for public health preparedness post earthquake.

a) Medical and public health relief responses

The literature indicated that renal, orthopedic and spinal injuries were typical post-disaster medical needs. Medical and health relief teams should include related clinical specialists and allied health workers that might provide medical services to earthquake victims. For mental health, studies indicated that post-traumatic stress disorder (PTSD), depression, and other mental health outcomes might be affected by the timing of interventions. These results suggest the need to provide integrated mental relief services in the early stage post-earthquake. In addition, as highlighted previously, whilst a number of studies examined physical and mental health outcomes, none have explored or discussed how outcomes might be affected by changing demographic and epidemiological patterns in China which is increasingly skewed towards older people and people with chronic conditions. More studies should be conducted to provide further understanding of proper medical relief for an aging population with changing disease patterns.

b) Policy implications for public health preparedness post earthquake

Disaster mitigation policies should be established to safeguard the well-being of vulnerable populations. The impact of a natural disaster is based on two principal factors, hazard and vulnerability. Hazard is fixed as it is based on geological, meteorological or ecological characteristics of a region, but the vulnerability of a population can potentially be alleviated. Human life protective interventions should target identifying and reducing vulnerabilities in order to prevent unnecessary injury and death. Vulnerability includes physical, social, economic, and environmental factors. Analysis has shown that disasters have a greater impact in poorer countries and there have been various hypotheses of how poverty and the impact of disasters are linked. In China, the costs of damage, loss of productivity and life are difficult to estimate since they are compounded by the rapid economic growth that is occurring. (Song et al., 2003) However, one example of estimated costs from the literature studied suggests that the estimated costs of the earthquake in the southeast of Jiashi in Xinjiang on February 24, 2003, which registered 6.8 on the Richter scale was RMB 1.4 billion. The earthquake resulted in the death of 268 people and injury to 4,853, including 2,058 severe injuries. 49,656 families, or 205,079 people, were displaced from their homes. The affected region amounted to 21,498 km^2, covering 6 counties or cities, 37 towns, and 931 villages. With the enormous cost of earthquake to society, it would be important to develop effective response plan to reduce human suffering and economic costs.

Literature review findings indicated that human life loss resulted from collapsed housing. **Table 3.5** has led to the national earthquake-related laws, rules, regulations and standard documents (CEA, 2008). Provincial governments have correspondingly established local administrative rules and regulations. In addition to improving building codes and earthquake predicting techniques, certain provincial governments

have also stressed the importance of individual preparedness for disaster handling in recent years (Kano et al., 2005). In Yunnan province where earthquakes historically have resulted in high mortality, the provincial government has committed to promoting disaster response knowledge and equipping 30% of the population in the risk area with basic disaster relief supplies within the first 24 hours (CEA, 2006). Similar policies have been developed for Sichuan, Inner Mongolia, Chongqing City and Tibet. Such preparedness may account for the rapid response to the devastating earthquake in Sichuan province in May 2008.

Table 3.5 National earthquake-related laws, rules, regulations and standard documents in China

Law, rules, regulations	Issue number	Issue date
National law, administrative rules and regulations (5)		
Environmental Protection Regulations on Earthquake Monitoring Facilities and Earthquake Observation	Promulgated by Decree No.140 of the State Council of the People's Republic of China	1994/01/10
Emergent Response Regulations on Destructive Earthquakes	Promulgated by Decree No.172 of the State Council of the People's Republic of China	1995/02/11
Law of the People's Republic of China on Protecting Against and Mitigating Earthquake Disasters	Order of the President of the People's Republic of China (No. 94)	1997/12/29
Regulations on Administration of Earthquake Predictions	Promulgated by Decree No.255 of the State Council of the People's Republic of China	1998/12/17
Regulations on Administration of Seismic Safety Evaluation	Promulgated by Decree No.323 of the State Council of the People's Republic of China	2001/11/15
Regulations on Administration of Earthquake Monitoring	Promulgated by Decree No.409 of the State Council of the People's Republic of China	2004/06/17
Law of the People's Republic of China on Emergency Responses	Order of the President of the People's Republic of China (No. 69)	2007/08/30
Regulations of the People's Republic of China on the Disclosure of Government Information	Order of the President of the People's Republic of China (No. 492)	2007/04/05
Scientific and technological rules, regulations and standard documents (7)		
Regulations on Proclamation of Evaluation of Post-earthquake Trend	中国地震局令第 2 号 Promulgated by Decree No.2 of the China Earthquake Administration	1998/12/29
Regulations on Administrative Law Enforcement on Earthquake	中国地震局令第 3 号 Promulgated by Decree No.3 of the China Earthquake Administration	1999/08/10
Regulations on Administrative Reconsideration on Earthquake	Promulgated by Decree No.4 of the China Earthquake Administration	1999/08/10
Regulations on Administrative Legal Supervision on Earthquake	Promulgated by Decree No.5 of the China Earthquake Administration	2000/01/18
Ordinance concerning the Procedures for the Formulation of Administrative Regulations on Earthquake	Promulgated by Decree No.6 of the China Earthquake Administration	2000/01/18
Management Regulations on Requirement for Earthquake Resistance Protection of Construction Engineering	Promulgated by Decree No.7 of the China Earthquake Administration	2002/01/28
Qualification Management Regulations on Seismic Safety Evaluation	Promulgated by Decree No.8 of the China Earthquake Administration	2002/02/27

Several study biases exist in this study. First, the literature search algorithm may have unintentionally excluded related articles as it did not include grey literature sources (local governmental reports, media/newspaper) and other non-health literature sources. For instance, whilst highly relevant, a related study report of the 1988 Yunnan earthquake (Sapir & Panaccione., 1992) did not shown up in our search strategy as the journal was not within the search reach of the health literature database. In addition, the scope of this study was based on historical records and potential reporting bias may have resulted. It is expected that a greater amount of scientific literature will be available after the Wenchuan earthquake in 2008. Furthermore, although the WHO definition of health normally includes physical, mental and social well-being of an individual, the health impact of this study only focused on examining the negative impact of earthquake on physical and psychosocial health. Social well-being and other related determinants of health outcomes were limited.

Summary

China remains as the country which has suffered the greatest human impact from earthquakes (EMDAT, 2006). The bilingual literature review highlights major gaps in the understanding of human health impact post-earthquake in China. Whilst China managed to mount a swift and effective emergency response to the Sichuan earthquake, analysis of the response highlights that not all lessons had been learnt from previous disasters (Chan, 2008). The lack of emergency preparedness and training of medical staff to face the medical challenges posed by natural disasters was highlighted by recent experience. In addition, the needs of older people and people with chronic diseases were often ignored. The experience underlines the need for

future policy development to incorporate lessons learnt from this and other disasters in order to meet the immediate as well as long term needs of affected populations.

Part III Literature review of chronic disease burden post natural disasters

Main ideas of this section were published as a discussion paper titled, *Natural disaster medical intervention: Missed opportunity to deal with chronic medical needs? An analytical framework"* in a Humanitarian Practice Network Paper of the Overseas Development Institute (ODI).

Through literature review and a proposed analytical model, this section aims: (1) to understand how natural disasters affect populations with chronic disease, (2) to analyze how the current disaster intervention decision making process has addressed chronic medical needs, and (3) to identify issues that may improve the current situation through better strategic planning.

Why is chronic disease management post disaster an important issue?

After the millennium, WHO reported non-communicable diseases alone had accounted for up to 59% of total mortality in the world and 46% of the global burden of disease. By the year 2020, chronic conditions will be responsibility for 78% of the global disease burden in developing countries (Beaglehole et al., 2008). Researchers had pointed out that disease often has the greatest effect and worst consequences in the developing world and in the poorest segments of the population (Ibrahim, 2005). Many of these developing countries have to concurrently deal with unfinished agendas around acute infectious diseases, malnutrition and child health as well as chronic diseases; respondings to disaster had become a formidable task with limited resources.

Although disasters may cause massive loss of human life and destruction of resources, they may also present affected population with a rare opportunity for access to external resources and service allocation. Frequently, emergency medical/health relief

programs remain in the affected region for more than 6 months post-disaster. Even though urgent survival needs to reduce mortality take priority for medical resources immediately after the disaster, once survival needs have been met and when mortality rates have returned to pre-disaster levels, rehabilitation of the medical service/structure of the affected area to pre-disaster conditions can begin. There is huge potential added value for medical relief resources to support the restoration and rebuilding of health services that can address needs within an affected area. In fact, international disaster response guidelines such as SPHERE have advocated that a comprehensive range of health services should be developed (SPHERE, 2004). Many disaster related medical intervention programs focus on provision of acute medical service and control of communicable diseases.

Methods

WHO (WHO, 2005) has expanded the definition of chronic conditions from traditional "non-communicable diseases" (e.g. diabetes, cancer and asthma) to include conditions that require extended periods of health care support such as persistent communicable conditions, long-term mental health disorders as well as ongoing physical impairment. However, for this study we limit the scope to "traditional non-communicable disease" only. A medical literature search and web site review was conducted using PubMed, Medline, Eldis, Reliefweb and Google Internet search engine with keywords including: "chronic medical needs", "disaster", "heart disease and disaster", "diabetes mellitus and disaster", "asthma and disaster", "disaster medical guidelines". Sources of articles included a mix of scientific studies, field reports, and documents provided by organizations for medical relief. The disaster

cycle model, as presented in **Figure 2.7** (Chapter 2), proved a useful framework to discuss factors hampering inclusion of chronic medical needs in the disaster response.

Research Analysis

The literature search initially yielded approximately 150 relevant articles related to various chronic medical needs in natural disasters. 83 percent of these studies were conducted in developed countries (e.g. US and Japan), while most studies conducting in developing countries were only available as unpublished grey literature or agency technical reports. About 10 percent of the identified articles were in languages other than English, but with a translated title indicating relevance. Most of these were from countries that were prone to natural disasters, such as Japan and China. Given the sophistication of the earthquake related research in Japan and the high frequency of natural disaster occurrences in countries like India, a pitfall of this study was the necessary exclusion of these papers due to the language barrier.

A literature search on the health experience of post-natural disaster older people was also conducted as older age groups are more likely to experience chronic medical conditions. The results of this additional search did not change the selection of articles as most of the studies on the post-natural disaster older people focused on excessive mortality of the older population group rather than on the chronic health conditions of the survivors. (Nishikiori et al., 2006; Jani et al., 2006; Jonkman et al., 2005; Chou et al., 2004; Hatamizadeh et al., 2006; Liang et al., 2001; Tanaka et al., 1999; MMWRa., 1989; MMWRb, 1989; Carter et al., 1989; Dobson et al., 1991)

Findings

Overall, there is some evidence that people with chronic medical problems are negatively affected by natural disasters in both developing and developed countries. A study of the health status of populations affected by floods in China from 1996-1999 (Li et al., 2004) reported a higher prevalence of eight chronic diseases in flooded areas when compared with non-flooded areas. In New Orleans, a post-flood study showed that about 25.4% of adults in the affected population had at least one or more chronic medical problem (Ford et al., 2006; Baggett, 2006) A study in Japan showed a 3.5 fold-increase of myocardial infarctions and a two fold increase in stroke cases in people living close to the epicentre of the Hanshin-Awaji earthquake in 1995 within the first 4 weeks, while an increase in cardiac mortality continued for about 8 weeks after the earthquake (Kario & Ohashi, 1997).

(I)How natural disasters affect populations with chronic disease?

A strong link was also identified between acute exacerbation of chronic bronchial asthma and the extent of damage due to a catastrophic (Matsuoka et al., 2000). Studies findings of the Great Hanshin Earthquake in 1995 and the Tottoir-Ken Seibu earthquake (2004) in Japan showed chronic respiratory problems such as asthma attacks (Tomita et al., 2005; Maeda et al., 1996), acute/chronic respiratory failure (Maeda et al., 1996) were more likely to occur and increased hospital admissions following disaster.

During Turkey's Marmara Earthquake in 1999, research showed that the earthquake had a negative impact on glycemic control and quality of life (QOL) of people with

type 1 diabetes (Sengul et al., 2004), while for the Kobe earthquake, Japanese researchers revealed that chronic, life threatening stress as a result of a disaster worsened metabolic control (HbA1c) in patients with diabetes mellitus (Inui et al., 1998; Salman et al., 2001; Kirizuka et al., 1997). These studies also revealed that pre-quake QOL levels only got re-established after extended periods of time. Other research showed an increase in the number of newly diagnosed diabetes patients following earthquakes in Los Angeles (Kaufman & Devgan, 1995) and Armenia (Armenian et al., 1997) respectively. An US Centre of Disease Control study in 2004 on needs and health status of older people after Hurricane Charley showed that disruption of medical care for pre-existing conditions (CVD, diabetes and physical disabilities) had led to a 32% increase of adverse effects of medical outcomes in some areas.

Earthquakes might also trigger and exacerbate gastric ulcer (Aoyama et al., 1998; Katakami et al., 1995; Takakura et al., 1997), with bleeding often reported as a complication. Other studies showed that earthquakes adversely affect chronic renal failure requiring dialysis (Kerk et al., 2002; Yahsiro et al., 2000).

The literature search leads to three conclusions. First of all, although many clinical findings were based on aggregated data and some associations may be subject to ecological fallacy, the overall pattern indicates that population groups with pre-existing chronic medical problems tend to be worse off post natural disaster. Secondly, pre-existing care for chronic medical needs may be seriously disrupted, with reported adverse outcomes. Finally, most available documentation is from developed countries and only limited information on the experience of populations

with chronic medical problems in developing countries can be found. Although similar chronic disease complication patterns can be expected from patients regardless of country of origin, the lack of reporting may reflect the lack of understanding, concern and expertise to deal with people with chronic disease in the developing countries. Further analysis in the following section tries to show how factors in disaster preparedness and response processes may prevent the uptake of addressing chronic medical needs in field practice.

(II) How the current disaster intervention decision making process has addressed chronic medical needs?

Figure 3.2 shows a model that highlights decision making moments in relief resource allocation post natural disaster. This disaster-cycle model views sudden impact disaster as a continuous time sequence of five different phases of operational importance: a pre-disaster phase; the immediate impact of the event; the initial relief response based on an initial need assessment, followed by relief programme modification based on further assessments; and finally work on longer term rehabilitation and reconstruction.

Figure 3.2 Proposed decision making model according to disaster response cycle

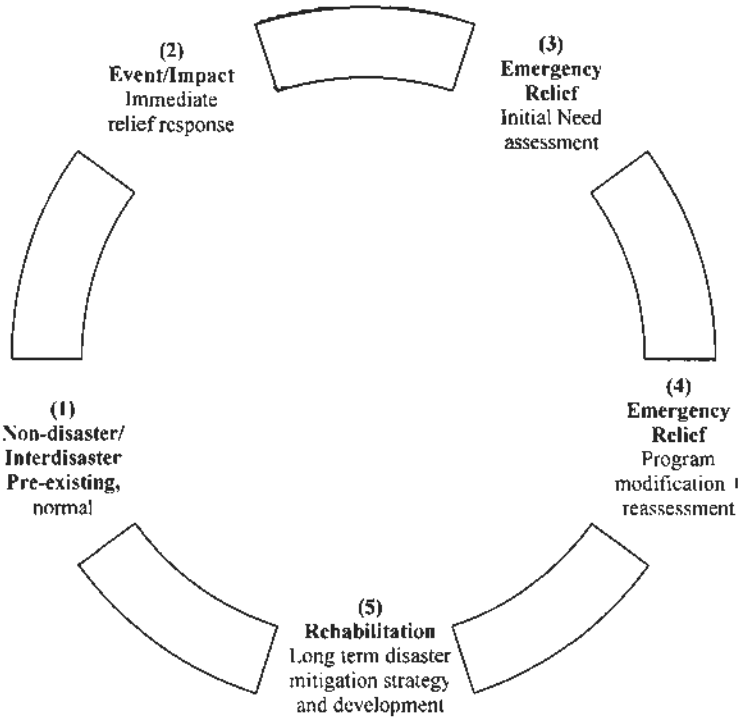


Diagram adapted from Chan. E.Y., & Sondorp, E. (2007). Medical interventions following natural disasters: missing out on chronic medical needs. Asia Pacific Journal of Public Health, 19 Spec No:45-51
Note: This is reprint of Figure 2.7 of Chapter 1 of this thesis for easy referencing.

1. Non-disaster/Interdisaster/Pre-existing Phase

Socioeconomic development would govern the availability of medical service for a population. For developed countries such as United States and Japan, disaster preparedness planning might include patient needs of non-communicable disease during emergency. On the other hand, for developing countries where health and medical services are not well developed, it would be unlikely that even acute/emergency services would exist for its population. Thus, the pre-disaster service for chronic medical needs may be very limited. As a result, the technical skills for service provision would be limited.

2. Event/Impact Phase

During disaster, the massive loss of human life, destruction of health services and structures have often impaired the ability for both government and relief agencies to provide relief beyond essential life saving procedures. As a result, except for life threatening medical complications of chronic disease, resources for regular primary health care services may be re-directed to emergency services and as a result, chronic conditions may be sidelined.

In addition, most immediate interventions relied on local responses. Situational factors such as logistics, security and time constraints may prompt agencies to intervene in areas where good logistic support is available. For international agencies, operational decision may be based on pre-existing insight about the location and characteristic of disaster (Noji, 1997).

3. Emergency Relief/Needs assessment

While it is critical to respond quickly to save lives and prevent suffering, obtaining valid information to make evidence-based, appropriate and relevant relief decisions is just as important. Using the "pathway of care" concept (Chapter 2), health needs are those needs that can benefit from a service or intervention along the pathway of care, namely, health protection, health education, disease prevention, diagnosis, treatment, rehabilitation and terminal care. Health needs assessment is a systematic method of identifying unmet health and healthcare needs of a population and making changes to meet these unmet needs (Noji, 1997; Gupa-Sapir et al., 1999; Redmond, 2006).

Frequently, developed countries have better, technology and equipment to assist in post-disaster data collection, with satellite surveillance providing information on population density, crop growth and even troop movement in conflict areas (Noji, 1997; Landesman, 2001; Ciottone et al, 2006). On the other hand, for low income societies, technology is not as accessible. Instead, these post-disaster health needs assessments are based on quick on-site manual surveys, which provide a simple description of population profile and health consequences of disaster and displacement (Darcy & Hoffmann, 2003; Brennan & Rimba, 2005; Redmond, 2006; Noji, 2006) .

Of note, the traditional needs assessment focuses on identifying health risk rather than health needs. Most health "needs" assessments are actually health "risk" assessments, which focus on minimizing potential health risks or hazards (such as possible disease outbreaks) instead of supporting ongoing chronic medical/health needs which have

been present prior to disaster. Bradt showed that standardized essential data sets of different agencies for rapid needs assessment did not identify chronic medical disease as essential data to be collected (Bradt, 2002). Frequently, the main argument for leaving out chronic medical diseasae information collection and service provision during disaster and emergency settings is that immediate life saving procedures should take precedence to stable chronic medical needs. Whilst the emphasis on acute immediate life saving needs is practical, disaster respondents and organizations often apply this principle simplistically and regard chronic diseases treatment as non-emergency needs and systematically rule chronic disease management in their service provision.

4. Emergency Relief/ Program Modification

Most health needs assessments only focus on acute health problems that were presented in an emergency clinic. The health needs of vulnerable population subgroups such as elderly and disabled people, who may have other active chronic health needs such as diabetes and hypertension, are often ignored due to the lack of attendance of these patients in acute clinic settings as well as the ecology fallacy as a result of population based aggregated data analysis. In Pakistan, despite older people had taken up 25% of health utilization, none of their chronic health conditions were managed because these needs were not captured or targeted during initial relief assessment (Chan & Gainey, 2006). In addition, unreliable population data, highly mobile population, poor security, difficult access, and extreme terrain will render direct, accurate collection of health statistics difficult. Proxy measures are often used instead. In countries like Iraq, South Sudan and Somalia, "availability of health

facilities", "presence/absence of health services" were two key indicators to measure health needs (Darcy & Hoffman, 2003). Although these indicators may capture access to health services, but they do not provide information that truly reflect the health problems or related needs of the population.

Darcy & Hoffmann (2003) found formal assessment was not the most important trigger for response and formal assessments were often marginal to the decision making. As the study argued, three types of information need to be collected during health needs assessments: health status of the population, factors contributing to health, and performance of health service (SPHERE, 2004). In practice, many health interventions are based on normative needs determined by relief workers, rather than on the unmet needs of the most vulnerable. These challenges in field information collection will deter intervention planners to conduct in-depth assessments.

Moreover, factors that affect health outcomes are multidimensional. Many health needs assessments only focus on simple measures such as mortality and neglect other relevant health determinants that contribute to morbidity. Ill health may be caused by the lack of basic necessities for a health living such as water and sanitation, food and nutrition, environmental factors, housing and security. Relief operation recommendations drawn from single sector assessments will be inadequate to address all aspects of underlying health needs. It is also important to identify the capacity and performance of local health services. Access to drugs and trained personnel will affect the health of population. Overly simplistic health indicators (mortality rates and malnutrition) are not sufficient to capture all possible solutions to address real needs.

Overall, the lack of reliable indicators, baseline information, multi-dimensional characteristics of chronic medical problems pose serious challenges for government and relief agencies to deal with diseases of a chronic nature and the potential for program modifications post acute emergency phase.

In disasters, time constraints and limited resources have led to unwillingness for medical/health care workers to deal with chronic conditions that are less urgent where results are less visible. Moreover, depending on the level of economic and social development of an affected country, the pre-existing health system may face shortages of appropriate human and technical resources. For instance, in developing countries where pre-disaster health services are limited, it would be unlikely to find relevant staff with adequate knowledge of drug use and skills to support the management of chronic disease even if external agencies are willing. The lack of appropriate human capital, supporting structures, history of multidisciplinary collaboration and government's policy that would be require to sustain service beyond emergency would often hamper the management or development of relevant chronic diseases post-disaster.

(5) Rehabilitation and exit strategy

Fundamentally, many disaster medical interventions are acute in nature, short-term and target oriented. The concept of exit/handover strategies was simply ignored. The chronic nature of non-communicable disease demands that sustainability be at a high level of importance when deciding on entry and exit strategies. Unless relief agencies or government have a strong underlying development ethos or policy that encourages community participation in the process, it would be challenging to sustain relevant non-communicable disease programs.

As pointed out in the previous section, the non-acute nature, the lack of technical expertise, absence of relevant assessment tools and gaps in strategic planning have rendered chronic disease management invisible in disaster response so far.

(III) Issues that may improve the current situation: What can we do?

Although a generic model would be impossible when considering potential solutions to deal with chronic medical problems, it is nevertheless meaningful to identify key elements that can facilitate a policy making process. In order to address chronic medical needs, it would be essential for stakeholders to increase awareness and sensitivity of the importance of placing non-communicable disease at a high priority during all phases of planning in order to be able to maximize the impact.

Needs assessment should also attempt to obtain relevant information for decision making about resource allocation for chronic medical needs. In the United States, there have been reports of using pre-existing databases such as the Behavioral Risk Factor Surveillance System (BRFSS) in 2004 to estimate the prevalence and numbers of people with chronic diseases such as diabetes, heart disease, stroke, hypertension, and current asthma who lived in the New Orleans post disaster for relief response planning (Ford et al., 2006). This information can assist the medical and public health community in assessing the needs of people with chronic diseases after disasters and in planning relief efforts. On the contrary, in many developing countries, due the lack of maps and official statistics, the best estimation of the burden of chronic medical problem in the region can only be done by reviewing clinical records, field estimation from on-site sampling surveys and triangulation of working reports from various field parties.

Summary of literature review in Chapter 3

Overall, the literature review of health impact of earthquakes has indicated previous studies which have identified epidemiological patterns of earthquake. Most of these studies were conducted in developed, high income countries where pre-existing health systems and disease patterns might be different than those of developing, middle income countries in Asia. The second bilingual literature review of the health impacts of earthquakes in China highlights that China, as a country, suffered the greatest human impact from earthquakes during the past century (EMDAT, 2006) and it has identified major gaps in the understanding of human health impact post-earthquake in China. Whilst China managed to mount a swift and effective emergency response to the Sichuan earthquake, analysis of the response highlights that not all lessons had been learnt from previous disasters (Chan, 2008). The third literature review on chronic disease burdens post disaster indicated that there are limited published articles that examine chronic medical needs post disaster in middle income developing countries.

These reviews have all highlighted the scarcity of knowledge on the health impact of earthquakes in developing, middle income countries in Asia. Most important of all, how epidemiological and demographic transitions, the two important factors that might affect medical services provision, may have affected disaster response, have yet to be examined by the global scientific community.

SECTION II

AIM, OBJECTIVES and STUDY DESIGN

"All generalizations are false, including this one."

Mark Twain

Section II consists of three chapters (Chapters 3-6). Chapter 4 outlines the aim and objectives of this thesis. Chapter 5 describes the research questions. Chapter 6 gives the study context and delineates the research methodologies of the thesis.

Chapter 4 Aims and Objectives

This chapter describes the main study aim and the five research objectives of this thesis.

Main study aim

The aim of this thesis is to examine the burden of chronic disease and population aging on medical and public health relief post natural disasters in middle income, developing countries.

Study Objectives

The following section describes the five study objectives in this thesis.

Study Objective I

Whilst recent disaster studies (Chan et al., 2006 & 2007; Ford et al., 2006; Guha-Sapir et al., 2007; Aldrich et al., 2008; Miller et al., 2008; Tomio et al., 2010) have shown that chronic medical conditions are important health needs during th recovery phase of natural disasters, due to the lack of data, chronic health needs and clinical profiles of survivors during the acute phase of natural disasters (first two weeks) are rarely reported. During acute disaster relief phase, as patterns of emergency clinical needs are uncertain, the lack of evidence based studies may have hampered clinical preparedness, resource allocation and effectiveness of post disaster medical response. On May 12th 2008, an earthquake measuring at 8.0 Richter scale occurred in Wenchuan in Sichuan, China. The earthquake, with a death toll of at least 80,000 (US Geological Survey, 2009), is considered as one of the most destructive earthquakes to date (Chan et al.,

2009). This study examines the health and chronic disease burden presented during the acute emergency phase of the Sichuan earthquake.

Study Objective II

The literature review on post earthquake health needs of older people in rural areas in developing countries found only a few relevant studies. The opportunity arose to redress this gap in literature following the earthquake which struck Pakistan's autonomous state of Kashmir and part of Indian-administrated Kashmir on October 8th 2005. Measuring 7.6 on the Richter scale, the official death toll in Pakistan was 79,000 and nearly 1,400 in Indian-administered Kashmir. This study reports the findings of a three-week health needs assessment to understand the needs of rural older people post disaster, conducted in February 2006 in the Neelum Valley of Kashmir Pakistan, four months after the earthquake. Our hypothesis is that the vulnerability and health needs of older people in rural settings are different than that of affected urban areas during emergency relief.

Study Objective III

No published study has examined the characteristics and health outcomes of natural disaster affected populations in unofficial self-settled rural internal displaced camps. By examining self-settled unofficial rural camps after the 2005 Kashmir, Pakistan earthquake, this study aims to: i) describe and compare the demographic characteristics among camps, ii) examine and compare their epidemiological profiles and health outcomes, and iii) highlight health needs and discuss implications on future disaster health relief operations.

Study Objective IV

Published studies (Guha-Sapir & Carballo et al., 2000; Woerching & Snyder, 2003, 2004a &b; Redmond, 2006; Noji, 2006; Krol et al., 2007; Chan & Griffiths, 2009) on health needs post natural disasters in developing countries have indicated access to health services is one of the major challenges experienced in rural areas. Outreach medical services are a potential service provision modality that may improve health service access for populations in secluded and remote environments. Except for one published review which examined patient utilization in mobile health clinics in conflict settings (Du Mortier & Corninx, 2007), no published studies have examined patient profile and disease patterns in remote areas that are served by mobile clinics post natural disaster. Using attendance to mobile clinics as a proxy indicator for expressed medical needs, this study compares analyzed clinical attendance data in a remote mountainous stationary clinic and a mobile helicopter outreach clinic after the Kashmir Earthquake to: i) compare the demographic and disease profile of health service users in the two remote clinical settings, ii) examine how acute and chronic disease patterns vary with clinical settings, and iii) discuss the potential implications for mobile emergency clinical service planning for the acute phase of natural disasters in remote areas.

Study Objective V

Physical and mental health problems, reduced income, and limited mobility can pose challenges for older people to support themselves and their dependants in emergencies. (Wells 2005) While older people may be recognized as a vulnerable group (Davis, 1996) post natural disasters, studies about older peoples' health needs following disasters in South East Asia (HAI, 2005), Kashmir Pakistan (Chan, 2006), China

(Chan, 2008) and the USA (Ford et al 2006; The White House, 2008) revealed that most health needs of older people were forgotten. Chan & Gainey (2006) found that while older populations composed 9-26% of the patient load in disaster affected areas, their specific health needs were not met by emergency service providers. The goal of this study was to examine the perception of health care providers towards older people's vulnerabilities, to understand the providers' awareness of geriatric issues and current provisions for older people's health needs post disasters. Specifically, service delivery patterns were compared among different types of relief agencies to identify gaps and discrepancies in awareness and implementation of geriatric related services in developing countries.

Chapter 5 Research questions

In this thesis, original disaster epidemiological research studies were conducted to examine patient profile, health risk factors, clinical outcomes, gaps in health relief service provision and policy related to disaster response in China and Pakistan post millennium. Specifically, implications of population aging and the burden of non-communicable disease on disaster relief response in middle income developing countries were evaluated and discussed. Six key research questions were as follows:

1. What types of patients were likely present to medical relief clinics during various stages of the responses to Asian earthquakes?

2. What were the characteristics and utilization differences of medical service users in different clinic care settings: urban versus rural clinics; official versus unofficial internal displaced camps; stationary versus mobile clinics?

3. What were the main health needs of the disaster affected population in various types of settlements?

4. Did chronic medical conditions constitute an important clinical burden post earthquake?

5. Why were the needs of disaster-affected-populations of older age and with chronic medical conditions forgotten by health care providers?

6. What are the emergency preparedness implications for doctors and medical relief workers regarding chronic disease management and older people?

Chapter 6 Study methodologies

This chapter highlights the study context and the research study methodologies used in this thesis. Research studies of two major Asian earthquakes after the millennium, the 2005 Pakistan-Kashmir Earthquake and the 2008 China Wenchuan Earthquake, were included in this thesis. The original published papers related to the studies can also be found in the Appendix.

Study Context

2005 Pakistan-Kashmir Earthquake: Measuring 7.6 on the Richter scale, the earthquake occurred on October 8th 2005 and struck Pakistan's autonomous state of Kashmir and part of Indian-administrated Kashmir. The official death toll in Pakistan was 79,000 and nearly 1,400 in Indian-administered Kashmir. Destruction in the region closest to the earthquake's epicentre was almost 100%. The study population consisted of disaster affected individuals, clinical relief providing organizations and patients/attendees of various relief clinics around the Neelum Valley, Pakistan Kashmir. Field based information was collected in February 2006 in the Neelum Valley of Kashmir Pakistan, four months post earthquake. Ethics approvals were sought and obtained from the London School of Hygiene and Tropical Medicine and three relief organizations: Merlin, HelpAged International and Muslin Hand. Verbal consent was also obtained from the participants. Four Pakistan-Kashmir related studies were included in this thesis.

2008 China Sichuan Earthquake: Measuring 8.0 on the Richter scale, the earthquake occurred on May 12th 2008 and caused more than 80,000 casualties. The study

population consisted of disaster affected individuals who were rescued and transferred by helicopter to a tent-based relief clinic within the first three weeks post disaster. Ethics approval was sought and obtained from the School of Public Health and Primary Care, Chinese University of Hong Kong. Two 2008 China Sichuan related studies were included in this thesis.

Study Methodology

To address the research questions described in Chapter 5, a range of research study methodologies were used in this thesis. In brief, these include: literature reviews, retrospective clinical and medical record based studies, cross-sectional face-to-face surveys, semi-structural qualitative stakeholder interview studies and narrative, action based research studies.

Study design, sample population, data collection tool and data management

Question 1: What types of patient, health and medical needs were likely to present during the acute phase of an earthquake in Asia?

This research question was examined through a cross-sectional descriptive, epidemiological study of an acute relief clinic which managed 182 patients from Day 3 to Day 21 post 2008 China Sichuan Earthquake. Demographic, clinical, basic laboratory information and discharge diagnosis data was collected and recorded in a pre-designed data recording template.

Descriptive analyses were conducted to assess morbidity patterns and health care needs of the survivors. The association between demographic variables and health outcomes was examined using Pearson's Chi-Square tests and multiple logistic regression analysis. Analyses were carried out using Microsoft Excel (Windows Microsoft Excel, Microsoft Corporation, Redmond, Washington, USA) and STATA 10.0(StataCorp LP, College Station, Texas, USA).

Question 2a, 3a & 4a: What were the differences in demographic and epidemiological profiles of patients between rural and urban post disaster clinics in the Kashmir Pakistan Earthquake? What were the main health needs of disaster affected population in rural and urban dwellings? Did chronic medical conditions constitute an important clinical burden post disasters in rural and urban dwellings?

This research question was examined through two Pakistan earthquake studies.

The first study was a retrospective clinical record-based, medical service utilization comparative study of rural clinic attendees located at Sarli Sacha. The clinic provided services for 30,000 rural people who resided remotely in the Pakistan/India border. A matched control site, an internal displaced person (IDP) camp clinic which served 382 displaced people was selected. This clinic was organized by a local NGO, Muslin Hands, at Chella Band, 45 miles from Muzzafarabad city. As the two study sites were the only clinical treatment facilities available in the study area during the initial four months post earthquake, it was assumed that health needs were captured by clinic attendance during the study period. Clinical records of 2942 and 392 consultations from the mountainous clinic (Site 1) and the IDP medical services (Site 2) respectively were reviewed during the study period of January 21 - February 20, 2006.

An information table was also designed to record retrospective clinical information from clinic medical records during the defined study period. Case number, dates of clinic attendance, gender, age, diagnosis and medication/treatment given were retrieved and recorded on the pre-set information table. All basic calculations were performed on-site.

The second study was a cross-sectional, systematic sampling, face-to-face interview based survey study on 125 patients who attended clinics during the study period (85 in the mountainous clinic and 40 in the IDP camps). The survey included questions on demographic background, past medical and drug history, self-reported health status, current and past symptoms, mental health, healthcare access and utilization, and post-earthquake livelihood related issues. A mini-mental health test and physical examination consisted of measurements of height, body weight, mid-arm circumferences, blood pressure, spot blood glucose level and spot blood cholesterol were also conducted to detect potential underlying medical conditions that were not captured during previous clinical consultations. The survey questionnaire was translated into Urdu from English and was piloted and validated. Gender-specific health care workers fluent in Urdu and English were employed to administer the questionnaires and the assessment team provided training to ensure consistency in data quality.

Since illiteracy rates were high in the region (80%), verbal consent with witness verification was obtained from patients instead of written consent before interviews and physical examinations were conducted. Patients attending the consultations were invited to participate in the study and were reassured that their participation of the

study would be independent of their eligibility to receive medical care/treatment. If the patient agreed to participate, a research team member would conduct the survey interview while the patients were waiting for their consultation. All physical examinations and indicator measurements were performed by the assessment team physician. Due to the instability of electronic appliances of high altitude and in extreme temperatures, all medical and health records were handwritten.

Descriptive analyses were conducted to assess morbidity patterns and health care needs of the survivors. The association between demographic variables and health outcomes was examined using Pearson's Chi-Square tests. Analyses were carried out using Microsoft Excel (Windows Microsoft Excel, Microsoft Corporation, Redmond, Washington, USA) and STATA 10.0(StataCorp LP, College Station, Texas, USA).

Of note, as the definition of old age may be different according to societies and culture, in rural Pakistan, it would be impractical to define old age by adopting the United Nation's chronological definition of older people as 60 years or above because the official life expectancy in 2009 was reported to be 66 and 66.7 for male and female respectively (UNdata, 2011). Taking into consideration functional capacity, and social expectations of people in rural Pakistan who tend to marry young (at 17) and become grandparents in their mid-forties, the definition of older age in the study setting was context specific and set to be 45 years or above.

Question 2b, 3b & 4b: What were the differences in demographic and epidemiological disease profiles of residents in unofficial and official displaced camps in the Kashmir Pakistan Earthquake? What were the main health needs of disaster affected population in unofficial and official displaced camps? Did chronic medical conditions

constitute an important clinical burden post disasters in unofficial and official displaced camps?

This research question was examined by conducting a cross-sectional, cluster sampling, face-to-face household-based survey. The study sample consisted of residents (n=2628) of all self-settled camps with less than 50 households in the study area. Camps were categorized to three groups according to number of households and cluster sampling was randomly performed from each cluster size and a total of three unofficial camps were invited to participate in this study. The household response rate post invitation was 98% and a total of 85 "unofficial camp" households were included in this study. For the final analysis, the "unofficial camp" sample included 49 households (392 residents) for the 31-49 household cluster, 28 households (238 residents) for the 16-30 household cluster, and 8 households (66 residents) for the 1-15 household cluster. To serve as a baseline comparison and to identify potential differences between official and small unofficial self-settled camps, a rural "official" registered IDP camp with 276 households (1932 residents) was also invited to participate in the study. Through snow-ball sampling, 82 households (30% of the official camp) were recruited and interviewed.

Face-to-face structured interviews were conducted in February 2006 to collect information related to demographic characteristics, earthquake damage, self-reported health outcomes of study participants in physical, mental, and social health status, and expressed needs post disaster. Survey questionnaire was designed in English and translated by bilingual speakers (Urdu and English). Gender specific interviewers were used for obtaining information and all interviews were done by interpreters and

health care workers who spoke both languages. The questionnaires were piloted and reliability of the tool was tested. The reported information was crosschecked with local heath care workers to ensure the quality of translation. Since illiteracy rates were high in the region (80%), verbal consent with witness verification was obtained from all patients interviewed instead of written consent during the field assessment.

Descriptive analyses and Pearson's Chi-Square test for statistical significance comparisons were conducted among different camps. Data entry, management, and analysis were conducted using Microsoft Excel (Windows Microsoft Excel, Microsoft Corporation, Redmond, Washington, USA), EPI INFO and STATA 10.0(StataCorp LP, College Station, Texas, USA).

As discussed in the previous section (Chapter 4, last paragraph of Question 2a, 2b & 2c) about the definition of old age in rural Pakistan, the definition of old age in the study is set to be 45 years or above.

Question 2c, 3c & 4c: What were the differences in demography and epidemiology of patient profiles between remote mountainous stationary clinics and a mobile helicopter outreach clinic in the Neelam Valley, Kashmir, Pakistan Earthquake? What were the main health needs of disaster affected population in remote rural dwellings? Did chronic medical conditions constitute an important clinical burden post disasters in remote rural dwellings?

A retrospective clinical record-based, medical service utilization comparative study was conducted to examine this question. The study population comprised of clinic attendees of two remote clinics in the Neelam Valley, Kashmir, Pakistan. As the two study sites

were set up and provided by the same relief organization during the acute phase (the first eight weeks after the earthquake) and were the only clinical treatment facilities available in the area during the initial four months post earthquake, it was assumed treatment provision standards were similar and expressed health needs in the area were captured by clinic attendance during the study period. Dataset 1 was collected from the mountainous border clinic at Sarli Sacha and Dataset 2 was collected from outreach clinical services serving three rural areas (Zabbar, Konka and Telegra) around the Neelam Valley reachable only by helicopter post earthquake. Specifically, for the outreach clinic, five episodes of helicopter clinic sessions were made during the study period.

In total, 3097 (site 1) and 145 (site 2) clinical records were available for analysis. After review, 5% (n=155, site 1) and 2% (n=3, site 2) were excluded due to illegible handwriting and missing information. For the final analysis, 2942 (95%) and 142 diagnoses (98%) were included. The data did not show evidence of selection bias in the recording of diagnoses and any non-recording was assumed to be random. Patient data included patient case code, age, gender, distance of area of residence from clinics (by hours), and main diagnosis. These were retrieved from the clinical records and manually entered into a data input table.

All basic calculations were performed on-site. Information collected was categorized into various variables for analysis. Four age categories: <5, 6-44, 45-64, >65 years were constructed. Patient gender was reported as a binary variable. Proximity to clinic was grouped into 4 groups: <30 minutes, 30 minutes to 1 hour, 1 hour to 4 hours and > 4 hours. Clinical diagnosis was divided in four main groups, namely trauma/injury

(earthquake related and non-earthquake related), infection (wound, respiratory, gastrointestinal related, skin), chronic conditions (diabetes mellitus, hypertension, heart related conditions, arthritis, pain), as well as non-specific medical complaints. Descriptive statistics and Pearson's chi-square test for statistic significance comparisons were conducted to examine and compare patient profile and disease patterns between the two remote clinics. Pakistan national data were also obtained from a public database to compare demographic characteristics and disease profile. Data entry, management, and analyses were conducted using Microsoft Excel (Windows Microsoft Excel, Microsoft Corporation, Redmond, Washington, USA), EPI Info and STATA 10.0(StataCorp LP, College Station, Texas, USA).

As discussed in the previous section (Chapter 4, last paragraph of Question 2a, 2b & 2c) about the definition of old age in rural Pakistan, the definition of old age in the study is set to be 45 years or above.

Question 5: Why were the needs of disaster-affected-populations of older age and with chronic medical condition forgotten by health care providers?

A cross-sectional, semi-structured stakeholder interview based study was conducted for this question. Health/medical relief agencies of three different organizational natures: international non-government organization (INGO), national organization and local/community group were invited and agreed to participate in the study. Except for the nature of the organization, the identity of the organization will remain anonymous to ensure confidentiality. The data collecting tool was a structured interview questionnaire, developed according to the "HelpAged International"

guidelines for best practices for older people in disasters and humanitarian crises. The questionnaire had three subsets of questions that aimed to assess i) organization operational background (five questions), ii) general awareness and planning of older people issues (five questions) and iii) information related to the provision of geriatric related clinical services (seven questions).

Question 6: What are the emergency preparedness implications for doctors and medical workers regarding chronic disease management and older people?

This research question was reviewed by a narrative, action based research study during the acute phase of the disaster (Day 3 to Day 24) at the medical relief triage center (SSHC) at Guanghan area, Sichuan Province after the Sichuan Earthquake in 2008.

Table 6.1 showing a summary of the setting, question, study design, sample population, data collection, data collection tool and remarks.

Table 6.1 Summary of the study setting, question, study design, sample population, data collection, data collection tool and remarks

Question	Study Design	Sample Population	Data Collection tool and collection methods	Remarks
Difference in demographic and epidemiological profile of patients between rural and urban post disaster clinics	A retrospective clinical record-based, medical service utilization comparative study	A rural Pakistan/India border clinic located at Sarh Sacha that provided service for a cohort of 30.000 population Matched control site in an internal displaced person (IDP) camp clinic, 45 miles from Muzzafarabad city that served 382 displaced people	Relevant information recorded on the pre-set information table 2942 and 392 consultations records from the mountainous clinic (Site 1) and the IDP medical services (Site 2) were reviewed respectively during the defined study period. January 21 - February 20, 2006 Case number, date of clinic attendance, gender, age, diagnosis and medication/treatment given were recorded in the information table	The two study sites were the only clinical treatment facilities available in the area during the initial four months post earthquake It was assumed that health needs were captured by clinic attendance during the study period
	A cross-sectional, systematic sampling, face-to-face interview based survey study	125 patients attending clinics during the study period (85 in the mountainous clinic and 40 in the IDP camps)	Relevant information recorded on the pre-set information table The survey included questions regarding demographic background, past medical and drug history, self-reported health status, current and past symptoms, mental health, healthcare access and utilization, and post-earthquake livelihood related issues A mini-mental health test and physical health indicators such as weight, height, mid-arm circumferences, spot blood glucose, spot blood cholesterol level, blood pressure were also collected to detect potential underlying medical conditions that were not captured during previous clinical consultations The physical examination consisted of measurements of height, and body weight, blood pressure, blood glucose level and blood cholesterol	Case number, date of clinic attendance, gender, age, diagnosis and medication/treatment given were recorded in the information table
Difference in demographic and epidemiological disease profile of residents in unofficial and official displaced camp	A cross-sectional, cluster sampling, face-to-face household-based survey	Residents (n=2628) of self-settled camps with less than 50 households in the study areas were categorized to three groups according to number of household and cluster sampling was randomly selected from each cluster size and a total of three unofficial camps were invited to participate in this study	Survey based study face-to-face structured interviews were conducted in February 2006 to collect information related to demographic characteristics, earthquake damage, self-reported health outcomes of study participants in physical, mental, and social health status, and expressed needs post disaster Household response rate post invitation was 98% and a total of 85 "unofficial camp" households were included in this study For the final analysis, the "unofficial camp" sample included 49 households (392 residents) for the 31-49 household cluster, 28 households (238 residents) for the 16-30 household cluster, and 8 households (66 residents) for the 1-15 household cluster A rural "official" registered IDP camp with 276 households (1932 residents) was also invited to participate in the study Through snow-ball sampling, 82 households (30% of the official camp) were recruited and interviewed	Rural official camp was recruited to serve as a baseline comparison and to identify potential differences between official and small unofficial self-settled camps.

Question	Study Design	Sample Population	Data Collection tool and collection methods	Remarks
Difference in demographic and epidemiological of patients profile between remote mountainous stationary clinic and a mobile helicopter outreach clinic in Neelam Valley	A retrospective clinical record-based, medical service utilization comparative study	Clinic attendees of two remote clinics in Neelam Valley, Kashmir Pakistan	A total of 2942 and 142 consultation records from the mountainous clinic (site 1) and the remote area outreach medical services (site 2), respectively, were reviewed and analyzed in this study	The two study sites were the only clinical treatment facilities available & were set up and provided by the same relief organization in the area during the initial four months post earthquake, so it was assumed that health needs were captured by clinic attendance where similar treatment provision, standards and management were provided
Why are chronic medical needs of disaster-affected populations forgotten by health care providers post natural disasters?	A cross-sectional, semi-structured stakeholder interview based study	*Three* different types of organizational nature international non-government organization (INGO), national organization and local/community group were invited and agreed to participate in the study Except for the nature of the organization, the identity of the organization would remain anonymous to ensure confidentiality	A structural interview questionnaire, developed according to the Help Aged International guideline[9] for best practices for older people in disasters and humanitarian crises The questionnaire had three subsets of questions that assess i) organization operational background (five questions), ii) general awareness and planning of older people issues (five questions) and iii) information related to the provision of geriatric related clinical service (7 questions)	
What are the health and medical needs during acute phase of an earthquake in Asia?	A cross-sectional descriptive, epidemiological study	82 patients presented at the acute relief clinic from Day 3-Day 21 post disasters	Demographic, clinical and basic laboratory information and discharge diagnosis was collected in a pre-designed data recording template	
What was the medical humanitarian relief policy and public health response implication of Sichuan Earthquake?	A narrative, action based research study design	Acute phase of disaster (Day 3 to Day 24) at medical relief triage center (SSHC) at Guanghan area, Sichuan Province		

SECTION III

RESULTS, DISCUSSION, POLICY IMPLICATIONS and CONCLUSION

"Knowing is not enough; we must apply. Willing is not enough; we must do."

Johann Wolfgang von Goethe

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Section III consists of four chapters (Chapters 7-10). Chapter 7 reports the findings of each study. Chapter 8 discusses how these findings answer the research questions. Chapter 9 highlights policy and future research implications of the findings. Chapter 10 presents a conclusion of the entire thesis. The original published papers of all thesis related studies can be found in the Appendix.

Chapter 7 Results

This chapter presents findings of the various studies described in Chapter 6. Results will be presented in six subsections namely i) the burden of chronic disease health needs during the acute disaster relief phase post natural disaster, ii) the difference in health needs between rural and urban disaster relief settings, iii) the difference in health needs between official and unofficial internal displaced camps, iv) the difference in health needs between stationary and mobile clinics, v) why were the needs of disaster affected populations of older age and with chronic medical conditions forgotten by the health service providers, and vi) the forgotten health needs in natural disasters in middle income countries post millennium.

1) The burden of chronic disease health needs during the acute disaster relief phase post natural disaster

Details of findings in this section can be found in the Appendix in the paper by *Chan Ying Yang Emily and Kim J Jacqueline* (2011) entitled "Chronic health needs immediately after natural disasters in middle income countries: The case of 2008 China Sichuan Earthquake" published in the *European Journal of Emergency Medicine,* Vol. 18 No 2 pg 111-114.

During the acute post disaster phase (Day 2 – Day 7) of the 2008 Sichuan earthquake, 182 patients were evacuated to the study site in Guanghan, Sichuan province, China. Among these evacuees, 12% (21 patients) were discharged upon initial examination as no clinical medical needs were established and 16% (29 patients) were diverted to a tertiary hospital for life-saving surgery. The study analyses focused on the 132 (73%) patients who were retained for clinical reasons in the triage center. Of note, no death occurred at the site during the study period.

Table 7.1 shows the demographic characteristics of patients in the triage centre during the study period. The median age for patients after triage was 79 years old. In general, among evacuees, there were more females (55%) than males (45%). 82% of the evacuees originated from the earthquake affected zone. Among the migrant subgroup, 73% was male. Overall, older women constituted the majority of the patients.

Among the 132 patients (73% of the total of 182 evacuees) who required clinical management on site, 54% patients required trauma/surgical management and 46% patients had non-surgical related clinical needs. Trauma pattern analysis showed that 12% had trauma injury in multiple sites and extremities (12%) were the most common site for injury. Survivors who required chronic non-communicable disease management represented 30% of the total clinical burden.

Table 7.1 Sichuan Patient Demographic and Health Needs Profile

Patient Profile	Male	Female	Total
	N=82	N=100	N=182
Median Age (range)	78 (2 mo.-95 yrs.)	80 (12 days-93 yrs.)	79
Origin:			
Local (epicenter)	67 (45%)	82 (55%)	149 (82%)
Proximal areas (Cheung Xia/ Chung Ching)	7 (32%)	15 (68%)	22 (12%)
Out of province migrant workers/travelers	8 (73%)	3 (27%)	11 (6%)
Total	82 (45%)	100 (55%)	182
Transferred upon arrival	N=26	N=24	N=50
No clinical indication of care needed	16	5	21
Needed re-diversion due to other treatment	10	19	29
Total	26	24	50
Patients requiring management and hospital care	N=56	N=76	N=132
Trauma/Surgical (n=71)			
Main site of trauma:			
Head/Face	2	2	4 (3%)
Neck	2	0	2 (2%)
Spinal	2	4	6 (5%)
Chest (Ribs)	3	7	10 (8%)
Pelvic	3	6	9 (7%)
Extremities(arms/legs) (include joints)	9	7	16 (12%)
Hand/Feet (include joints: wrist and ankle)	5	3	8 (6%)
Multiple trauma (which include more than 1 site with at least one of the following: cervical/chest/spinal/pelvis)	6	10	16 (12%)**
Non-trauma related/but required hospitalization (n=51)			
Non-communicable diseases without injury related treatment needs	13	26	39 (30%)**
Need secondary clinical support (e.g. exhaustion, dehydration, nutritional, wound infection)			
Pneumonia	1	2	3 (2%)
GI infection	1	1	2 (2%)
Wound infection	1	2	3 (2%)
Exhaustion/Dehydration	1	3	4 (3%)

Table 7.1 (Continue) Sichuan Patient Demographic and Health Needs Profile

Patient Profile	Male	Female	Total
Patient requiring outpatient care (n=10)			
Need simple management and managed as outpatient (e.g. minor cuts, wound infection)	7	3	10 (8%)
Total	56	76	132 (100%)[-]

*Among the 182 patients, 21 patients were discharged right away upon initial examination as no clinical medical needs were established 10 patients had minor injury such as cuts, bruises which required wound dressing only and were managed as outpatients 29 patients were re-diverted to tertiary hospitals for life-saving surgery because of hemodynamic instability Thus, a total of 50 were excluded in this analysis as their medical records were incomplete or medical reasons for evacuation were not established *132 patients were included in the analysis ** Of note, 16 patients had multiple trauma and their injury profiles were not listed in detail to avoid double counting *** 39 patients had no orthopedic injuries but chronic disease which needed management [-] Rounded up to complete figures*

Table 7.2 shows a detailed breakdown of chronic non-communicable disease (NCD) health needs and emergency preparedness among the evacuees. 77% of admitted patients had at least one underlying NCD. 12% of patients were unaware of their underlying NCD condition prior to this clinical encounter. 20% of the NCD patients had more than one type of NCD. Hypertension (47%) and diabetes mellitus (23%) constituted the largest NCD disease burden. Of note, 54% of the identified NCD patients had clinical needs as a result of disease exacerbation or a lack of medication and required active clinical management.

Patients with accompanying family members reported a positive outlook for the future when compared with those who were at the site alone. Patients with perceived social support were 2.01 (95% OR CI: 1.00-3.24) times more likely to report confidence in the future.

Emergency preparedness, in terms of tetanus immunization, was low particularly among the older age group. A significant difference in tetanus immunization status was found when comparing the under 60 year old age group with those over 60. Over 60% of evacuees on site were never immunized and 15% were not sure about their status.

Table 7.2 Chronic health needs of patients in the Sichuan triage site (n=102)

Chronic Disease	Known history	Newly diagnosed (no prior awareness)[a]	Total	Treatment need (among NCD cases)	Patients with medication (among NCD cases)
Diabetes mellitus	20	4	24 (23%)	15 (63%)	3 (13%)
Hypertension	42	6	48 (47%)	29 (60%)	5 (10%)
Heart arrhythmia/ health failure	15	2	17 (17%)	10 (59%)	4 (24%)
Other conditions[b] (required chronic medication)	13	N/A	13 (13%)	5 (38%)	2 (15%)
Total	90	12	102 (100%)	59 (58%)	14 (14%)
More than 1 chronic medical condition	20	N/A	20 (20%)		N/A
Confidence about future		**Yes**	**No**	**Total**	**OR*(95% CI) P-Value**
Accompanied by someone	**Yes**	17	4	21	1.28 (0.073-2.48)
	No	32	27	59	*p=0.031*
Family/friends/relatives to rely on after disaster	**Yes**	28	14	42	2.01 (1.005-3.03)
	No	8	30	38	*p<0.001*
Emergency Preparedness		**≤60 years old**	**>60 years old**	**Total**	
Tetanus[c]	**Positive**	36	5	41	*p=0.013**
	Negative	62	52	114	
	Don't know	11	16	27	
	Total	109	73	182	

[a] Two independent spot blood glucose and blood pressure measurements repeated within 24 hours For spot glucose, spot glucose test is done 2 hours after meal Cut off value 7 0mmol l, Blood Pressure cut off values at 140/90mm Hg

[b] e g thyroid supplements

[c] 142 with uncertain status not immunized status, 77% not immunized

**p-value of Pearson's chi-squares is less than or equal to 0 05*

2) The difference of health needs between rural and urban relief settings

Details of findings in this section can be found in the Appendix in the paper by *Chan Ying Yang Emily and Griffiths Sian Meryl* (2009) entitled "Comparison of Health Needs of Older People Between affected rural and urban areas after the 2005 Kashmir Pakistan Earthquake." published in the *Prehospital and Disaster Medicine*, Vol.24 no.5, pp.365-371.

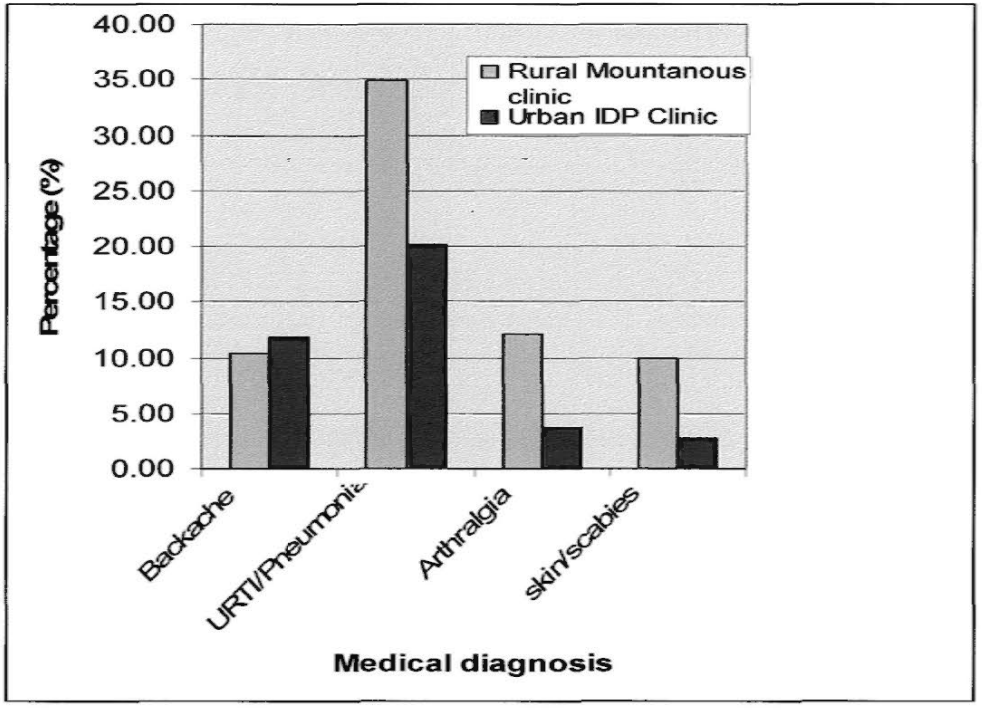
The following sections present the findings of the study according to: i) health needs of older people, ii) health care utilization by older people, and iii) various access issues related to old age in the rural communities of middle income developing countries.

I. Health care needs of older people

2942 and 392 consultations from the rural mountainous clinic (Site 1) and the urban IDP medical services (Site 2) were reviewed respectively during the study period, January 21 to February 20 in 2006, four months post earthquake. Older people had taken up 14% (rural) and 26% (urban) of the clinical service utilization. In the rural clinic, there were more male rural clinic users than female (7:3), while for the urban clinic, there are more female users when compared with men (4:3). **Figure 7.2** shows the comparison of the commonest medical diagnoses reported for older people between the urban and rural settings. Overall, disease patterns amongst the older population were similar in the two study settings. Backache/myalgia, URTI/ pneumonia, heart burn/gastritis and arthralgia were the most common medical conditions recorded among urban older people. Triangulation of these findings with Dr. N.A. Sherich of the Central Military Hospital in Muzaffarabad, the main referral hospital, confirmed that the most common medical conditions observed within the

urban hospital during the study period were respiratory infections and skin infections such as scabies.

Figure 7.3 Comparison of the commonest medical diagnosis* between rural and urban clinics



As recorded in medical consultation records from January to February, 2006.
** Rural: Among 2942 medical records at Sarli Saccha mountain clinic;*
Urban: Among 392 medical records at the urban MH Chella Bandi IDP clinic.

For the second study, 125 questionnaires and examinations were completed on site (85 for the mountainous clinic and 40 in the IDP camps). Significant differences in self-perceived well-being were found between older people in the remote mountainous area and IDP camps. Whilst none of the respondents sustained any injuries due to the earthquake, twice as many older people (68%) in the remote mountain area reported worse health outcomes post-disaster than those in the IDP camps. Chi-square analysis indicated that remote mountain respondents had more complaints and increased severity of clinical symptoms, such as headache (40% versus 23%, $P = 0.04$), psychosocial distress (72% versus 44%, $P < 0.001$) and sleeplessness (65% versus 45%, $P < 0.001$) when compared with affected individuals living in the IDP camps.

For specific physical complaints, older people from mountainous areas in Study 1 had more dental, hearing, eating and visual complaints than their IDP counterparts. The severity of dental problems also corresponded with reports of weight loss (75% versus 50%, $P < 0.001$) and eating problems (87% versus 50%, $P < 0.002$) among older people. **Tables 7.3 a-c** shows the results of selected self-reported health status and well-being of older people.

Table 7.3a Comparison of selected self reported health status of older people in two different settings

	Rural Site Mountainous Clinic* %(N=85)	Urban Site IDP camp** %(N=40)	Chi-square P-Value
Selected Physical Health Related Problems			
Dental problems	100% (85)	25% (10)	<0.0001
Visual problems	75% (64)	38% (15)	<0/0001
Weight loss	75% (64)	50% (20)	0.001
Eating problems (indigestion, lack of appetite)	87% (74)	50% (20)	0.002
Hearing problems	54% (50)	40% (16)	0.043
Other physical complaints			
Headache	40% (34)	23% (9)	0.043
Dizziness	34% (29)	20% (8)	0.07
Joint/muscle pain	54% (50)	50% (20)	0.10
With known underlying medical problems:	25% (21)	38% (15)	0.02
Of which:			
i) without treatment/never had treatment	65% (59)	30% (12)	<0.001
ii) treatment/care before disaster	35% (30)	70% (28)	<0.001
-discontinue treatment post disaster	80% (68)	40% (16)	<0.001

Table 7.3b Comparison of selected self reported health status of older people in two different settings

	Rural Site Mountainous Clinic* %(N=85)	Urban Site IDP camp** %(N=40)	Chi-square P-Value
Selected Psychosocial Health Related Problems			
Experience death of at least one family member/close relative	90% (77)	40% (16)	<0.001
Loss of Possessions			
Some	30% (26)	30% (12)	0.1
All	50% (43)	40% (16)	0.07
Refused to answer	20% (17)	30% (12)	0.06
Feeling Depressed and Helpless	72% (61)	44% (18)	<0.001
Sleeplessness	65% (55)	44% (18)	<0.001
Feeling lack of resources:			
Medical	60% (51)	20% (8)	<0.001
Food	25% (21)	5% (2)	<0.001
Clothes/ not enough clothes	20% (17)	5% (2)	<0.001
Shelter	70% (60)	50% (20)	<0.001
Financial support	90% (77)	55% (22)	<0.001
Social support	60% (51)	20% (8)	<0.001
Most cited other needs:			
Cooking utensils	40% (34)	5% (2)	<0.001
Overall worsening of health post earthquake (4 months after)	68% (58)	35% (14)	<0.001

Table 7.3c Comparison of selected self reported health status of older people in two different settings

	Rural Site Mountainous Clinic* % (N=85)	Urban Site IDP camp** % (N=40)	Chi-square P-Value
Social related issues			
Currently living alone	10% (9)	2% (1)	<0.001
Living with family	50% (43)	70% (28)	0.04
Living with friends/neighbor	40% (34)	28% (11)	<0.01
Living in:			
Houses	30% (26)	10% (4)	0.03
Tents	60% (51)	90% (46)	0.02
Had any received assistance post earthquake (aside from medical services)	50% (43)	100% (40)	<0.01

**Results abstracted from mountainous clinic: 85*

***Results abstracted from IDP camp clinic: 40*

Of note, clinical records reviewed in all study locations showed a systematic absence of documentation of common chronic diseases. Specifically, records showed that only acute medical complaints were managed in these clinics. There was little or no record of common cardiovascular conditions (e.g. hypertension, strokes, or diabetes mellitus) or nutritional status of the older age groups in either the mountain clinics or the IDP camps unless it was reported as a chief complaint or symptom of the consultation (e.g. hypertension). Chronic conditions such as diabetes mellitus and hypertension and basic anthropometric data such as body mass index (BMI) were not recorded.

Findings of the self-reported health surveys illustrated that 25-38% of the respondents were aware of the existence of at least one unmanaged, underlying medical problem. The three-day on-site physical examination in the mountainous clinic further confirmed this finding by revealing that 38% of the examined patients (31of 85 patients) had at least one underlying chronic condition. Diabetes mellitus was the most common under-diagnosed or managed chronic condition found during on-site physical examination (22%, 19 out of 85 patients).

Results also indicated increased disparities in access to care for chronic medical conditions among population groups post-earthquake. Before the disaster, only 35% (30) of older people living in mountains had received medical management for their underlying chronic medical problems, compared to 70% (28) of the older people living near the city IPD camps. Post-earthquake, among those who had chronic medical treatment prior to the disaster, 80% (68) of those living in the remote mountains reported losing access to chronic medical treatment when compared to 40%(16) of those who were living near the city IDP camp. Moreover, clinical records showed

discrepancies between diagnoses and drugs prescribed and an over-prescription of antibiotics across all age groups.

II. Health care utilization of older people in different settings

Table 7.4 demonstrates the utilization of health care services by older people. Fewer older people attended the remote mountainous clinic (Site 1) when compared with the IDP clinic. Given older people was the predominant age group in rural community, this suggested geographic access barriers may exist in remote areas. This is also supported by the internal survey of Merlin's airlifted medical mobile clinic in the remote areas of Neelum Valley (Zabbar, Konka and Telegra) which showed older people took up to 45% of the consultations in medical outreach services to the remote area (Chan et al., 2006).

Table 7.4 Utilization pattern of older people in the two health care settings according to clinical records[#]

Location	Rural mountainous clinic*	Urban IDP camp**
Total attendees	2942	392
Service taken up by older people[+]	14%	26%
Male/Female	7:3	3:4

[#] *Clincal Records review from January-February, 2006*

**Merlin's P3, Sarli Saccha Clinic*

*** Muslim Hand IDP camp in Chella Bandi*

[+] *According to UNHCR, population aged 45 constituted about 19% of the population in that area*

Differences were found in gender utilization of health services by older people. Men were the predominant service users (70%) in the mountainous clinic (Study 1). Service utilization by older women was found to be inversely related to the travel distance to the clinic (i.e. the use of services was greater the shorter the distance from home).

iii) Access issues

As service provision was free in both study settings, direct treatment cost was not an access barriers to health/medical services for the studied population. However, an important unintended service access barrier reported by both urban and rural respondents was gender discrimination to specific service. Clinical service access for older women in rural areas was found to be related to the gender of service providers. Clinic attendance records in the mountainous clinic showed that during days when clinical services were provided solely by male doctors, medical services utilization decreased by 30%.

Meanwhile, men were found to have problem in accessing psychosocial support because most programs were targeted exclusively to women and children. A recurrent theme found amongst men during discussion in both clinics (rural and urban) was "a feeling of limited access to international relief service because they were only available for the 'vulnerable groups: women and infants."

Summary of findings

Overall, significant differences were found in health needs and utilization patterns when comparing service users of rural and urban clinics four months after the Pakistan Kashmir earthquake. Older people with chronic medical needs were the predominant profile of the clinic service users. Various access barriers were identified which merit attention to ensure unmet health needs are addressed.

3) The difference of health needs between official and unofficial internal displaced camps

Details of findings in this section can be found in the Appendix in the paper by *Chan Ying Yang Emily and Kim J Jacqueline* (2010) entitled "Characteristics and health outcomes of internally displaced population in unofficial rural self-settled camps after the 2005 Kashmir, Pakistan earthquake." published in the *European Journal of Emergency Medicine.* Vol 17 No 3 pg 136-141.

Overall, the findings of this study indicate that the resident characteristics and post-disaster profile varied with camp sizes. In general, resident profiles were more similar between residents of official self-settled camps and larger unofficial self-settled camps. **Table 7.5** shows results for selected demographic and health related status among the various types of rural self-settled IDP camps.

Table 7.5 Demographic Characteristics among the IDP camps*

IDP Camp No.	1	2	3	Combined (C)[†]	Official (O)[‡]	1xO	2xO	3xO	CxO
Number of Households	49	28	8	85	82				
N	392	238	66	952	574				
	% (95%CI)	% (95%CI)	% (95%CI)	% (95%CI)	% (95%CI)	p-value(Chi square test)			
Average household size	7	8	9	8	7				
Respondents head of household	55% (50,60)	60% (54,66)	100% (100,100)	71% (69,74)	55% (53,57)	1.00	0.19	<0.01	<0.01
Gender (respondents): Male	70% (65,75)	55% (49,61)	45% (45,50)	58% (55,61)	70% (68,72)	1.00	<0.01	<0.01	<0.01
Originally from:									
Local (within 30 mins)	30% (25,35)	35% (29,41)	60% (55,65)	41% (38,45)	35% (33,37)	0.10	1.00	<0.01	<0.01
Other city (>30 mins from site)	20% (16,24)	15% (10,20)	10% (7,13)	15% (13,18)	15% (13,17)	0.04	1.00	<0.01	0.20
Rural/mountainous area (>30 mins from site)	40% (35,45)	50% (44,56)	30% (25,35)	39% (36,42)	55% (53,57)	<0.01	0.19	<0.01	<0.01
Is this the 1st settlement	40% (35,45)	48% (42,54)	80% (76,84)	56% (52,59)	40% (38,42)	1.00	0.04	<0.01	0.02
% < 5 years old	30% (25,35)	30% (24,36)	20% (16,24)	27% (24,29)	30% (28,32)	1.00	1.00	<0.01	<0.01
% Older people (>45 years old)	50% (45,55)	50% (44,56)	60% (55,65)	53% (50,57)	35% (33,37)	<0.01	<0.01	<0.01	0.38

[†] *Combined is the sum of IDP 1, IDP 2, and IDP3.* [‡] *82 out of 276 (30% response rate) households were included in the rural official IDP camp sample. N=1932* **Values are rounded off.*

Demographic characteristics

The households in the smaller camps tended to be headed by females (% male as head of household, in order of smallest to largest self-settled camp: 45%, 55%, 70%), have larger family sizes (average family size, in order of smallest to largest self-settled camp: 9,8,7), have larger percentage of older people than the larger camps (60% vs. 50% and 50%, respectively), and originate from local areas (in order of smallest to largest self-settled camp: 60%, 35%, 30%). Smaller camps were also more likely to be the first settlement for residents four months post-disaster (first settlement in order of smallest to largest self-settled camp: 80%, 48%, 40%).

Earthquake related damage

Smaller self-settled camps tended to have residents who sustained more severe property/possession loss (smallest self-settled camp 80%, vs. official camp 70%, $p<0.01$), reported more family deaths (aggregated small camps 47% vs. official camp 40%, $p<0.01$), and received less assistance post-earthquake (aggregated small camps 41% vs. official camp 70%, $p<0.01$). Of concern, these small self-settled IDP residents (aggregated small camps 76% vs. official camp 65%, $p<0.01$) also had less means to sustain livelihood and household income post-disasters. **Table 7.6** shows earthquake-related damage as reported by study respondents in the IDP camps.

Table 7.6 Earthquake-related damage among respondents in the studied IDP camps*

	IDP 1 (n=392)	IDP 2 (n=238)	IDP 3 (n=66)	Combined (C)† (n=952)	Official (O)‡ (n=574)	1xO	2xO	3xO	CxO
	% (95%CI)	% (95%CI)	% (95%CI)	% (95%CI)	% (95%CI)	p-value(Chi square test)			
% of household reported to have received some form of assistance post earthquake	60% (55,65)	40% (34,46)	20% (16,24)	41% (38,45)	70% (68,72)	<0.01	<0.01	<0.01	<0.01
Loss of possessions: house (non-repairable or in serious doubt about safety)	65% (60,70)	75% (69,81)	80% (76,84)	73% (70,75)	70% (68,72)	0.10	0.15	<0.01	<0.01
Cannot sustain livelihood (loss of farmland, livestocks, products/goods)	60% (55,65)	85% (80,90)	90% (87,93)	76% (74,79)	65% (63,67)	0.11	<0.01	<0.01	<0.01
Financial: household income of some sort after earthquake (include financial assistance)	35% (30,40)	30% (24,36)	10% (7,13)	25% (23,28)	35% (33,37)	1.00	0.17	<0.01	<0.01
Experience death of at least one family member/close relative	40% (35,45)	40% (34,46)	60% (55,65)	47% (44,50)	40% (38,42)	1.00	1.00	<0.01	<0.01

*† Combined is the sum of IDP 1, IDP 2, and IDP3. ‡82 out of 276 (30% response rate) households were included in the rural official IDP camp sample. N=1932 *Values are rounded off.*

Health related Impact

Table 7.7 shows self reported health-related issues among IDP camps. Residents of the largest self-settled camps were nearly twice as likely to report better well-being as those residing in the smallest camp (60% vs. 35%, p=0.01). Although the official camp reported a lower incidence of earthquake injury (30%), no statistical difference for earthquake related injury incidence rate was detected among different unofficial self-settled camps. When comparing self-rated health status before and after post disaster, more residents (50%) of the smallest self-settled camp residents reported their health were worse than before the earthquake compared with 35% in the largest unofficial self-settled camp.

Self-reported infectious disease patterns were comparable among small self-settled camps. When compared with official camps, detailed differential analysis showed that residents in smaller unofficial self-settled camps reported to have experienced more gastrointestinal infections (smallest camp 65% vs. official camp 45%, P<0.01) and wound infections (smallest camp 45% vs. official camp 20%, P=0.07). Whilst the proportion of population with chronic conditions was similar across these studied camps, 85% of residents in the smallest unofficial camp had no available drugs to manage their chronic medical conditions as compared with their counterparts who resided in larger rural unofficial (40%) and official camps (25%).

With regard to psychological health, there was a significant difference in self-reported psychological symptoms between rural official and unofficial camps. Although complaints of sleeplessness (50%) were similar among various camp types, more residents in rural unofficial small camps were found to be depressed (45% in smallest

camps vs. 30% in official camp, $p<0.01$), felt helpless (50% in smallest camps vs. 20% in official camp, $p <0.01$), anxious (45% in smallest camps vs. 35% in official camp 35%, $p <0.01$) and experienced poor appetite (50% in smallest camps vs. 30% in official camp, $p <0.01$). Furthermore, residents in smaller camps reported more fear of another disaster (55% in smallest camps vs. 30% in official camp, $p <0.01$).

For social health and well-being, whilst settlers in the largest unofficial rural camp were comparable to those in official camps in terms of establishing post disaster contact with family (for both: 65%), only 20% of settlers in the smallest camp were in contact with other family members. In addition, only 55% of the smallest rural camp residents reported to feel supported by network and community when compared with the larger unofficial rural (70%) and official camps (75%).

Expressed needs were also examined and found to be different among respondents of the different camp types. For the smallest unofficial camp, medical, financial and access to information were regarded as most immediate needs (33% reported for each). Meanwhile, the second smallest unofficial camp reported household utensils (45%) and the largest rural unofficial camp cited psychological (55%) services and the official rural camp reported psychological (45%) as well as utensils (45%) to be the most important needs that may support their well-being in the study period.

Table 7.7 Health-related issues among IDP camps*

	IDP 1 (n=392) % (95%CI)	IDP 2 (n=238) % (95%CI)	IDP 3 (n=66) % (95%CI)	Combined(C)† (n=952) % (95%CI)	Official (O)‡ (n=574) % (95%CI)	1xO	2xO	3xO	CxO
						p-value(Chi square test)			
Health-related									
Self-reported health status:									
Well being(0-5 point scale)	60% (55,65)	40% (34,46)	35% (30,40)	47% (43,50)	60% (58,62)	1.00	<0.01	<0.01	<0.01
Weight Loss	40% (35,45)	40% (34,46)	60% (55,65)	47% (44,50)	50% (48,52)	<0.01	0.01	0.00	0.00
Eating problems	40% (35,45)	35% (29,41)	30% (25,35)	35% (32,38)	50% (48,52)	<0.01	<0.01	<0.01	<0.01
Health status as compared to before the earthquake:									
Better	25% (21,29)	15% (10,20)	10% (7,13)	17% (15,20)	25% (23,27)	1.00	<0.01	<0.01	<0.01
Similar	30% (25,35)	40% (34,46)	25% (20,30)	31% (28,34)	30% (28,32)	1.00	0.01	<0.01	0.01
Worsen	35% (30,40)	30% (24,36)	50% (45,55)	39% (36,42)	35% (33,37)	1.00	0.17	<0.01	<0.01
No comments	15% (11,19)	15% (10,20)	15% (11,19)	15% (13,17)	10% (9,11)	0.02	0.04	<0.01	0.55
Reported injuries	30% (25,35)	30% (24,36)	35% (30,40)	32% (29,35)	25% (23,27)	0.09	0.14	<0.01	0.22
Medical problems related to quake									
Reported of at least 1 household member post earthquake who had acute conditions and required medical attention:									
Infection	45% (40,50)	30% (24,36)	65% (60,70)	48% (45,51)	45% (43,47)	1.00	<0.01	<0.01	<0.01
Gastrointestinal	40% (35,45)	30% (24,36)	60% (55,65)	44% (41,47)	40% (38,42)	1.00	0.01	<0.01	<0.01
Skin	25% (21,29)	25% (19,31)	25% (20,30)	25% (22,28)	25% (23,27)	1.00	1.00	<0.01	<0.01
Wound	20% (16,24)	20% (15,25)	45% (40,50)	28% (26,31)	20% (18,22)	1.00	1.00	<0.01	0.07
Family members with known chronic conditions and on medication before earthquake. (Include Diabetes Mellitus, Hypertension, Arthritis, Heart Diseases, Hyperthyroidism)	35% (30,40)	40% (34,46)	40% (35,45)	38% (35,41)	35% (33,37)	1.00	0.18	<0.01	<0.01
With no available drugs to manage conditions	40% (35,45)	60% (54,66)	85% (81,89)	60% (57,63)	25% (23,27)	<0.01	<0.01	0.01	<0.01
Psychological-related									
Depressed	30% (25,35)	25% (19,31)	45% (40,50)	34% (31,37)	30% (28,32)	1.00	0.15	0.00	0.00
Felt helpless	20 % (16,24)	35% (29,41)	50% (45,55)	34% (31,37)	20% (18,22)	1.00	0.00	0.00	0.83
Anxious	35% (30,40)	40% (34,46)	45% (40,50)	40% (37,43)	35% (33,37)	1.00	0.18	0.00	0.00
Sleeplessness	50% (45,55)	40% (34,46)	50% (45,55)	48% (44,51)	50% (48,52)	1.00	0.01	0.00	0.00
Poor appetite	30% (25,35)	45% (39,51)	50% (45,55)	41% (37,44)	30% (28,32)	1.00	0.00	0.00	0.22
In fear of another disaster	45% (40,50)	30% (24,36)	55% (50,60)	45% (41,48)	30% (28,32)	0.00	1.00	0.00	0.95

	IDP 1 (n=392) % (95%CI)	IDP 2 (n=238) % (95%CI)	IDP 3 (n=66) % (95%CI)	Combined(C)[†] (n=952) % (95%CI)	Official (O)[‡] (n=574) % (95%CI)	1xO	2xO	3xO	CxO
						p-value(Chi square test)			
Social health-related									
In contact with other family members(beyond the immediate circle)	65% (60,70)	40% (34,46)	20% (16,24)	44% (40,47)	65% (63,67)	1.00	0.00	0.00	0.00
In contact with at least 1 friends/colleagues/neighbour	65% (60,70)	60% (54,66)	45% (40,50)	57% (54,60)	70% (68,72)	0.10	0.01	0.00	0.00
% felt supported by network and the community	70% (65,75)	55% (49,61)	55% (50,60)	61% (58,64)	75% (73,77)	0.09	0.00	0.00	0.00

*[†] Combined is the sum of IDP 1, IDP 2, and IDP3 [‡]82 out of 276 (30% response rate) households were included in the rural official IDP camp sample N=1932 *Values are rounded off*

Summary of findings

Significant differences in settlers' demographic characteristics and health outcomes were found according to the size of unofficial IDP camps. Whilst larger unofficial self-settled camps appeared to have similar characteristics and health outcomes as official camps, the most vulnerable population groups who had the largest average family size, received the least assistance and resources to sustain livelihood and exhibited the worst self-reported physical, mental, and social health outcomes, and were usually found in the smaller unofficial camps. Of note, results also indicated that the population in the smaller camps experienced less access to information, medical services, and chronic disease medication for underlying medical problems.

4) The difference of health needs between stationary and mobile clinics

Details of findings in this section can be found in the Appendix in the paper entitled *Chan Ying Yang Emily and Kim J Jacqueline.* "Remote mobile health service utilization post 2005 Kashmir-Pakistan Earthquake" published in the *European Journal of Emergency Medicine,* Vol 17 No 3 pg 158-163.

2942 and 142 consultation records from the mountainous clinic (Site 1) and the remote area outreach medical services (Site 2), respectively, were reviewed and analyzed. Results are presented in the following sections according to: i) the comparison of demographic and disease profile of health service users in the two study sites, and ii) the comparison of acute and chronic disease patterns in these remote settings.

1. Comparison of demographic and disease profiles of health service users in the two remote clinic sites

Table 7.8 shows the results by comparing user demographic characteristics and diagnoses of the stationary clinic versus the mobile clinic after the acute phase of 2005 Kashmir earthquake in remote areas. Overall, significant differences were found between the two settings. The average age of stationary clinic users (38 years old) was slightly higher than those at the mobile clinic (35 years old). Whilst 44% of the stationary clinic users were from the extremes of age (<5 and >45 years old) as compared to 32% at the mobile clinic, the mobile clinic had twice as many patients who were older than 65 years old (stationary: 3% versus mobile: 6%, p=0.03). 56% of mobile clinic users were female compared to 30% in the stationary clinic (p<0.0001). Average travel distance was also found to be significantly longer for mobile clinic than stationary clinic ($p < 0.01$ in all categories), with 20% of mobile clinic users having to travel for more than 4 hours as compared with 10% in the stationary clinic group.

Respiratory disease constituted 20-22% of the case load in both clinics and was found to be the largest single diagnosis group during the study period. Yet, beyond respiratory conditions, other disease patterns were different between the sites. Mobile clinic attendees tended to have more earthquake related trauma (mobile: 18% versus stationary 10%, p<0.01), wound infections (mobile: 15% versus stationary: 5%, p<0.01), and gastrointestinal diseases (mobile: 15% versus stationary: 5%, p<0.01).

Meanwhile, stationary clinics had almost tripled as many patients presenting with chronic conditions when compared with mobile clinics. Arthritis (stationary: 13% versus mobile: 3%, $p<0.01$) and various forms of pain (including stomach, head and back) were found to be significantly different when comparing the two sites (stationary: 17% versus mobile 4%, $p<0.01$). In addition, more non-specific medical conditions presented at the stationary clinic as compared with mobile clinic (stationary: 8% versus mobile: 3%, $p = 0.02$).

Table 7.8 Chi-square comparison between user characteristics of stationary clinic versus mobile clinic post acute phase of 2005 Pakistan Kashmir earthquake in remote areas

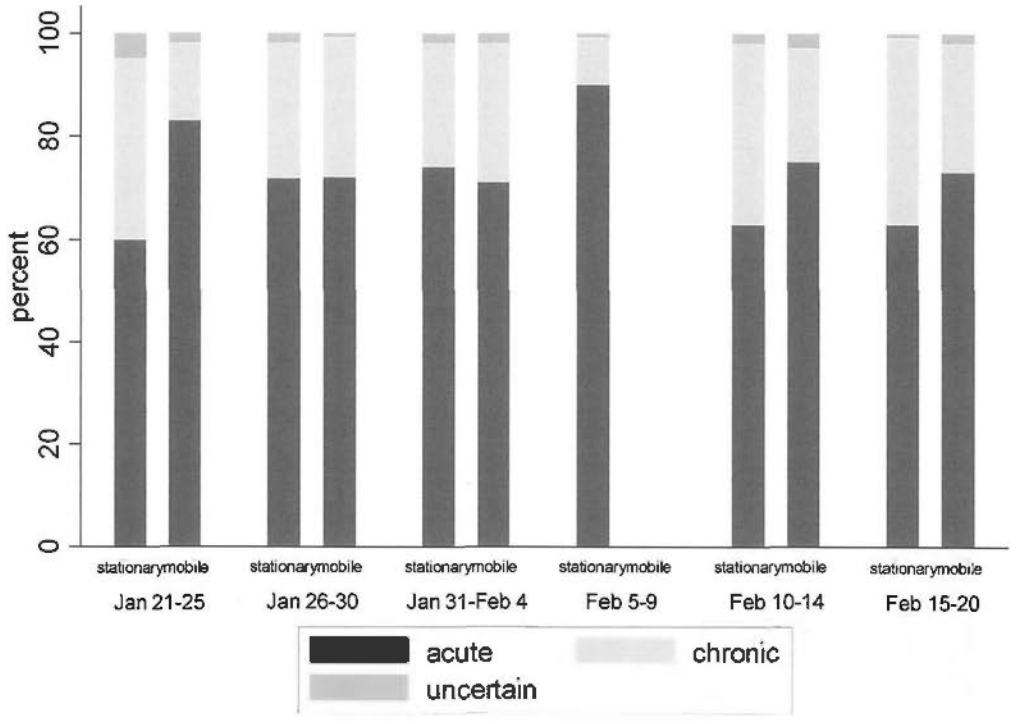
Demographic Information	Stationary Clinic n=2942	Mobile Clinic n=142	Chi-square test	National Statistics
	% (95%CI)	% (95%CI)	p-value	
Age				
< 5 years old	30% (28,32)	23% (21,24)	0.0850	15%†
6 – 45 years old	56% (54,58)	23%(21,24)	0.0745	71%
>45 years old*	14% (13,15)	9% (8,10)	0.0913	14%†
>65 years old*	3% (2,4)	6% (5,7)	0.0256	3%†
Mean age (range)	38 (0-83)	35 (0-63)	N/A	N/A
Sex				
Female ratio, %	3:7, 30% (28,32)	5:4, 56% (54,57)	<0.0001	49%†
Proximity to clinic (travel time from home)				
<30 minutes	25% (23,27)	15% (14,16)	0.0057	N/A
>30 minutes to <1 hour	35% (33,37)	25% (23,27)	0.0181	N/A
>1 hours to < 4 hours	30% (28,32)	40% (38,42)	0.0104	N/A
>4 hrs	10% (9,11)	20% (19,21)	0.0002	N/A
Main Diagnosis				
Trauma/Injury	15%	25%	N/A	
Trauma/Injury - Earthquake related	10% (9,11)	18% (21,24)	0.0015	41.2% per 1000‡
Trauma/Injury-Non-disaster related	5% (4,6)	7% (8,10)	0.2787	
Infection	35%	51%	N/A	
Wound	5% (4,6)	15% (14,16)	0.0000	N/A
Respiratory (including pneumonia, URTI)	22% (21,23)	20% (19,21)	0.5222	N/A
Gastrointestinal (Watery Diarrhea, bloody diarrhea)	5% (4,6)	15% (14,16)	<0.0001	N/A
Skin/Scabies	3% (2,4)	1% (1,1)	0.1118	N/A
Chronic Conditions	42%	21%	N/A	
DM	2% (1,2)	3% (2,4)	0.5044	N/A
HT	8% (7,9)	9% (8,10)	0.6174	N/A
Heart Conditions	2% (1,2)	2% (1,2)	0.9291	N/A
Arthritis	13% (12,14)	3% (2,4)	0.0003	N/A
Pain(Back, stomach head)	17% (16,18)	4% (3,5)	0.0001	N/A
Non-specific medical condition	8% (7,9)	3% (2,4)	0.0244	N/A

*†Rural areas, Pakistan Demographic Survey 2003, Federal Bureau of Statistics, Government of Pakistan ‡Rural unintentional injuries per year was reported to be 41 2 per 1000 with 95% CI of 32 2-50 0 in the National Health Survey Pakistan 1990-94 *Old age can be defined in many ways, particularly between different societies In rural Pakistan, it would be impractical to define old age by adopting the United Nation's chronological definition of older people as 60 years or above because the official life expectancy in 2009 was reported to be 63 4 and 65 64 for male and female respectively[10]. Taking into consideration functional capacity, and social expectations of people in rural Pakistan who tend to marry young and become grandparents in their mid-forties, the definition of older age in the study setting was context specific and set to be 45 years or above*

2) Difference in acute versus chronic disease patterns in clinical settings

As indicated in **Table 7.8**, chronic diseases constituted 42% of the case load in the stationary clinic which is almost double that of the mobile clinic (21%). **Figure 7.2** shows a comparison of the proportion of chronic and acute diseases per week within the study period. In general, although more chronic conditions presented in stationary clinics than mobile clinics, descriptive results indicated diagnosis of acute conditions remained as the majority cause of clinical visits (approximately 75%) for both clinics during the post acute phase of the disaster.

Figure 7.2 Comparison of the proportion of acute* and chronic diseases presenting at the two study sites in remote areas per week during the study period**



*A total of 2942 and 142 consultation records were reviewed from the mountainous clinic (Site 1) and the remote area outreach medical services (Site 2) respectively during the study period from January 21 to February 20, 2006. *Acute conditions consisted of trauma/injury (earthquake related and non-earthquake related) and infection (wound, respiratory, gastrointestinal related, skins), **Chronic conditions included diabetes mellitus, hypertension, heart related conditions, arthritis, pain) and unspecific medical complaints was grouped as uncertain group within the figure.*

Summary of findings

To summarize, significant differences in demographic and disease profile of users were found between mobile clinic and stationary clinic attendees post acute emergency in remote setting. Older age, female gender, population living further way from clinics, patients with earthquake related trauma, wound infection, and gastrointestinal conditions were found to be more significantly associated with mobile clinic users. Users of the stationary clinic tended to be younger, living closer to the clinic site and had disease profiles which were predominantly chronic in nature.

5) Why were the needs of disaster-affected populations of older age and with chronic medical conditions forgotten by health care providers?

Details of findings in this section can be found in the Appendix in the paper by *Chan Ying Yang Emily* (2009) entitled "Why are older people health needs forgotten post-natural disaster relief in developing countries? A healthcare provider survey of 2005 Kashmir, Pakistan earthquake." published in the *American Journal of Disaster Medicine,* Vol.4 No.2, pp.107-112.

A total of 15 participants took part in the study. Representatives were nominated from international organizations (five), national organizations (five) and local community responding groups (five). Interviews, each lasting approximately 15-30 minutes, were conducted in field offices of related organizations in February 2006.

Due to the small sample size, only a descriptive analysis of the results was conducted. Findings were organized according to: a) the perception of older people's vulnerabilities, b) awareness towards older people's health needs, and c) capacity, human and material resources for the provision of geriatric related services. **Table 7.9a-c** shows selected results of the provider survey.

Table 7.9a Key findings of provider survey for older people health needs post Kashmir Pakistan Earthquake (2005)

Related Question	Overall*	Local	National[+]	International
Background: Awareness of geriatric related issues and guidelines				
Have direct health/medical/mental health components?	73.3% (11/15)	80%(4/5)	60% (3/5)	80% (4/5)
Consider Older people# as vulnerable groups?	93% (14/15)	100%(5/5)	80%(4/5)	100%(5/5)
Aware of any older people related guidelines in emergency relief and response?	20% (3/15)	0%	20%(1/5)	40% (2/5)
Are programs planning/implementation follows some guidelines related to older people?	6.6% (1/15)	0%	20%(1/5)	0%

**15 organizations 5 local (Muslim Hands. Chellabandi community group, Muzzafarabad regional hospital, Muzzafarabad community responders. Muzzafarabad city relief organizations) 5 National(Pakistan Red Crescent, Pakistan Ministry of Health x2. Pakistan Army x 2) 5 International(Merlin. MSF, Turkey Red Crescent. UNHCR, UNICEF) ** But for those respondents who provided relevant services, most services include older people group within their target (general adult population) ˆ (Out of province groups) # The definitation of old age may be different according to societies and culture. in rural Pakistan, it would be impractical to define old age by adopting the United Nation's chronological definition of older people as 60 years or above because the official life expectancy in 2009 was reported to be 66 and 66.7 for male and female respectively (UNdata, 2011). Taking into consideration functional capacity, and social expectations of people in rural Pakistan who tend to marry young (at 17) and become grandparents in their mid-forties. the definition of older age in the study setting was context specific and set to be 45 years or above*

Table 7.9b Key findings of provider survey for older people health needs post Kashmir Pakistan Earthquake (2005)

Related Question	Overall*	Local	National[+]	International
Geriatric Service provision				
Providing service indiscrimination of age	60% (9/15)	80%(4/5)	40%(2/5)	60% (3/5)
Providing relevant geriatric related clinical services	0%	0%	0%	0%
Providing outreach services for older people**	40% (6/15)	40%(2/5)	20%(1/5)	60% (3/5)
Providing psychosocial care specifically for older people**	0%	0%	0%	0%
Providing clinical service indiscrimination of gender	60% (9/15)	80%(4/5)	60%(3/5)	40% (2/5)
Providing gender sensitive outreach service	33.3% (5/15)	20%(1/5)	40%(2/5)	40% (2/5)

**15 organizations 5 local(Muslim Hands, Chellabandi community group, Muzzafarabad regional hospital. Muzzafarabad community responders, Muzzafarabad city relief organizations) 5 National(Pakistan Red Crescent, Pakistan Ministry of Health x2, Pakistan Army x 2) 5 International(Merlin. MSF, Turkey Red Crescent. UNHCR. UNICEF)*
*** But for those respondents who provided relevant services, most services include older people group within their target (general adult population) [+] (Out of province groups) ≠ The definitation of old age may be different according to societies and culture. in rural Pakistan, it would be impractical to define old age by adopting the United Nation's chronological definition of older people as 60 years or above because the official life expectancy in 2009 was reported to be 66 and 66.7 for male and female respectively (UNdata, 2011). Taking into consideration functional capacity, and social expectations of people in rural Pakistan who tend to marry young (at 17) and become grandparents in their mid-forties, the definition of older age in the study setting was context specific and set to be 45 years or above*

Table 7.9c Key findings of provider survey for older people health needs post Kashmir Pakistan Earthquake (2005)

Related Question	Overall*	Local	National+	International
Human and Material Resources				
Has geriatric Dr/Nurses	0%	0%	0%	0%
Has trained health care workers for chronic medical needs	40% (6/15)	20%(1/5)	20%(1/5)	20% (3/5)
Has drugs treating common morbidity for older people	60% (9/15)	40%(2/5)	60%(3/5)	80% (4/5)
Has mobility aid for patients	20% (3/15)	20%(1/5)	40%(2/5)	0%

**15 organizations 5 local(Muslim Hands, Chellabandi community group, Muzzafarabad regional hospital, Muzzafarabad community responders, Muzzafarabad city relief organizations) 5 National(Pakistan Red Crescent, Pakistan Ministry of Health x2, Pakistan Army x 2) 5 International(Merlin, MSF, Turkey Red Crescent, UNHCR, UNICEF) ** But for those respondents who provided relevant services. most services include older people group within their target (general adult population) + (Out of province groups) ≠ The definitation of old age may be different according to societies and culture, in rural Pakistan, it would be impractical to define old age by adopting the United Nation's chronological definition of older people as 60 years or above because the official life expectancy in 2009 was reported to be 66 and 66.7 for male and female respectively (UNdata, 2011). Taking into consideration functional capacity, and social expectations of people in rural Pakistan who tend to marry young (at 17) and become grandparents in their mid-forties, the definition of older age in the study setting was context specific and set to be 45 years or above*

a) Perception of older peoples' vulnerabilities

Among the respondents, 73.3% (11/15) of responding agencies reported to have direct health/medical/mental health components in their relief programs. While 93% regarded older people as a vulnerable group and 9 of the 15 agencies claimed to provide service that were age indiscriminating, only 6.6% of responding providers had relevant planning/considerations in their implementing programs related to older peoples' needs.

b) Awareness of older people issues

Awareness of medical relief guidelines for older people was generally low and varied among local groups, national organizations and INGOs. Findings indicated local groups had the least awareness regarding guidelines available for geriatric service planning and technical capacity for program implementation. Although 40% international NGOs claimed to have heard of relevant guidelines, none of these international agencies had planned for geriatric specific services or had related policies in their programs. In comparison, only one national agency was aware of relevant guidelines for the care of older people during emergencies and this organization did consider geriatric needs in its earthquake relief programs.

c) Capacity, human and material resources

In terms of capacity, none of the agencies provided geriatric specific clinical services within their emergency programs. While none of the providers had medical staff trained in geriatric subspecialties or psychological care during the study period, 40%

of the responding agencies had trained staff to manage chronic medical needs and explained that their general clinical services and outreach services should have covered general medical needs for older people (Merlin, 2005). Paradoxically, despite the international relief experiences which INGOs tended to have, results revealed that the INGOs fared the worst among all provider subcategories regarding the provision of age and gender sensitive clinical programs. In addition, 80% of INGOs had the relevant drug supplies, but none of them provided geriatric specific services and mobility aids. On other hand, local (20%) and national (40%) counterparts provided mobility aids and 80% of the local groups reported having programs which were more gender sensitive when compared with INGO (40%).

6) The forgotten health needs in natural disasters in middle income countries post millennium.

Details of the findings in this section can be found in the Appendix in the paper by *Chan E YY* (2008) entitled "*The untold stories of Sichuan Earthquake,* published in the *Lancet,* Vol. 372. No. 9636. 359-362.

China, with its huge land mass and diverse terrains has suffered many natural disasters. According to the international database (CRED), the three most severe natural disasters in the 20th century occurred in China and local records reveal a series of major earthquakes and floods over the years, better detailed in the latter half of the twentieth century. Participated in disaster relief and assessment in the Asian Tsunami and Pakistan earthquake, I once again became involved as a clinician and a public health specialist in the Sichuan earthquake relief effort. The experience provided an opportunity to assess not only the short term needs but also the medical and public health challenges which will be faced by the Chinese population in the post-earthquake rehabilitation and reconstruction effort.

On 12th May, 2008, an 8.0 Richter scale earthquake hit the Chinese province of Sichuan. The major difference between the response to the Sichuan Earthquake and the 1976 Tangshan earthquake, the quake with the highest mortality in the 20th

century (with limited literature reported due to the political context in that era) has been in China's progressive openness towards information and media access (Gupa et al., 2000). In addition the impact of its recent economic development has enhanced the capacity to respond effectively to major natural disasters. Within hours of the quake local Communicable Disease Centres (CDCs) had become involved in disaster relief and the national network, built up as a response to SARS, was used to bring in public health help from other regions.

Immediate medical and public health needs are often emphasized on physical health outcomes. Yet, through participatory research observation, a number of disaster relief issues were identified. Specifically, the hesitancy of involving external agencies, suboptimal relief organization, inappropriate treatment facilities, forgotten health needs and supplies, health needs of disaster relief workers, concern of treatment cost and logistic arrangement, health care entitlement of migrant workers within the disaster areas, mental health needs are all important issues. **Table 7.10** shows these key issues identified during participatory research during the first three weeks post 2008 Sichuan earthquake.

Table 7.10 Key issues identified during participatory research during the first three weeks post 2008 Sichuan earthquake

Relief issues identified	Corresponding text in the article*
Overwhelming needs	*"Although the mandate at the triage site was to stabilize patients after their aeromedical transfer and to quickly re-direct patients out to other hospitals at city/provincial level, by 17th May, the 3rd day of the triage centre's operation, the hospital was overflowing with patients. Their transfer to the well-equipped secondary hospitals designated for major operations was just not possible as they tended to be multistory buildings and their use was prohibited due to the fear of post quake structural instability"*
Ambivalence with external assistance	*"Whilst the Chinese government was in general receptive to offers of outside support and help, in practice, they were cautious about allowing in civilian based relief efforts from outside mainland borders so not to not interfere with the overall efficiency of operations. Even from within the country, dozens of relief teams from other provinces were not given the official facilitation needed to reach the relief sites. No air-travel was granted into the disaster area."* *"Meanwhile, although roads were monitored by the PLA, this did not stop many people trying to rush to the destruction zone to offer their help. The British consul in Chongqing later told me he found himself doing most of his search for wounded British citizens in a series of hitch hiked lifts. The government granted our civilian medical team, largely composed of Chinese nationals from Hong Kong who had relevant post earthquake relief experience, immediate facilitation with travel permits, relief participation endorsement letters and the flexibility to choose the site where we might best support the medical relief effort. We traveled from Chengdu by road and in contrast to other Asia relief settings, highway travel was well-managed by troops with no traffic or security problems."*
Lack of disaster preparedness training	*" Our work was also further complicated by the frequency and magnitude of aftershocks. We could only work on the ground floor of our three storey building after a 6.3 Ritcher scale aftershock. Indeed at midnight on Day 5, the government, worried about further aftershocks, issued an evacuation order to move all patients outside the building onto the street. Within two hours we had transferred 100 seriously injured patients to hastily-erected hospital field tents, each one with different manufacturers' instructions!"* *"In addition to the heavy clinical duties under suboptimal conditions and resources, teams had no preparedness training, little rest and were working under ad-hoc arrangements. Disagreements regarding the protocols for clinical management, quality of care and level of expertise inevitably emerged, adding to the pressures."*

Suboptimal relief response	*"During our first day in the disaster zone (Day 4 post-earthquake) we visited several relief medical facilities, and our rapid health and medical need assessment revealed no apparent lack of medical supplies. However it appeared that the effectiveness of the medical response was impaired by suboptimal organizational arrangements of the medical facilities... "*
Human resources issues	*"Its workforce was composed of both local and out of province volunteer doctors, none with previous experience of disaster response or preparedness training. Overwhelmed and working with limited resources, the existing team quickly incorporated us into the medical relief operations and we soon found ourselves at the front line of care, receiving the patients, assessing their injuries and also their general medical conditions."* *".....mismatch of clinical specialties and the general lack of skill mix in the field relief teams. In some sites, although the patient to doctor ratio was 1:3, 80% were orthopedic surgeons and there were too few anesthesiologists to assist operations and manage pain control. In many sites there were insufficient generalist physicians to manage underlying common chronic medical conditions[4] land there were no mental health specialists around to deal with post-disaster psychological needs during the 1st week. A patient entering trauma surgery might have no pre-operative assessment and of poor management of underlying unstable chronic medical conditions. The lack of multidisciplinary teams or a more holistic approach meant that some survivors who had no immediate surgical needs but who had potentially life-threatening medical conditions (e.g. unstable arrthymias or hypertension) were not always optimally managed despite the availability of drugs and resources."*
Suboptimal facilities and IDP camps	*"By that evening, we arrived at one of the 6 airlift triage sites, Guanghan San Shiu Triage Referral Hospital (SSTTRH), which had been receiving patients evacuated by helicopter from the areas suffering from greatest devastation: Wenchuan, Ching Ping, Mengzhu, Beichuan and ShiFang. The site was originally a modern maternal child health centre and had been turned into a triage site on post quake Day 2."* *"One month after the earthquake Dr. Chok Wan Chan, the President of International Pediatric Association visited medical facilities specifically for child survivors in the affected area. On his return he commented: "Children are housed in temporary tents where daytime temperatures can reach up to 40 degrees Celsius."*
Unmet needs: Child protection	*"Although their health conditions are stable, most of them are very frightened and many left with disabilities. In addition to their mental health, the well-being and protection of these orphaned children needs to be highlighted". Indeed, the media reports a police crack down on infant traffickers who prey upon lost children and orphans in hospitals."*

Forgotten health needs: Older people	*"Whilst the official total mortality has not yet been released, the media has tended to report mortality amongst young people in the collapsed schools. However, the greatest morbidity will probably be amongst those over 60 who lived in low-density houses which collapsed. Despite the pre airlift military triage which prioritized those with the highest chance of survival, the median age of our patients was 79 years old. Similar age patterns were observed in other government and civilian relief sites with 40% of patients above 60 years old[5]. In addition, for infection control, whilst no major outbreak of tetanus has been reported in Sichuan it is inevitably a risk, and our survey[5] found 78% of the population >60 were unimmunized."*
Forgotten health needs: Mental health	*" Typically, patients first arrived with excessive eagerness to tell us how they survived through the ordeal but as they settled after a few hours, their emotional liability was obvious, ranging from abnormal positivity towards their post-quake rehabilitation to uncontrollable crying and even attempted suicide. The lack of experience and training in mental health needs perhaps limited patient care and sensitivity in this phase of the emergency response. The imbalance of the doctor:patient relationship in rural China ,where doctors are credited with powerful professional status, perhaps contributed to a lack of sensitivity to patients' psychological needs."*
Forgotten health care needs of relief workers	*"And in addition to physical needs the mental health needs post disaster will need support –not only for survivors but for those involved in the relief process, including healthcare workers themselves."* *" but the healthcare staff themselves also had their own needs. Chronically fatigued and emotionally disturbed by the traumas they had witnessed our role as more experienced disaster relief workers included providing support to our local medical team members."* *" The team spirit helped alleviate the discomforts of our shared makeshift home, where regardless of rank or gender, we slept in the open air on the streets, next to the tents where our patients were crammed together. When it rained we created make shift shelters using thin plastic sheeting which kept us partially dry but offered little protection from the cold when the ambient temperature fell to under 10 degrees Celsius. The sound of falling cement, the movements of aftershocks and patients moaning made an unlikely lullaby."*
Post disaster issues	
Post disaster cost and logistics of treatment	*"Survivors expressed their concerns about medical costs and the associated treatments. Specifically, almost 10% of the most severely injured patients were sent out of province for treatment and it was not clear how those transferred out-of-province patients might be able to pay for their daily living maintenance, post surgical rehabilitation and the return expenses in order to make their way back to Sichuan after a perhaps prolonged stay of their treatment."*

Needs and entitlement of access to post disaster care for migrants workers	*"Migrant workers among the internal displaced people (IDPS) may also face lack of entitlement to free post-disaster medical services. In the immediate post disaster period, the government has been providing free access to services and entitlements to assist regardless of place of origin or status (houkou, which is important in the Chinese System regarding access and entitlement to services). Yet migrant workers, who composed 15% of the population of the affected area, tend to be from the lowest socio-economic strata[19] and may face uncertainty for entitlement to health services once the immediate emergency relief is over."*
Issues with Long term rehabilitation	*"In addition to the challenge of rebuilding their socioeconomic support systems they face not only the typical post earthquake needs related to orthopedic trauma, but the continuing needs of support for the clinical management of their complex chronic conditions. The issues about payment for such conditions within a health system recently reorganized to provide some but not all medical health care costs can potentially increase the stress and anxiety of survivors as they struggle to rebuild their lives and for whom additional medical costs will pose substantial financial burdens caring for their families if not for themselves."* *The left behind elderly in rural Sichuan will be heavily dependent on the post-disaster reconstruction programme which will have major implications for their future.*

**Details of findings in this section can be found in the Appendix in the paper by Chan E YY entitled "The untold stories of Sichuan Earthquake" Lancet. Vol 372 359-362 No 9636, 2 August 2008*

Medical related issues post emergency

Reflecting on the experience several lessons emerge. The rapid and effective response by the government should be commended but preparedness was minimal, even though Sichuan is known to be at risk of earthquakes and suffered a major quake with human mortality in 1981(Jhung et al., 2007). The patterns of morbidity revealed a large burden had fallen on older people whose chronic long term conditions required additional care over and above the disaster response. Their rehabilitation will pose particular challenges not least how their care will be paid for.

In addition to patient subgroups such as old people, orphans (both young and old), people with chronic disease, mental health needs and staff training to manage chronic diseases are all important gaps identified. As the acute phase of disaster relief comes to an end, the challenge of long term policy and planning for rehabilitation services for populations with long-term disabilities becomes an additional need. Earthquakes are known to cause comparatively high mortality but low morbidity (Hu, 2006). Injury patterns reported (Alexander, 1996) in Sichuan appear to be similar to other earthquakes and survivors who are left with permanent disabilities may face challenges in physical recovery as well as having psychological needs.

Concerns for older people run in parallel. Primary health care facilities with an understanding of geriatric services will be needed to bridge the service gaps and prevent complications which could arise from a lack of medical treatment for their often multiple chronic diseases.

Chapter 8 Discussion

This chapter is organized in three main sections. **Section I** provides a general discussion of the result findings. **Section II** examines how these result findings may address the six research questions. **Section III** discusses the study limitations.

Section I: General discussion of results findings

Overall, study findings indicated that major gaps in health and medical services for people with chronic diseases and of older age were found for all the phases of disaster and across different types of post disaster settlements in middle income countries post millennium. In most of the presented studies, the studied service provision site was the only clinical service available in the area post disaster. Whilst treatment for acute conditions (eg. injury and infection) might be available, basic patient anthropometric data (such as body mass index, BMI & blood pressure, BP), diagnosis equipments and medication for chronic conditions such as diabetic mellitus and hypertension were not available.

The study of acute relief health needs in the 2008 Sichuan earthquake showed that more than 70% of earthquake survivors had some form of management to their underlying chronic conditions during the emergency phase. In the post-acute emergency phase of the remote disaster affected area of Kashmir Pakistan, 42% case load in the stationary mountain relief clinic were related to chronic conditions. The implications of non-treatment for chronic disease might lead to disabilities as a result of avoidable complications (e.g. diabetic retinopathy, stroke) and would hamper the

quality of life for patients and potentially livelihood for some households. During the field research investigation in Kashmir Pakistan, on-site physical examination of patients in the mountain relief clinic found 38% of the clnical attendees have at least one type of underlying chronic condition. Whilst hypertension, the most common non-communicable chronic medical conditions in Pakistan (Pakistan federal bureau of statistics, 2005), constituted to be the most important chronic disease burden in the earthquake affected community, the thesis study also found diabetes mellitus (22%) to be the most likely under-diagnosed and sub-optimally managed condition among chronic diseases. As poor clinical management of diabetes mellitus predisposes patient to poor wound healing, unfavorable surgical outcomes and secondary infections which might only be treated through 2nd and 3rd line antibiotics, this potential adverse health outcome implications for ignoring diagnosis and treatment of diabetes mellitus in disaster medical response in these settings should be highlighted.

Of note, in addition to the lack of awareness & sensitivity of disaster service providers, provision of chronic disease service to the disaster affected non-injured population who has underlying chronic disease might also be disrupted as a consequence of injury and death of medical personnel, destruction of drugs and health care structure during the disaster.

Overall, the burden of chronic conditions in all Kashmir Pakistan studies was likely to be underestimated as there was a systematic absence of documentation of common chronic diseases in clinical records in most sites. Specifically, retrospective records showed that only acute medical complaints were managed in these clinics and there was little or no record of common cardiovascular conditions (e.g. hypertension,

strokes, or diabetes mellitus) or nutritional status of the older age groups in either the mountain clinics or the IDP camps clinics. The study of why chronic health needs and older age group were forgotten by medical providers found there was a general lack of sensitivity, technical capacity, resources and guidelines towards the management of chronic and older people health needs among relief and health workers in post disaster settings. The decision on whether chronic disease service should be offer during disaster relief was reported also to be complicated by the lack of know-how, program development guidelines and ethical dimension of the possibility of lack of continuity of treatment program in locations where pre-disaster medical treatment for chronic disease was limited or non-existent.

The next section will discuss the study findings according to the research questions highlight in Chapter 5.

Section II: How the study result findings may address the six research questions

1. What types of patients were likely present to medical relief clinics during various stages of response to Asian earthquakes?

Types of patients: Overall, although the findings of thesis related studies indicated that health needs varied by age, gender, disease types and post disaster clinical service delivery settings, older people and population with chronic diseases were most likely to present at the medical relief clinics. These findings in China and Pakistan echoed reports of patient profiles and disease patterns in high income countries such as US (Corinne et al., 2001) and Japan (Wisner, 1998). The most vulnerable population

subgroups were found in remote rural settings and the smallest rural unofficial self-settled camps.

Stages of disaster: With the exception of remote clinical settings served by helicopter where acute trauma care needs remained significant four months post earthquake, the thesis related studies all indicated that the demand of clinical service by people of older age and patients with chronic disease were the predominant health need found for all stages of post disaster medical responses.

2. What were the characteristics and utilization differences of medical service users in different clinic care settings: urban versus rural clinics; official versus unofficial internal displaced camps; stationary versus mobile clinics?

Urban versus rural Health profile, access to health care, service availability and prevalence of non-communicable disease were found to be different when comparing between urban and rural settings. In rural setting, older people had taken up 14% of services utilization and more men used the clincs than women (gender ratio: 7:3). For the urban IDP clinic, older people constituted to 26% of clinic attendees. Contrarily to the rural clinics, more women used the clinical service than men (gender ratio: 4:3).

Official versus unofficial displaced camps Overall, significant differences in settler's demographic characteristics and health outcomes were found according to the size of various IDP camps four months post earthquake. Findings revealed vulnerability in terms of extreme of age, access to service, access barriers to assistance, information, medication, and various health outcomes are inversely related to the size of the internal displaced camp post natural disaster. The most vulnerable population subgroups were found in the smallest rural unofficial self-settled camps. Issues related to disparities in

overall health outcomes, access to assistance, lack of information, limited contact to family and friends, and lack of access to chronic disease medications were identified.

Stationary versus mobile clinic Findings indicated a different disease profile in users of the mobile clinics when compared with stationary clinics during post acute emergency phase in natural disasters. 44% of stationary clinic users were at extreme of ages when compared with 32% of that at the mobile clinic. Whilst patients with respiratory diseases consisted of 20-22% of recorded diagnosis in the study clinics, more people with chronic conditions were presented in the stationary clinics than at the mobile clinic. Of note, descriptive results indicated that helicopter based mobile clinic, earthquake related trauma management remained as the majority cause of clinical visits (approximately 50–75%) four months post earthquake.

3. What were the main health needs of disaster affected population in various types of settlements?

The greatest gap in health services at all sites was the lack of non-communicable disease management. Due to various policy and logistic reasons, major relief groups have frequently focused their relief efforts on official camps (Lilly, 2006). Furthermore, disaster affected populations in the small unofficial relief camps are frequently not eligible for official assistance. These marginalized groups are often left to fend for their own relief resources and health assistance. The study has identified that residents in the smallest unofficial camps are four times as unlikely to obtain chronic medication to manage their underlying chronic medical illness four months post earthquake when compared with their counterparts living in official camps.

Given the demographic characteristics, limited access to assistance, chronic medical conditions, the lack of information in smaller unofficial IDP camps, disaster response efforts which aim to target vulnerable populations should include service modalities (e.g. health information dissemination and outreach clinics) that may cater the health needs of population in these smaller unofficial self-settled camps.

4. Did chronic medical conditions constitute an important clinical burden post earthquake?

The findings of the health needs assessment during the acute relief phase of the Sichuan earthquake in May 2008 indicated that non-communicable diseases constituted 77% of immediate health needs post earthquake which is much higher than reported national non-communicable disease burden 48.6% in 2008 (Chinese MOH, 2008). Specifically, 38% of survivors required clinical management of their pre-existing chronic medical conditions before further surgical interventions could be performed for their physical trauma.

In Pakistan, where studies were done in a later stage of earthquake response, the greatest gap in health services at all sites was the lack of non-communicable disease management and gender issues associated with service availability. The IDP findings of the self-reported health surveys (Chan & Kim, 2009) illustrated that 25-38% of the respondents were aware of the existence of at least one unmanaged, underlying medical problem. The three-day on-site physical examination in the mountainous clinic further confirmed this finding by revealing that 38% of the examined patients (31 out of 85 patients) had at least one type of underlying chronic condition.

Furthermore, the most common under-diagnosed or managed chronic condition found during on-site physical examination was diabetes mellitus (22%).

Overall, the NCD pattern found in the China study was comparable to the chronic disease patterns as reported in other post disaster related health care utilization studies (43-79%) in post 2005 Indian Ocean Tsunami (Guha-Sapir et al, 2007), El Salvador earthquake (Woersching & Synder, 2003; Woersching & Synder, 2004a; Woersching & Synder, 2004b), and other relief service delivery settings in Kashmir earthquake related studies (Miller & Arquilla, 2008). On the other hand, there appeared to be an under-reporting of chronic disease health needs in the Pakistan study series of this thesis. Possible explanations for such discrepancies may be due to the lack of awareness of clear protocols for documentation.

5. Why were the needs of disaster-affected-populations of older age and with chronic medical conditions forgotten by health care providers?

Important issues identified while studying why needs were forgotten by medical providers include the need to sensitize and to train relief and health workers about health and medical needs of people with chronic conditions and of older age groups post disaster. The development of operational guidelines towards geriatric and chronic disease patient groups, relevant need assessments protocol, clinical management guidelines of chronic disease in disaster settings, field based diagnosis equipments and staff training programs for chronic disease management post disaster in developing countries will be essential to address current gaps needs. In order to address effectively the medical and health vulnerability of people with chronic conditions and older age, it is important for governments, medical relief agencies and

local partners to include all the issue described above in their relief operation mandate, policy planning and evaluation.

6. What are the emergency preparedness implications for doctors and medical relief workers regarding chronic disease management and older people?

In order to effectively address needs during the "emergency phase" of natural disasters, preparedness and planning are essential. As illustrated in the findings, there could be a wide range of challenges for managing chronic disease patients in developing countries. Patients might be unaware of their clinical condition, there might be issues with care and medication, patient might have lost their medications during evacuation, or patients might lack preparedness by not stocking up medications for disasters/events. Specifically, in China (Chan, 2008) the lack of possession of chronic disease medication and limited coverage of tetanus vaccinations indicate that emergency preparedness was limited in the study population. Of note, there might also be patients that are not directly affected by the disaster but were indirectly affected because of the collapse of the medical service provision infrastructure and the death of medical staff.

With the aging population and change in epidemiological disease profile of low and middle income countries, the burden of chronic disease has become a major health need post disaster. To improve disaster preparedness, patients should be advised to stock up on necessary chronic disease medication in the event of an emergency to avoid preventable clinical complications. In addition, for effective response, allied medical workers (such as dietitian and physiotherapist) should be included in disaster

response as they enhance the recovery potential of patients (Guha-Sapir & Carballo, 2000).

The IDP camp study (Chan & Kim., 2009) is the first study to examine unofficial IDP camps, population characteristics and health needs profile post natural disaster. Recent studies conducted in post conflict settings (Wantanabe et al., 2007; Roberts et al., 2008 a & b; Kim et al., 2009) have highlighted that populations in official IDP camps post-conflict were susceptible to infectious diseases (Wantanabe et al., 2007; Kim et al., 2009). Physical and mental health status were also found to be associated with deprivation of basic goods and services, traumatic events, and fear and uncertainty amongst displaced and crisis affected populations (Roberts et al, 2008a; Robert et al, 2008b). Due to the different context between natural disasters and conflict settings, more research should be conducted in post natural disaster settings to enhance the understanding of health needs in these unofficial vulnerable population subgroups.

For organizations or agencies who desire to effectively address the medical and health needs in remote areas should consider providing mobile clinics service in remote settings. As indicated with the findings, mobile clinical services which operate during post acute emergency phase of natural disaster in remote areas should aim to be gender sensitive and staffed with highly trained and experienced staff to provide trauma orthopedic and wound care.

Of note, whilst mobile services might be an effective initiative to improve emergency medical and health service access to disaster affected population, it is important to highlight the limitations related to the use of mobile health units in emergency

operations (Du Mortier & Corninx, 2007). Similar to using mobile clinics in conflict zones, mobile services post natural disaster in remote areas are generally expensive to run and require extensive logistic operation support such as helicopter, medication and equipment supply chains. In addition, in order to be effective, mobile clinics should be able to send patients to a referral facility and to carry out medical evacuations if necessary. Thus mobile clinical service providers should be specifically trained and experienced health and clinical staff as they are gate-keepers to expensive patient transfer procedures and specialized services. In addition, before such services were commissioned, it would be important to pre-assess the disease pattern in the served areas and prioritize services.

The findings coincided with a previous study of Hurricane Katrina in New Orleans, USA (Krol et al., 2007). Commonly encountered diseases reported by operating mobile medical units in underserved populations of the affected areas during the post rescue phase of Hurricane Katrina included respiratory illnesses, skin conditions, and minor injuries. A high proportion of visits were recorded for vaccine administration and chronic medical problems including hypertension, diabetes, and asthma. The thesis study on mobile service users post earthquake in remote Pakistan (Chan & Kim, 2009) suggested that in addition to acute and chronic medical needs, trauma orthopedic and wound care remain as important health needs in areas served by mobile clinics which presumably were more remote and secluded. In addition to trauma care, the user demographic pattern findings also implied that if mobile clinical services were to be offered in remote areas, gender sensitive services should be organized in traditional and conservative rural areas where older females might be the predominant population.

Study results also indicated a lack of gender concern for organizing health services post disaster which rendered access barriers for older traditional women from receiving medical services and older men from access to psychological services. Future post earthquake medical relief operations should evaluate health needs with additional gender-based service need and provision analysis and should consider delivery of gender sensitive medical assistance in remote, conservative communities.

Whilst most relief healthcare settings had the necessary drug procurement for basic treatment of common chronic medical problems (e.g. diabetes mellitus or hypertension), the lack of awareness of underlying medical problems and the absence of technical expertise had contributed to a general reluctance to manage non-acute conditions post disaster in developing county settings (Chan, 2009).

Lack of management of chronic conditions may affect wound healing, hemo-dynamic suitability for surgery and long term complications. A clinical service utilization study in Banda ACEH in Indonesia showed that chronic disease medical needs (Guha-Sapir et al., 2007) made up of 43.5% of all medical service needs one month post disaster.

Section III: Study Limitations

There were a number of study limitations. There will be discussed according to disaster contextual issues, access to the study population, selection bias, information bias, recall bias and other study design related issues.

Disaster contextual issues

The main limitations for this study series, as for all other natural disaster health related studies in developing countries, are the extremely unstable environmental context, mobility of population and fluidity of health relief services post disaster. These disaster contextual circumstances have often rendered data collection with standard research methodologies challenging. For instance, in Pakistan, the field studies were affected by difficult high mountain terrain, weather uncertainty, constant landslides and the unstable political climate with major demonstrations protesting against the Danish cartoon incident that was taking place across the Muslim world during the study period. There were several occasions when the assessment team encountered the potential security risks of inciting sentiments with the sight of foreigners inside a motor vehicle. In China, during the acute phase, there were safety concerns with the frequent aftershocks and the risk of secondary disasters such as landslides and floods.

Selection bias and access to the study population

Access to the study population was subject to difficult terrain, weather uncertainty and constant environmental risks such as landslides. All the thesis related studies only captured survivor data and did not include fatalities or information related to victims' causes of death. To understand survivor characteristics, these studies also suffer from selection bias as the true incidence rates could not be obtained for this study as local surveillance systems were unable to capture the high-level of population movement immediately after the earthquake.

In China, the study was done at a triage helicopter based clinic. Whilst patients were flown in directly from the disaster zone immediately after rescue, the selection criteria of patients evacuated by the army from ground zero might affected the types of patients arrived at the study site.

In Pakistan, with the time constraints, vast geographic distance and cultural concerns of venturing into home settings in remote mountains communities, only clinic attendance and on-site survey was used as a proxy for expressed health needs in various settings. Yet, these study designs suffers from selection bias and captures no information for understanding the experiences of the most vulnerable post acute phase of disaster –those who cannot attend clinic due to immobility, old age and distance despite health needs (Davis, 1996). In addition, whilst local counterparts attempted to inform potential attendees about clinic dates and location, the helicopter service was irregular and limited by weather conditions. It is uncertain how information dissemination of the timing of mobile clinic availability and site selection for mobile clinic might affect access. Furthermore, in the remote clinic study, even though user comparisons were made during the same study period and these clinical services had no service provision competitors, the stationary clinical service was made available five weeks post earthquake and the helicopter mobile unit was only available after eight weeks because of concerns over access and well-being of patients in the secluded area. It was unclear how this may affect attendance and user characteristics.

Information bias

Information bias might stem from clinical diagnostic inaccuracy that may be due to limited clinical expertise, lack of relevant diagnostic equipments (e.g. blood glucose monitoring), potential equipment instability (subzero temperatures) and unawareness of the importance of good audit data collecting and record keeping of medical information.

As there are neither published reports nor explicit triage criteria for the acute rescue phase operations, inconsistencies may have affected the health and disease profile of disaster survivors. However, the study attempted to provide the best available evidence to describe patterns of disease and health needs immediately post disaster. Of note, the template-based study design offered an unobtrusive opportunity to obtain relevant information. Not only did this provide data for further research analysis, it assisted relief operations in providing evidence of real time program planning support. For instance, the original operation mandate did not include chronic disease management in the relief site. Nevertheless, with the available data, the evidence helped to re-prioritize needs, make medical assessments, and distribute related treatments.

Recall bias

For the study conducted during the later stages of disaster i.e. four months post Pakistan earthquake, respondents may suffer from potential recall bias especially when enquiries were related to acute post-disaster experiences.

Issues with cross-sectional study design

It is also uncertain how a cross-sectional study may capture the rapid dynamic nature of population movement and service provision post disaster. On the other hand, there were limited opportunities to follow up the internal displaced population in both earthquakes as disaster affected population are extremely mobile in Pakistan and the non-standardized patient re-deployment policies in China had rendered follow up impossible.

Generalizability

There are also a number of issues with the generalizability due to small sample sizes and lack of baseline comparison. Similar challenges were reported in other post-disaster epidemiological studies of internal displaced population during the emergency phase in China (Sapir & Panaccione, 2007), South East Asian Tsunami (Guha-Sapir et al., 2007) and Pakistan Kashmir earthquakes (Chan & Gainey, 2006).

Other research issues

There is a general lack of comparable research in related settings and contexts. For example, there are no research studies for related emergency clinical service, small unofficial IDP settings post natural disasters (Lilly, 2006) and most existing studies are in Africa that focus on official IDP camps (CDC, 2005; Merlin, 2005; Lee et al., 2005; Watanabe et al., 2007) or in post-conflict settings (Leus, 2001; IDMC, 2007; Roberts et al., 2008 & 2009; IDMC, 2009; Kim et al., 2009). Further studies are needed to obtain greater understanding of small unofficial IDP camp experiences as to better formulate potential interventions that address their heath needs and vulnerabilities post crisis.

Chapter 9 Medical relief response policy and future research implications

Chapter 9 presents the implications of thesis study findings on medical and public health relief response and policy in natural disasters. The burden of chronic diseases and natural disasters in middle income developing countries, impact of demographic and epidemiological transition in medical disaster relief, gaps in current disaster relief response, challenges for policy makers, suggested ways forward and a proposed health delivery model for chronic disease post natural disaster in developing countries will be examined. Future research directions in disaster public health and medicine will also be discussed.

Burden of chronic diseases and natural disasters in middle income developing countries

Global aging of the population is occurring in this century (WHO, 2005; Beaglehole, 2008). Researchers suggested 80% of US older adults have at least one chronic condition and many also have some level of disability (Aldrich & Benson., 2008). As illustrated by the thesis studies, for the 21st Century, with the global population aging and the increasing burden of non-communicable, chronic diseases, there is a need to rethink how to provide post natural disaster medical and health care needs (Ford et al., 2005; Chan, 2008; Chan & Griffiths, 2009; Chan & Kim, 2010a & b). Specifically, as pointed out by Wells (2005), post emergency needs of older people in disasters and crises are overwhelming because as a subgroup, they have higher likelihood of socio-economic vulnerability and suffering from underlying chronic medical conditions.

Table 9.1 highlights the burden of chronic disease in selected countries that are frequently affected by natural disasters. For the first decade post millennium, four out of five of the world's most populous countries (China, India, Indonesia and Pakistan) are disaster prone, middle income developing countries in Asia. These countries have entered into demographic and epidemiologic transition and their health needs have changed according. Not only are they experiencing population aging, health care systems of these countries are often faced with the need to manage and cater for populations that are facing a double-disease burden for both infectious diseases and chronic illnesses.

Table 9.1 Burden of chronic disease and natural disasters in selected middle income countries (2000–2008)

Country	Total number of natural disasters 2000–2008	% deaths by chronic disease caused in the country					% chronic disease deaths (among total reported deaths)
		Cardiovascular disease	Cancer	Chronic respiratory disease	Other chronic diseases	Diabetes Mellitus	
China *	235	33	20	17	8	1	79
India *	160	28	8	7	8	2	53
Indonesia*	133	28	12	7	11	3	61
Pakistan**	61	22	6	5	8	1	42

Sources WHO, Preventing Chronic Disease A Vital Investment. World Health Organization Global Report, 2005. http : www who int chp chronic_disease_report en . Centre of Research on Epidemiology of Disaster (EMDAT). http . www unisdr org disaster-statistics pdf isdr-disaster-statistics-50top-countries pdf and http www emdat be Database Trends trends html Table adapted from Chan, E Y Y . & Sondorp. E (2008) Including chronic disease care in emergency responses Practice and Policy Notes Humanitarian Exchange Magazine Issue 41 December 2008 pg 43–45 Humanitarian Practice Network URL http . www odihpn org report asp?id=2976

** As projected in 2005 ** As projected in 2002*

Impact of demographic and epidemiological transition in medical disaster relief

Despite the changes in underlying health and medical needs in these communities, international post disaster medical humanitarian aid practices and policies are built upon assumptions that are based on conflict settings a couple decades ago (Chan & Sondorp, 2007; Spiegel et al., 2010b). For post natural disaster relief, the provision of emergency and disaster health care has traditionally been emphasized on the treatment of acute and communicable clinical conditions. In recent years, whilst psychosocial and mental health services have received more attention post disaster, the burden of aging populations and increases in both chronic communicable and non-communicable diseases are often forgotten (Chan & Sondorp., 2007).

There are many ways which disasters might affect populations with chronic conditions. The absence or disruption of treatment for chronic diseases like high blood pressure, diabetes mellitus, mental illness and HIV/AIDS post natural disaster is not only life-threatening for vulnerable groups, but may also give rise to complications (e.g. diabetes retinopathy, stroke) resulting in a reduction in quality of life and potentially impaired livelihoods, due to the costs of complicated treatments and avoidable deaths. **Table 9.2** provides some key mechanisms to how population with chronic conditions might be affected during disasters.

Table 9.2 Some key mechanisms and possible outcomes of how disaster may affect populations with chronic disease.

Mechanisms	Possible Outcomes
Communicable Conditions	
Discontinuation of drug intake (e.g. TB)	Failure of treatment compliance. Increase risk of multidrug-resistance TB strains to the community
AIDS (Population need may have existed before or the occurrence of the natural disaster, but the needs have not been met, (Spiegel, 2004))	Increase incidence and vulnerability of transmission
Pre-existing structure/availability of resources and capacity	Prioritization of other medical conditions for treatment
Invitation of the local authorities	Political pressure from the authorities not to tackle the issue
Non-communicable conditions	
Direct impact through disaster induced-stress. e.g. Cardiovascular disease. (Kario et al., 2003)	Increase incidence and prevalence of stress-induced manifestation and complications of chronic conditions.
Interruption of health services	Higher risk of disease complications
Inappropriate diet and lifestyle post disaster: Health of patients who have underlying chronic conditions often are sensitive to changes in lifestyle and diet (Kirizuka et al., 1997)	Increase risk of manifestation and complications of chronic medical conditions.
Complication from diabetes and other chronic conditions: Unable to conduct operations	Affected disease prognosis and survival
Lack of information on patient's medical history, loss of medical record	Unaware of potential complications and problems. Issues with resources allocation (drug and treatment planning)
Unstable NCD status increases the risk of medical treatment on injuries	Affected disease prognosis and survival
Local willingness to accept technical transfer (of knowledge and know-how)	Lack of competency and platform of knowledge transfer

Gaps in current disaster relief response

Typical natural disaster emergency health responses would include emergency treatment for injuries, basic care for communicable diseases such as diarrhea and respiratory infections, surveillance and emergency preparedness for disease outbreaks, nutritional support, water and sanitation (Landesman, 2001; SPHERE, 2004). The management of non-communicable chronic disease has been forgotten or usually left out (Chan & Sondorp, 2007). As of 2010, with the exception of the SPHERE standard (SPHERE, 2004), there are virtually no international guidelines for the management of chronic medical conditions after natural disasters (Wells, 2005; HAI, 2005).

The SPHERE project was an initiative started by a group of humanitarian NGOs and the Red Cross and Red Crescent Movement following the humanitarian crisis in Rwanda in 1994 (SPHERE, 2004). It serves as the minimum standard for relief actions of humanitarian agencies. Whilst the 2004 version of the guideline includes a section on non-communicable diseases under health services, only one page was dedicated on the management of chronic diseases and recommended that only life-saving therapy should be given post disaster for patients with chronic conditions (The SPHERE Project, 2004). There is no discussion in terms of priority for clinical management, monitoring indicators or guidelines on chronic disease treatments to be adopted in emergency settings.

As indicated by the thesis study results, the key gap at the field response level seems to be the lack of operational mandate, lack of resource, limited awareness and technical know-how among relief agencies and health workers on the management of chronic diseases

during emergency relief operations. In general, although most frontline practitioners agree that life-saving treatment should be given, it is unclear whether regular treatment should be offered in locations where pre-disaster medical treatment for chronic disease is limited or non-existent.

Challenges for policy makers: To act or not to act

Whilst there are many issues that complicate the decision on whether chronic disease service should be offered during disaster relief. In the decades to come, non-communicable chronic medical conditions will become too significant a burden to ignore during emergency medical field operations. Although it is important that emergency medical missions do not substitute for local systems and issues of sustainability of treatment should be carefully assessed, refusing to manage chronic medical conditions during emergency operations may result in the very mortality and morbidity which the relief operation intends to minimize.

For example, in acute trauma care, even when surgeons and appropriate equipment and drug supplies were available, many older patients with orthopedic trauma were not surgically treated because of their poor underlying clinical condition (for instance unstable glucose control for diabetes) which might affect potential surgical outcomes and survival. In addition, after the initial acute phase, patient profiles change as there are increasing number of patients seeking care for non-disaster related health needs, such as unstable hypertension and minor stroke as a result of a lack of medication. After the Sichuan earthquake in May 2008, frontline medical teams found that up to 38% of survivors needed clinical management of their pre-existing chronic medical conditions

before further surgical interventions could be performed for their physical trauma. In addition, more than 70% of the earthquake survivors had management needs for their underlying chronic conditions during the emergency phase.

Meanwhile, there are a number of questions that need to be considered by responders when deciding if they were to provide medical services for chronic diseases in developing countries during medical relief after natural disasters. **Table 9.3** outlines some of these decision making issues.

Table 9.3 Issues to consider when providing non-communicable disease services

To act	Not to act
Affected population	
Population need	Local population resistance due to different cultural understanding of the problem
Demand from recipient population	Competition (local physicians' financial incentive is being threatened)
Pre-existing structure/availability of resources and capacity	Prioritization of other medical conditions for treatment
Invitation of the local authorities	Political pressure from the authorities not to tackle the issue
Capacity of relief agencies versus local capacity	
Resources (medication, human resources, equipment)	Competing medical priorities
Operational mandate	Lack of operational mandate for health-related issues
Humanitarian imperative (emergency/lifesaving for patients)	Lack of technical capacity/competency
Technical challenges	
Technical capacity	Lack of training and accreditation of qualification
Treatment standard/best practices guidelines	Lack of field relevant guidelines/standards/protocols
Sustainability/continuity because of available local partnership	Unwillingness or lack of cooperation from stakeholders
Willingness to accept technical transfer (of knowledge and know-how)	Concern for management continuity and sustainability

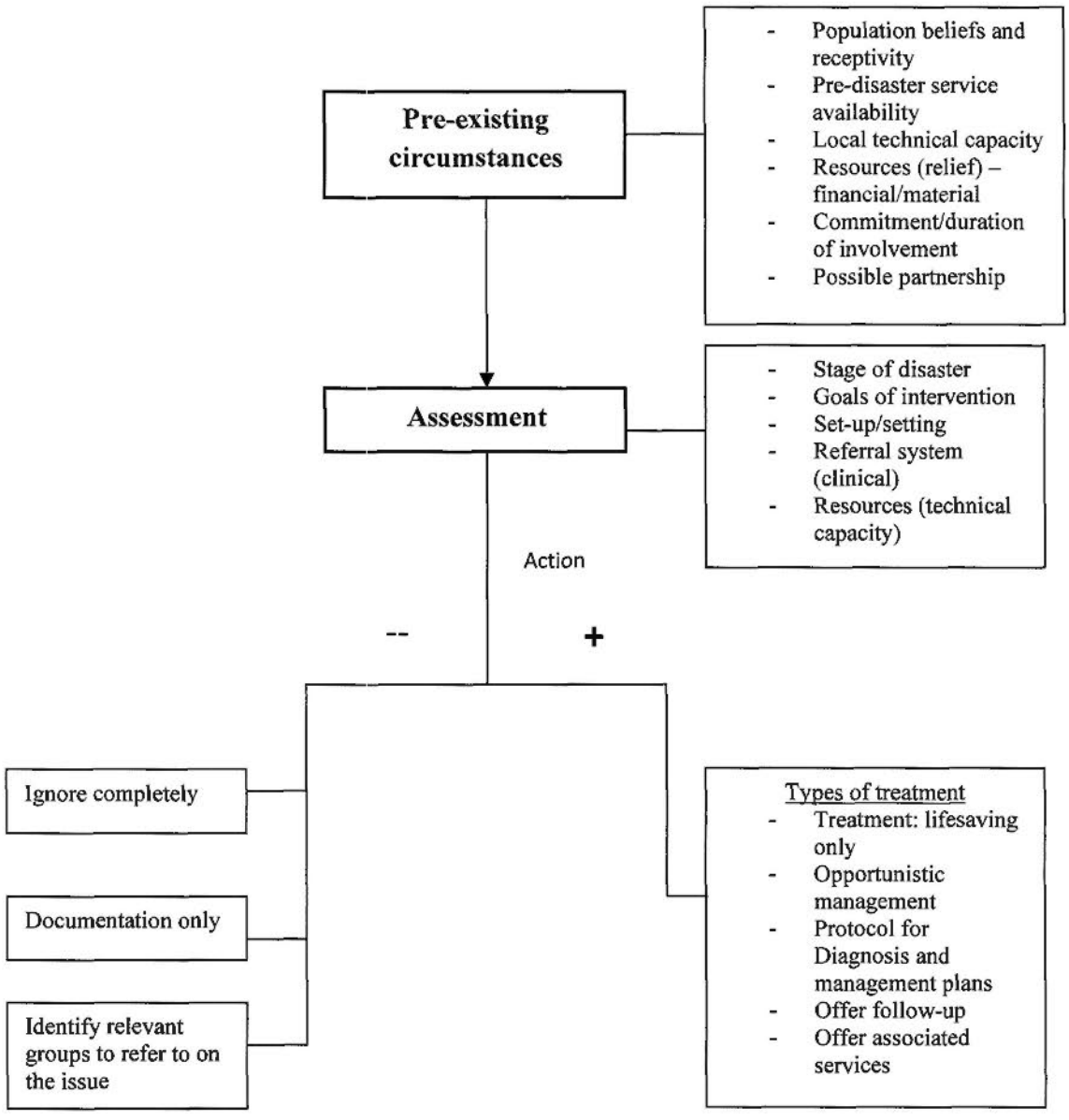
Abstract from Chan, E. Y.Y., & Sondorp, E. (2008). Including chronic disease care in emergency responses. Practice and Policy Notes. Humanitarian Exchange Magazine, Issue 41 December 2008 pg 45-48. Humanitarian Practice Network.

In order to effectively address the vulnerability of older people and the health needs of population with chronic diseases, it is important for governments, medical relief agencies and local partners to include and address these issues during their relief operation and policy planning. Important issues identified when studying why older people and chronic medical needs were forgotten by medical providers included the need to sensitize relief and health workers about older peoples' health needs post disaster, the provision and accreditation of field relevant technical training, the development of field based clinical guidelines for chronic disease and geriatric disease management post disaster in developing countries, and the advocacy of building in geriatric as well as chronic disease specific components in natural disaster medical relief programs.

For large population based, developing, middle income countries in Asia, even with the limitation of underlying information or data, it will be important for emergency health and medical responders to review the demographic and epidemiological profiles of disaster affected populations before deployment, program planning and program implementation.

In areas where pre-disaster health services for chronic conditions do not exist, the major debate regarding chronic disease management in developing countries post disasters is whether medical care should be provided for disaster affected chronically ill people. **Figure 9.1** proposes a conceptual model to examine whether or not to include management of chronic diseases after natural disasters.

Figure 9.1 A proposed conceptual model to guide decision-making on whether or not to provide chronic medical services post-disaster in developing countries



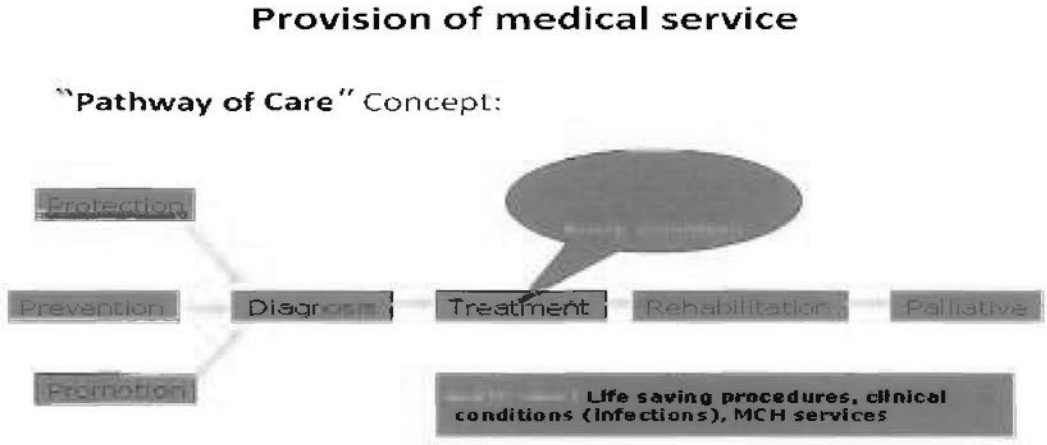
Chan, E.Y.Y., & Sondorp, E. (2008). Including chronic disease care in emergency responses. Humanitarian Exchange Magazine. Issue 41 December 2008 Humanitarian Practice Network. URL: http://www.odihpn.org/report.asp?id=2976

Health delivery model for chronic disease post natural disaster in developing countries

As the health needs of a population with chronic disease vary with clinical presentation, it would be impractical to recommend a homogenous, single solution to address chronic disease health needs after natural disaster. Fundamentally, it is important for responders to understand the pre-existing circumstances in the disaster-affected areas before making decisions. Population beliefs and receptivity, pre-disaster service availability, local technical capacity, resource availability in terms of finances and materials, commitment and duration of involvement of the intervening agency and possible partnerships should all be considered. During the assessment, timing of the intervention (in terms of the stage of the disaster), its goals, where the operations are set up, availability of a referral system and technical capacity of relief agencies have to be examined.

Although health and medical treatments are often perceived as the only cost-effective medical care intervention in disaster relief, according to the pathway of care model (Chapter 2), there is a range of possible health related interventions to be carried out in disaster-affected settings. **Figure 9.2** is a schematic illustration of the pathway of care, which incorporates the idea of the principles of prevention, namely primary prevention, secondary prevention and tertiary care. It illustrates the application of the concept of "pathway of care" for health care management in disaster response. This framework delineates how the various disaster relief programs might be developed according to the seven areas in the pathway of care: prevention, promotion, protection, diagnosis, treatment, rehabilitation and palliative care. It highlights the often missed opportunities for offering interventions to disaster affected population.

Figure 9.2 Application of the concept of "pathway of care" for the management health care in disaster response



Health protection: Provision of more nutritious food aid; Food items suitable for patients on specific diet (e.g. diet for diabetic patients, low-salt diet); Medical kit (pre-disaster) for patients with chronic illness; Issuing medical card with simple NCD record for patients in emergency

Health prevention: Vaccination (for extremes of age); Communicable disease prevention (bed nets in malaria prone area); maintain water and sanitation.

Health Promotion: Health education programs: increasing awareness on NCDs and their prevention Education on the transmission of chronic communicable diseases: TB, HIV

Diagnosis: Simple screening for hypertension and cholesterol level, blood glucose level

Treatment: Medications for chronic diseases, stabilization of patient's condition

Rehabilitation: In large-scale disasters, immediate health needs often strain the provision of healthcare in the already limited health facilities. Focus is usually placed on getting more clinicians to facilitate operations, especially in earthquakes. Many of the patients who have just received treatment or finished operation are forced to leave the health facility, and end up having nowhere to reside and recover. Rehabilitation center is a major need to follow the cases treated in disasters.

Palliative Care: If possible, people should have a place to finish their last stage of life. Having a place to stay and be cared for is not only important for the patient's family, but also crucial out of respect for humanity. Palliative care is often not addressed in the health needs in disasters, which should have been a major burden in disaster.

Figure 9.2 Readapted from Hill & Griffiths, (2007) Public Health and Primary Care.

If health relief programs and activities are built within a primary health service framework provided during disaster relief, they could be low cost and have a profound effect on reducing the impact on long term health of the affected population. Of note, even for populations with no pre-existing or regular access to services for chronic non-communicable disease, low cost, primary prevention programs that target behavior modification such as dietary advice and exercise would be applicable for the benefit of the health of general population in the long run. **Table 9.4** showed some potential low cost activities and programs that might prevent as well as support chronic medical needs of population in developing countries.

Table 9.4 Some potential low cost activities and programs that might prevent as well as support chronic medical needs of population in developing countries

Primary Prevention
Educate the affected population about chronic disease prevention and awareness (e.g. dietary /habit, exercise, smoking cessation, alcohol use, injury prevention)
Secondary Prevention
Identify and assess health risk (cardiovascular risk) during opportunistic consultation
Opportunistic screening of chronic medical condition (hypertension, DM)
Establish patient management plans for chronic medical problems based on local resource availability
Support establishment of chronic medical service through training and coordination
Tertiary Prevention
Educate health care workers to prevent and detect chronic disease complications through training and coordination.
Act as a liaison to support the development of multidisciplinary service among different sectors in to promote communication and partnership.
Establish disease target monitoring according to local service availability
Support development of disease surveillance programs in local setting

Adapted from Chan, E.Y., & Sondorp, E. (2007). Medical interventions following natural disasters: missing out on chronic medical needs. Asia Pacific Journal of Public Health, 19 Spec No:45-51.

Suggested ways forward

Whilst the successful avoidance of epidemics of infectious disease and ability to provision of basics for public health such as clean water and food were commendable in many recent post earthquake health responses (CRED, 2010), the lack of emergency preparedness and training for medical staff to face the upcoming demographic and epidemiological challenges of natural disasters deserve special attention for future policy development.

Health needs assessment and service provision following natural disasters is a specialized discipline which examines and addresses health needs in special austere working context, environment, time and logistic constraints. Specifically, for middle-income developing countries where most of the post-millennium natural disasters happen (CRED, 2010), health care respondents' ability to respond effectively is further curtailed by the limited information available to understand demographic profile and disease pattern in these countries.

In order to design and implement chronic disease preventive based relief program programs, there is an urgent need to develop an emergency health need assessment tool that may collect relevant demographic profiles, health information, knowledge, attitudes and behavior information during needs assessment. In addition, to capture general health profiles and medical need, the proposed health need assessment tool (e.g. in survey format) post natural disaster in middle income developing countries should collect information related to non-communicable medical condition and disease screening tool which identify the potential clinical service needs and resources

requirements to facilitate service development (human resources, medication and related equipments such as glucometers).

When developing such tool, emphasis should be placed in the feasibility of actual field application. For examples, the length of the survey and the type of questions to be asked will have to be field, gender appropriate, cultural and context relevant (e.g. As roads might be blocked and destroyed by landslides post disaster, it might be more appropriate to enquire the time required for a patient to get to the clinic instead of physical distance between residence and health clinic in terms of kilometers for people living in remote, difficult terrain). Assessment training should be provided during the emergency response pre-departure briefing program and accompanied equipments (e.g. Blood pressure monitoring machine, glucometer, weight balance) should be included in the emergency response kit. Organizations and agencies with disaster medical and health responding activities should aim to establish stock pile of essential emergency chronic disease drug list and supplies. Field based clinical guidelines protocols for non-communicable disease management and patient referral protocols should be developed. In addition, human resources development and skill mix consideration of a health responding team (e.g. physiotherapy, eye care etc) should be facilitated to address the multidisciplinary nature for non-communicable disease care.

In general, to facilitate better disaster response and preparedness for medical and health professionals, medical and health care workers should be taught on the disease patterns in both developed and developing countries during their formative academic training years. For support their clinical work in disaster settings, they should be given clinical training and exposure to perform their clinical duties in non-standard

environments. In addition, they should be familiar to disaster training resources (e.g. online resources, major disaster responding agencies, guidelines an protocol) so as to facilitate their life-long learning and emergency knowledge need in this discipline.

It is important to emphasize once again that the management of medical conditions involves a spectrum of services ranging from disease prevention/protection to health promotion, diagnosis, treatment, rehabilitation ('tertiary prevention') and palliative care. One of the key arguments to rebut the ethical dimensions for not providing unsustainable care during disaster in middle/low income developing settings is that even if medical and health relief interventions have no resources or capacity to provide chronic disease treatment, disaster responding organizations and agencies can still empower middle/low income community through non-pharmacological or surgical based programs. Some of such programs are: i) providing health education and promotion information that are relevant to protect patients with knowledge to reduce potential chronic disease complications, ii) identifying referral where relevant services and clinical management support are provided, iii) facilitating referral with good clinical record keeping, as well as, iv) coordinating with other domains of relief services (e.g. food and nutrition based assistance group to provide nutritional appropriate diet for chronic medical disease affected population (e.g. low salt, low sugar diet) to minimize avoidable clinical chronic disease complications. Some of these services, such as health advice, will incur almost no operation cost but have potentially long-term implications for disease prevention. For instance, not only can smoking cessation advice prevent potential adverse clinical outcomes such as heart diseases, stroke and cancer, but health advice may also reduce spending on cigarette consumption.

For medical relief groups and health respondents who might have the technical capacity and resources, they might consider engage in local technical knowledge transfer and community capacity building through training since the beginning of the relief program. It is important to stress that community partnership and collaboration that promotes local ownership might maximize sustainability of clinical follow up programs.

At the very least, even if medical and health relief groups and respondents might be unable to provide chronic disease management or to address geriatric care needs, they should still consider documenting the key chronic disease burdens among the disaster-affected population so as to highlight health gaps to relevant authorities as to be reflected health and medical needs in the post disaster rebuilding phase.

Recommendations for future research

A better understanding of how patterns of injury and illness following earthquakes may be affected by demographic and epidemiological transitions will be useful to support medical and health responses. Future research should focus in four major areas namely: i) clinical research that provides evidence based information for the development of diagnostic and treatment guidelines in field settings, ii) cost-effectiveness analysis on interventions and program effectiveness and sustainability studies in post disaster context in middle income developing settings, iii) human resources training effectiveness studies, & iv) the applications of clinical guidelines in various disaster environments.

1. *Clinical research that provides evidence based information for the development of diagnostic and treatment guidelines in field settings.*

As the context, resource availability and patient profile in post disaster field settings will be different than that of a stable context, clinical research that examines diagnosis criteria and treatment protocol (drug regimen and clinical management) for field based environments of the most common non-communicable diseases in middle-income developing countries,

2. *Cost-effectiveness analysis on interventions, evaluation of program effectiveness and sustainability studies in post disaster context in middle income developing settings.*

Further studies will be necessary to analyze what might be the most cost-effective approach to deliver services that address health needs for population with chronic disease and of older age post disaster. Evaluation of program effectiveness and sustainability studies will be useful to facilitate future decision making in program planning and implementation.

3. *Human resources training effectiveness studies.*

One of the major response limitations in middle-income developing countries is the lack of technical capacity and human resources to management chronic disease and geriatric patient health needs. It will be useful to understand what might be the minimum technical competency for performing effective field medical relief response, how to organize and provide an appropriate pre-departure preparedness training

program for staff as well as the best training modality (e.g. workshop, short course, online training, practice-skill based training etc) for field references and clinical updates of chronic disease and older people health needs management in the disaster settings.

4. Applications of clinical guidelines in various disaster setting environments.

Research in other natural disasters such as tornados in the United States indicated a high proportion of old people among the victims (Legates & Biddle, 1998). It would also be important to examine how epidemiological and demographic transitions may impact human experience in other types of natural disasters such as floods and meteorological disasters. Specifically, with the expected increase in the frequencies of meteorological disasters as a result of climate change and growth of the urban living population globally, it will be important to examine the spatial effect and implications of natural disaster relief in urban, high density environments to understand the human impact and potentially increase the capacity to enhance mitigation.

Conclusion

As pointed out by Stephenson and Dufrane (2002a & b), disasters have long term implications in the affected areas. An effective post disaster relief intervention can save lives and may even answer the population's unmet pre-disaster needs in resource deficit settings. From a public health perspective, resources available during the rehabilitation phase may present an opportunity to reduce future vulnerability and a chance to decrease the global burden of chronic disease through external resources in these communities. Fundamentally, expanding the concept of post disaster medical

intervention to include chronic medical needs throughout stages of disaster planning, response and rehabilitation would be beneficial to these middle income, disaster prone Asian communities.

Chapter 10 Conclusion

Reports and researchers (CRED, 2010; Graham, 2011) have pointed out that natural disasters appear to be on a rising trend again since 1980. Recent natural disasters in El Salvador (2010), Haiti (2009) and Japan (2011) once again remind us that disaster can lead to an enormous human toll.

In the 21st century, public health needs in middle income countries have changed in the context of evolving social structures and population dynamics. These transitions have created unprecedented non-communicable health needs in many developing countries that remain to be met. This study series highlights how patient profiles and health needs post natural disasters may have been affected by epidemiological and demographic transitions. Whilst the findings show that public health and medical care needs vary in time, type and size of temporary settings, populations of older age and chronic medical conditions are the pre-dominant health care need post disaster throughout the disaster response cycle in recent Asian earthquakes in the 21st century. Results indicate that health care needs in large population based, middle income developing post natural disasters are similar to that of their high income developed counterparts.

The non-communicable health needs emerging from these phenomena have not only created an extra dimension of health needs in disasters, but more importantly they have posed major obstacles in the provision of treatment in injuries and conditions resulting from disasters. Unfortunately, clinical provision for chronic diseases is rarely seen as a priority in all study settings. The findings reveal how the needs of the population of older age or with chronic diseases are systematically "forgotten" post

earthquake. The absence or disruption of treatment for chronic diseases (like diabetes, high blood pressure, mental illness and HIV/AIDS) is not only life-threatening for vulnerable groups, but may also give rise to clinical complications (e.g. stroke, retinopathy) resulting in avoidable deaths, a reduction of quality of life, potentially impaired livelihoods as a result of costly treatments.

Responding agencies in disaster relief, including local government and international relief organizations, should be aware of changes in disease patterns in disaster-affected settings. Guidelines on chronic disease management should be developed. Field relevant diagnosis equipments (e.g. glucometers) and medication for population with chronic conditions and of older age, should be stocked in the essential drug kit. Even with limited resources, agencies should understand that needs may be catered for with simple interventions if preventive approaches and the different interventions of pathway of care are considered. Perhaps, findings serve to alert practitioners that effective medical actions post disasters require good preparedness, planning and a multi-disciplinary approach.

Prevention is always better than cure. For public health practitioners, good knowledge of health impact and needs for disaster and humanitarian responses will be essential for public health practices and training. Future disaster relief research should aim to examine the best approach to improve population resilience and enhance health system capacity to respond to the needs of the 21s century. Given the aging population and increase of frequency of natural disasters in this region, to mitigate the adverse impact of disaster in Asia, it is important to strengthen the public health preparedness in the health system and the technical response capacity by enhancing staff training and research.

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APPENDICES

Appendix I

Summary of Chinese Literature review

Code	Name of Article	Author	Journal	Description	Studies types	Quality** of Evidence
W14	唐山大地震對母孕期胎兒情緒障礙的遠期研究 Long term study of perinatal impact of Tangshan earthquake on emotional disorders *	王學義、張本、馬文有、孫賀祥、董濤、Sarnoff A.Mednick	中國健康心理學雜誌 2005 年 01 期	探討地震應激對胎兒成人後的情緒影響。結果暴露組的胎兒成人後 HAMD 評分明顯高於對照組；男性比女性的抑鬱情緒更為明顯。 Study of the impact of emotion outcomes in adult subjects who exprienced post-seismic stress during perinatal stage. Depression score(HAMD) was fould to be significantly higher for the studied (fetal exposure) group than that of control. Impact was also found to be stronger for men than women.	採用 Hamilton 抑鬱量表盲式對地震暴露組與對照組進行抑鬱情緒的評估。 Assessment of depression was done with Hamilton Depression Scale using concealed study groups when examining earthquake exposure group and control group. Case Control study	III-2

Code	Name of Article	Author	Journal	Description	Studies types	Quality** of Evidence
W31	河北唐山地震後孤兒的心理變異及其社會化治理 Psychopathology and Socialized Direction of Orphans in the Tangshan earthquake	高民杰	山西地震 EARTHQUAKE RESEARCH IN SHANXI 2002 No.2	對 1976 年河北唐山大地震後的孤兒進行了調查, 就唐山大地震後對孤兒這一特殊災民實施社會救助過程中, 孤兒的心理變異問題進行了分析, 指出社會化治理是消除孤兒心理變異的重要對策。 A survey was conducted on 1976 Tangshan earthquake orphans. for two comparason groups: Cases were victims who received specific social assistance compared with control who received no support. Community-based treatment was found to have significantly factor eliminated the psychological adverse outcomes.	應用中國精神疾病分類方案與診斷標準第 2 版修訂本中的急性應激反應(ASR)和心理創傷後應激障碍(PTSD)診斷標準,於 1998 年 3 月對 57 例地震所致孤兒進行診斷,按有無 PTSD 分為患者組和正常組,採用焦慮自評量表(SAS)、症狀自評量表(SCL90)、明尼蘇達多相個性測查表(MMPI)等進行測評和比較。2nd revised edition of diagnostic criteria for acute stress reaction (ASR) and psychological post-traumatic stress disorder (PTSD) diagnostic criteria was used. For diagnosis of (in March 1998) of the 57 cases were examined. self-rating anxiety scale (SAS), Symptom Checklist (SCL90), Minnesota Multiphasic Personality Inventory (MMPI) were used to collected information for evaluation and comparison. Case Control study	III-2

Code	Name of Article	Author	Journal	Description	Studies types	Quality** of Evidence
W38	母孕期經歷唐山大地震的青少年認知功能遠期研究 Long term study on perinatal impact of Tangshan earthquake on teenage cognitive outcomes	王學義、張本、張寶廷、劉曉雲、薑濤、孫賀祥、馬文有、張露萍、孟雪梅、SarnoffAMednick	中國心理衛生雜誌 2001 年 01 期 Chinese Mental Health Journal	研究地震嚴重應激對胎兒認知功能的影響。提示唐山大地震對宮內胎兒的認知功能水準具有潛在的影響。 This study examined the impact of seismic severe stress on cognitive function of fetus. Results suggested Tangshan earthquake may potentially affect of fetus cognitive function. Results indicated fetus who experienced an earthquake had a significant lower RSPM score when compared with than the control group. In addition, it appeared those who were exposed during the second trimester (pregnant 3-6 months) were more significantly affected than those who were exposed during third trimester fetus more obvious (P <0.01)	方採用瑞文標準推理測驗 (RSPM)分別測評 6 16 例在胎兒期遭受地震應激但未經歷地震體驗的青年學生及以地震第二年同期出生的 6 16 名學生為對照的認知功能水準。結果：經歷過地震的胎兒的 RSPM 評分明顯低於未經歷過地震的對照組 ,第二個三個月 (孕 3-6 個月)和第三個三個月 (孕 3 -6 個月)的胎兒更為明顯(P<0.01) Raven Standard Matrices (RSPM) was used to measure 616 students who had experienced earthquake-in perinata stagel. A comparable group born the following year (after the earthquake) over the same period was used as the control group for evaluating level of cognitive function. Case Control study	III-2

Code	Name of Article	Author	Journal	Description	Studies types	Quality** of Evidence
W43	唐山大地震孤兒遠期心身健康的調查研究 Long term implication on physical and mental health on Tangshan earthquake orphans	張本、王學義、孫賀祥、馬文有、徐廣明、於振劍、孟雪梅、劉秀花、劉曉芸、李秀芝	中國心理衛生雜誌 2000 年 01 期 Chinese Mental Health Journal	探討遭受唐山大地震嚴重精神創傷的孤兒遠期心身健康狀況。孤兒組目前存在心理問題較多,其原因可能是孤兒所承受的精神創傷的強度嚴重於對照組,尤其是缺乏父母情感依附而使孤兒應。 *This study examined long term physical and mental health outcomes of Tangshan Earthquake orphans. Results: indicated that 57 cases of orphans in the 13 cases were diagnosed as post-traumatic stress disorder (PTSD), while the control group, only 1 case. Orphan group SAS total score and standard score, SDS total score and standard score, SCL-90 project in the number of positive, somatization, anxiety, hostility, other factors, CMI in fatigue, depression, anger factor were significantly higher the control Lack of parental emotional attachment in the orphans in studied group (when compared with the control group) was hypothesized to be a possible explanation.*	以經受唐山大地震且父母在地震中震亡的孤兒 57 例為研究組,對照組為經歷唐山大地震的非孤兒 47 例。兩組之間均完成了唐山大地震兒童心身健康調查問卷和標準化評定工具的調查、評定和診斷。結果:57 例孤兒中目前有 13 例診斷為心理創傷後應激障礙(PTSD),而對照組中僅有 1 例。孤兒組 SAS 總分和標準分、SDS 總分和標準分、SCL-90 中陽性專案數、軀體化、焦慮、敵對、其他因數、CMI 中疲勞感、抑鬱、憤怒因數分均顯著高於對照組。 57 cases of orphans(Tangshan) in the study group and 47 children were recrited in the control group. Children's psychosomatic health survey questionnaire and standardized assessment tools were used for the investigation, evaluation and diagnosis. Case Control study	III-2

Code	Name of Article	Author	Journal	Description	Studies types	Quality** of Evidence
W49	巴拉考特地震災區發病狀況分析 Disease pattern analysis study on Pakistan earthquake*	張永青、楊造成、彭碧波、白曉東、高進、王軍	中國急救復蘇與災害醫學雜誌 2007 年 01 期 Journal of emergency rehabilitation and disaster medicine	目的研究巴基斯坦巴拉考特地震災區傷病發生的特點和規律。結果 2005 年 10 月在巴基斯坦巴拉考特地震災區中國國際救援隊(China International Search and Rescue, CIARS)流動醫院共接診當地發病災民 2231 人次,其中居前五位的為損傷和中毒疾病占 29.18%,呼吸系統疾病占 17.08%,消化系統疾病占 9.91%,肌肉骨骼結締組織疾病占 9.64%,皮膚病和皮下組織疾病占 6.95%。結論應根據地震災區不同傷病發病規律及時採取預防措施,以便合理應用有限的醫療資源,更好地為災民提供醫療服務。 Objective To study injury patterns of victims of the Balakot Pakistan earthquake in October 2005, China International Rescue Team (China International Search and Rescue, CIARS) mobile hospitals examined incidence of admissions of 2231 people disaster affected individual. The top five for the injury and poisoning, diseases accounted for 29.18 %, respiratory diseases accounted for 17.08%, digestive diseases, accounting for 9.91%, musculoskeletal diseases accounted for 9.64% of connective tissue, skin and subcutaneous tissue diseases accounted for 6.95%. Result suggested relief allocation should be based on injury incidence and post disaster diseases pattern to allocate limited medical resources and to provide more appropriate of medical services for victims	方法採用國際疾病分類方法(ICD-10)進行統計分類,計算疾病發病例數及構成比。 International Classification of Diseases (ICD-10) for statistical classification was used to analyze disease pattern Cross sectional, ecological analysis	III-3

Code	Name of Article	Author	Journal	Description	Studies types	Quality** of Evidence
W70	中國大陸百年(1901～2001 年)淺源強震活動及生命損失回顧與分析 Retrospective analysis off earthquake damage and impact on human lifes for the past century in China	傅征祥, 劉桂萍, 邵輝成, 丁香	地震學報 ACTA SEISMOLOGICA SINICA Vol.27 No 4, Jul 2005 367-376	中國大陸百年(1901-2001 年)淺源地震活動(Ms>= 6.0)及生命損失的某些特徵。1901-2001 年中國大陸發生約 420 次 6 級以上的淺源地震，死亡人數超過 60 萬人，其中 88%發生在大陸西部，平均震源深度(25km)比東部(16km)的深。西部 6 級以上的淺源地震較東部活躍 7 倍。針對 6 級以上的地震群體活動有轉移的現象。地震的死亡人數與震級存在線性關係外；地震釋放的能量與地地面震動的大小存在關係；地震發生時間、區域、建築物破壞程度和人口密度有直接關係。 This study examine the characteristics of serious earthquake (Ms> = 6.0) and mortality pattern for the past hundred years (1901-2001 years) that took place in mainland China. There was about 420 times of earthquakes of MS>6, These earthquakes costed more than 60 million lefts, of which 88% occurred in the western mainland, with an average focal depth (25km) than in the east (16km) deep. Western 6 shallow earthquakes of more than 7 times more active in the east. For the six groups of activities over the transfer of seismic phenomena. The magnitude of the earthquake death toll there is a linear relationship with the outside; seismic energy released and the earth there is the relationship between the size of the ground shaking; earthquake occurrence time, region, building damage and population density are directly related.	事後回溯法 Retrospective, descriptive, ecological analysis	III-3

Code	Name of Article	Author	Journal	Description	Studies types	Quality** of Evidence
W82	1954 年山丹 71/4 級地震概述 Outline of the Shandan Earthquake of Ms 7 ¼ in Gansu Province on February 11, 1954	董治平, 赵仪全, 慕文斋, 代炜, 陈瑶,	西北地震学报 2005 年 第 27 卷 第 z1 期 Northwest Earthquake Report	1954 年山丹 7 1/4 级地震的极震区烈度达 X 度,造成 50 人死亡,329 人受伤,受灾面积 4800 km2,山丹县城破坏最重.本文回顾、总结了山丹地震五十年的研究积累,重点论述了该地震的基本参数、震源机制、地震序列、地震烈度、地震破裂带、历史地震、震害及其损失等. 1954 Shandan 7 1 / 4 of earthquake intensity reached a very X-degree earthquake zone, resulting in 50 deaths and 329 people were injured, affected an area of 4800 km2, with Shandan County incurred the heaviest damage. This recview paper summed up Shandan earthquake related research in the past 50 years , with emphasis on the basic parameters of the earthquake, focal mechanism, earthquake sequence, seismic intensity, earthquake rupture zone, historical earthquakes, earthquake damage and losses.	事後回溯法 Retrospective, descriptive analysis	IV
W91	遼寧海城 7.3 級地震死亡人數-年齡分佈的分析 Mortality analysis of 7.3 Richter Scale Haicheng Earthquake in Lianning province*	賈燕、高建國	中國地震 Earthquake research in china, Vol 20, No.4, Dec 2004(394-398)	The study investigated distributions of cause of death and by age group after the 7.3 Reitcher scale earthquake in Haicheng, Lianning province earthquake in 1975. The results indicated that death directly resulted from earthquake occured in two age groups (children aged 0-8 years and adults aged 67-75 years). Children aged 0-2 years accumulated the most severe death toll from cold and children in 5-12 years old had the most common reported cause of death was from burn. The highest disaster injury related rate was in children less than 4 years. While the elderly (72-89 years old) most died from subsequent diseases.	事後回溯法 Retrospective, descriptive analysis	III-3

Code	Name of Article	Author	Journal	Description	Studies types	Quality** of Evidence
W97	2003 年 12 月 1 日新疆昭蘇縣 6.1 級地震與救災 2003 6.1 Richter Scale Xinjiang Earthquake and disaster response*	吳淑英	國際地震動態 2004 年 11 期 International Earthquake Activities*	2003 年 12 月 1 日新疆昭蘇縣遭遇 MS61 級地震,這次地震造成 10 人死亡,47 人受傷。受災人口涉及全縣各村鎮(含兵團團場)約 92000 個。新疆生產建設兵團農四師駐昭蘇團場和昭蘇村鎮房屋及公共設施等均受到不同程度的破壞。地震發生後救援工作及時,極大限度地減少了災情的擴大。從這次災害中獲得教訓,從救災工作中得到啟示。 A MS61 Zhaosu County Xinjiang earthquake hit on December 1, 2003. The earthquake led to mortality in 10 people and injury in 47. The affected population was closed to 92000. Xinjiang Production and Construction Corps 4 Division in Zhaosu mission field and Zhaosu housing and public facilities in towns and villages reported varying degrees of damage. Due to a timely earthquake relief response, this, greatly reducing the limits of the damage of the disaster. Access to lessons learned from this disaster, from relief work were discussed as lessons learnt	事後回溯法 Retrospective, descriptive, ecological analysis	IV

Code	Name of Article	Author	Journal	Description	Studies types	Quality** of Evidence
W101	河北省張北地震震害初探 Hebei Province Earthquake Study*	曹志誠、刁桂苓、刁建新	災害學 2004 年 S1 期 Disaster Studies*	分析了河北省張北地震的傷害情況,提出了應採取的措施。認為,政府應當儘快制定農村建築物抗震設防的管理制度,加強防震減災宣傳,增強農村幹部群眾的抗震意識,全面提高農村房屋的抗震能力。 Damage analysis of Zhangbei earthquake in Hebei Province recommended relief response to be taken. The study believed. Government should expeditiously formulate a rural buildings earthquake-proof management system, strengthening earthquake disaster reduction campaign to increase awareness of rural cadres and the masses of the earthquake and comprehensively improve the seismic capacity of rural housing.	事後回溯法 Retrospective, descriptive, ecological analysis, Policy, discussion focus	IV

Code	Name of Article	Author	Journal	Description	Studies types	Quality** of Evidence
W104	唐山大地震遠期神經症抽樣調查和病因學探討 Randomized pathology study of long term neurological impact resulted from Tangshan Earthquake*	張本、王學義、孫賀祥、馬文有、萱濤、張秀鳳、於振劍、許瑞芬、彭精芬、孟雪梅、劉曉雲	神經疾病與精神衛生 2001 年 01 期 Neurological and Mental Hygiene *	目的 瞭解唐山大地震遠期神經症患病率,並探討重大精神創傷和神經症發病之間的關係。1807 人中診斷神經症 114 例、神經症現患病率為 62.87‰,男性現患病率 43.74‰、女性現患病率為 78.79‰ 神經症組在大地震中遭受的精神創傷嚴重度顯著高於非神經症組。結論 本調查顯示神經症高患病率與精神創傷持續性影響效應有關。精神創傷的嚴重程度和神經症發生之間存在著密切的聯繫。應對遭受重大精神創傷的群體和個體實施神經症防治工作。 Objective of the study was to understand the prevalence of long-term neurological disorders resulted from Tangshan earthquake., The study explored the mental trauma and its relationship between the incidence of neurosis. For the 1807 sampled population, 114 patients with diagnosis of neurosis, neurological disorders prevalence rate is 62.87 ‰, the prevalence of male is 43.74 ‰, and females 78.79 ‰. The study group with neurological outcomes was found to be associated with more significant severe mental trauma than control group. Conclusion This survey shows significant association between neurosis and the severity of traumatic effects. Response should focus on disaster affected individuals who had undergo severe mental trauma and target individuals for the prevention and treatment of neurosis.	方法抽樣調查了親身經歷唐山大地震的倖存者 1 807 人,全部抽樣樣本完成了自行編制的唐山大地震調查表和標準化評定工具的調查、評定和診斷 Study group was randomly selected from 1807 first-hand survivors of the Great Tangshan Earthquake. All study subjects completed a self-administrated Tangshan earthquake related questionnaires. Standardized assessment tools, surveys, assessment and diagnosis were used. Randomized, cross-sectional analysis	III-2

Code	Name of Article	Author	Journal	Description	Studies types	Quality** of Evidence
W106	2003 年 12 月 3 日四川道孚 4.8 級地震烈度調查與損失評估 2003 Sichuan Earthquake investigation and damage estimation*	龍德雄、龍思勝、劉建明、張鐵寶	四川地震 2004 年 03 期 Sichuan Earthquake*	2003 年 12 月 3 日 7 時 26 分發生道孚 4.8 級地震,宏觀震中在四川省甘孜州道孚縣葛卡鄉至木茹鄉一帶,震中烈度為Ⅴ度。這次地震影響到道孚縣 4 個片區(尼措區、瓦日區、紮壩區和八美區)兩個鎮及十個鄉,地震災害評估區總面積 2395 平方千米。這次地震未造成人員傷亡和牲畜死亡或丟失;也未造成公路、橋樑、通訊等生命線基礎設施損失。房屋未出現倒塌;只出現個別片石砌築的房屋牆體局部垮塌和輕微裂縫,有個別房屋出現梭瓦和掉瓦。地震所造成的損失程度分為中等、輕微和基本完好三個等級;對道孚縣造成的經濟損失為 85.39 萬元。 At 7:26 on December 3, 2003 Daofu 4.8 earthquake occurred, The epicenter of the earthquake was in Dawu County, Ganzi Prefecture in Sichuan Province to the wood Ru kugqa Townsh, Township area with Ⅴ degree of intensity. The quake affected 4 areas in Daofu County, 2 towns and 10 townships, a total area of earthquake hazard assessment of 2395 square km. The earthquake caused no casualties and livestock killed or missing. It also did not cause roads, bridges, communications lifeline infrastructure losses. Housing collapse does not occur; only when a particular piece of local stone masonry wall of the housing collapse and slight cracks, there are some houses out there shuttle tiles and tile. The extent of losses caused by the earthquake were divided into moderate, mild, and basic integrity of three levels; The economic loss of Daofu County economic was estimated to be 853.9 thousand yuan.	事後回溯法 Retrospective, descriptive, ecological analysis	Ⅳ

Code	Name of Article	Author	Journal	Description	Studies types	Quality** of Evidence
W133	2003 年 8 月 16 日内蒙古 5.9 級地震概述 Overview of 2003 August 16 Inner Mongolia*	張洪由	國際地震動態 2003 年 09 期 International Earthquake Activity*	2003 年 8 月 16 日内蒙古赤峰發生 5.9 級地震 ,造成生命和財產較嚴重損失。這是赤峰市歷史上 70 0 多年來最大的一次地震。文章對該震的基本參數、震源機制、破壞傷亡和救援等作了概述。 A magnitude-5.9 earthquake occurred in August 16, 2003 at Chifeng, Inner Mongolia and resulted in severe loss of life and property. This is the biggest earthquake of Chifeng City in its 700 years of history. The article reviewed basic data and parameters related to the earthquake and implication of mortality, morbidity and rescue.	事後回溯法 Retrospective, descriptive, ecological analysis	IV

Code	Name of Article	Author	Journal	Description	Studies types	Quality** of Evidence
W137	新疆烏恰 2002 年 12 月 25 日 5.7 級地震災害損失評估 Damage estimation study of 5.7 Richter Scale Xinjiang earthquake on December 25th 2002*	胡偉華、宋立軍、宋和平、李軍、呂桂林、艾爾肯· 哈斯木、張永奎	內陸地震 2003 年 03 期 Inland Earthquake	2002 年 12 月 25 日 20 時 57 分,新疆維吾爾自治區克孜勒蘇柯爾克孜自治州烏恰縣境內發生 5.7 級地震。阿圖什市、喀什市強烈有感。烏恰縣城、黑孜葦水泥廠、康蘇鎮等地感受地震強烈,房屋建築物遭受一定程度的破壞。本次地震沒有造成人員死亡,輕傷 1 人,部分房屋結構受損,總經濟損失為 3045.85 萬元,屬輕微破壞性地震。 A 5.7 magnitude earthquake occurred at 20:57 on December 25, 2002, Kizilsu Kirgiz Autonomous Prefecture of Xinjiang Uygur Autonomous Region Wuqia County. The impact of the quake felt strongly also at Artux City, Kashi City,. Ucha County, black Zi Wei cement factory, Cansou .town. Houses and buildings suffered damage. The earthquake caused no deaths, injured one person, structural damage in building, The estimated total economic loss was about 30.4585 million yuan. It was categorized as a minor destructive earthquakes.	事後回溯法 Retrospective, descriptive, ecological analysis	IV

Code	Name of Article	Author	Journal	Description	Studies types	Quality** of Evidence
W138	新疆巴楚-伽師 6.8 級地震災害損失評估 Xinjiang Bachu - Jiashi 6.8 earthquake damage assessment	宋立軍、苗崇剛、袁一凡、胡偉華、尹力峰、田勤儉、唐麗華	內陸地震 Inland Earthquake Vol 17, No.2, June 2003	The study assessed the cost of the 6.8 Reitcher scale earthquake in southeast of Jiashi of Xinjian on February 24, 2003. It caused 268 people killed and 4,853 injured, including 2,058 severe cases, and 49,656 families, about 205,079 people, displaced from their homes. The affected region amounted to 21,498 km2, covering 6 counties or cities, 37 towns, and 931 villages. The estimated direct cost reached 1,397. 9223 million RMB.	地震現場科學考察，大範圍均衡抽樣方法(自然村、鄉鎮)進行房屋破壞程度調查，採樣點為 85 個，第 1 評估區 8 個，第 2 評估區 24 個，第 3 評估區 53 個，鄉鎮 16 個。建築物的破壞程度為 5 個等級。 Earthquake field scientific investigation, a wide range of cluster sampling method (villages, towns) for housing damage surveys, the sampling point 85, the first one assessment zone with 8 sample, the second assessment zone with 24, the 3rd Assessment District with 53, township 16 months. Extent of the damage the building were divided into 5 grades. Cluster sampling study	IV

Code	Name of Article	Author	Journal	Description	Studies types	Quality** of Evidence
W144	2003 年 2 月 24 日新疆巴楚-伽師 6.8 级地震 The Earthquake of M 6.8 Occurring in Bachu-Jiashi Region,Xinjiang Uygur Autonomous Region on February 24,2003	张云峰、王海涛、徐锡伟、欧阳飚、张洪由、黄建发	国际地震动态 Recent Developments in World Seismology 2003 No 3 (SERIAL NO 291) March 2003	2003 年 2 月 24 日 10 时 03 分,新疆伽师县境内发生 6.8 级地震,极震区烈度IX度,对邻近的巴楚县琼库尔恰克等乡镇造成严重毁坏和伤亡.地震造成灾害损失近 14 亿人民币.文章对此次地震的基本参数、震源机制、地震序列、震害损失评估及地震应急工作等作了概述. A 6.8 earthquake occurred at 10:03 on February 24, 2003, County of Xinjiang in northwestern. The seismic area recorded IX degree of intensity and had caused serious damage and casualties in neighboring towns such as Bachu county 琼库尔恰克 Economic loss associated with earthquake was nearly 14 billion yuan. Basic data and parameters of this earthquake, focal mechanism, earthquake sequence, earthquake damage earthquake damage assessment and emergency work were examined	事後回溯法 Retrospective descriptive analysis	IV

Code	Name of Article	Author	Journal	Description	Studies types	Quality** of Evidence
W156	2001 年 5 月 24 日四川鹽源 5.8 級地震災害及損失評估 Damage estimation study of 5.8 Richter scale 2001 May Sichuan earthquake*	何玉林、王雲基、杜國光、張勤	四川地震 2002 年 02 期 Sichuan Earthquake*	對 2001 年 5 月 24 日發生在四川鹽源之 5.8 級地震災情作了概述。這次地震宏觀震中位於四川鹽源縣瀘沽湖鎮舍垮村一帶,震中區烈度為Ⅶ度,個別點可達Ⅷ度。其中四川地區受災面積達 1130 平方千米,受災人口達 9632 戶,48249 人。地震造成 1 人死亡,39 人受傷,5930 人無家可歸,其直接經濟損失在 9000 萬元左右。同時,位於震區週邊的木裏縣城所在地—喬瓦鎮因位於老滑坡地帶,成為災害異常區,從而使建築物遭受較大的損壞。 This study examined a 5.8 earthquake occurred on May 24, 2001 took place at Yanyuan Sichuan province. The quake epicenter was located at Lugu Lake Town Yanyuan County, Sichuan. Village where the homes collapsed and at the epicenter, intensity ranged from Ⅶ to Ⅷ. 1130 square kilometers were affected. 9632 households, 48249 people were affected. One people was killed, 39 were injured and 5930 people were left homeless. The direct economic loss of 9,000 million. In addition, due to landslide at, Muli County that was located in the old town, severe building damage was observed when compared with other affected areas.	事後回溯法 Retrospective, descriptive, ecological analysis	IV

Code	Name of Article	Author	Journal	Description	Studies types	Quality** of Evidence
W163	內鄉—鎮平 4.7 級地震及震後應急 The Neixiang-Zhenping, Henan, M4.7 earthquake and the post-earthquake emergency response	劉堯興、謝智、王文旭、夏修軍、黃永權、劉斌、邱海濤	地震學刊 2001 年 03 期 Earthquake Journal*	內鄉 -鎮平 47 級地震 ,是河南省解放以來唯一一次造成人員傷亡的地震事件。本文對這次地震的震害及烈度進行了考察評定 ,總結了有關部門的震後應急措施 ,討論了從這次地震中應吸取的經驗教訓。 The earthquake occurred within the Township - Township Level 47 earthquake, was the only earthquake that caused casualties since the liberation of Henan Province. This paper examined the seismic intensity and the damage assessment. It summarized the relevant the post-earthquake emergency measures among responding departments. It also discussed lessons learned from this earthquake	事後回溯法 Retrospective, descriptive, ecological analysis	IV
W179	中國的地震災情及其區域分異 Geographic and Disaster profile analysis of China earthquakes*	袁藝、王理、白海玲	自然災害學報 Journal of natural disasters Vol 10, No.1, Feb 2001	本世紀，地震的死亡人數是佔世界地震死亡人數的 50%,亦佔中國在自然災害的死亡人數的 50%,總損失的東、西部對比為 5:1 到 10:1 間, 次損失為 10:1 到 25:1 之間，地震的損失主要取決於人口密度, 經濟及社會發展水準因素. 50% of global earthquake related life loss of earthquake occurred in China during the last century. 50% of natural disaster related mortality was also due to earthquake in China. Overall, the ratio of economic loss between east and west ranged about 5:1 to 10:1. Secondary loss ranged from 10.1 to 25.1 Serious human life loss were incurred for earthquake in eastern side of China when compare with west provinces and loss might be associated with population density, economic and social development.	事後回溯法 Retrospective, descriptive, ecological analysis	IV

Code	Name of Article	Author	Journal	Description	Studies types	Quality** of Evidence
W188	1998 年 8 月 27 日伽師 6.6 級地震宏觀烈度與震害 Overview study on 6.6 Richter Scale JiaShi Earthquake*	李鋐、伊力亞爾、張雲蜂、戴曉敏、趙純青、王堅	內陸地震 Inland Earthquake 2000 年 01 期	1998 年 8 月 27 日伽師 6.6 級地震的宏觀考察結果為 :極震區烈度為 度 ,宏觀震中位於烏堂村和艾孜尼庫木一帶 ,震前無明顯的宏觀異常 ;在烈度區內 ,不同地點的房屋破壞存在差異 ,這除了與場地土、地下水埋深有關外 ,與災區房屋的重建率有關 ;包括嶽普湖和疏勒縣 2 個烈度異常區 ,受災人口共計 17 萬餘人 ,其中死亡 3 人 ,重傷 5 人 ,輕傷 13 人。 A 6.6 earthquake occurred in August 27, 1998 at Jiashi . A study found no pre-earthquake abnormality was detected around the epicenter (Wu Tong Village, and Yi Zini wooden base area) before the earthquakes The required reconstruction varied with the type of soil and underground water level. At 2 severely damaged areas (yopurga and Shule County) , more than 170,000 were affected, three people died, five people heavily wounded and 13 people were injured.	事後回溯法 Retrospective, descriptive, ecological analysis	IV

Code	Name of Article	Author	Journal	Description	Studies types	Quality** of Evidence
W194	1999 年 11 月 29 日辽宁省海城-岫岩 5.6 级地震震害统计和损失评估 Disaster impact and damage estimation study 5.6 Richter Scale 1999 November Haicheng Earthquake in Lianning province*	高常波 谷军	自然災害學報 Journal of natural disasters Vol 2, No.9, 2000	在海城－岫岩５．６级地震中，震中区遭受到７度地震事後回溯法破坏，同时震区又遭受多次强余震，总直接经济损失８４８８．８万元，１６２９户房屋发生严重研究，５７３４人无家可归，由于震前进行了成功的预报，无人员伤亡发生。本次地震震区为农村，其中农村砖房大多数为基本完好和轻微破坏，而大量的石砌房屋则破坏较生，在重建家园中应采取必要的抗震措施。 During the 5.6 magnitude Haicheng – Xiuyan earthquake, the epicenter suffered from a 7 degree earthquake related damage 7, Several episodes of strong aftershocks were experiences Estimated economic loss accumulated to 84.888 million yuan, 1629 severely damaged households were examined , 5734 people were left homeless.This study examined rural areas and found most brick houses remained undamaged or with only slightly damaged. Anti-seismic capacity must be emphasized for post disaster housing reconstruction..	Retrospective, descriptive, ecological analysis	IV

Code	Name of Article	Author	Journal	Description	Studies types	Quality** of Evidence
W196	新疆喀什地區鄉村地震人員傷亡矩陣與對比研究 A comparison study of mortality and morbidity pattern in rural population from Kashgar, Xinjiang Earthquake*	李鋐、尹力峰、宋立軍	自然災害學報 Journal of natural disasters Vol 9, No.1, Feb 2000	The study analyzed major causes of mortality resulted from the earthquakes (6-9 Reitcher scales) occurredl Karshi area (Xinjiang) during 1955-1998 and showed 房屋的抗震能力 was the leading cause of death in lower 烈度 earthquakes, whereas population density was the first in higher 烈度 ones.	事後回溯法 Retrospective, descriptive, ecological analysis	IV
C2	唐山地震孤兒 21 年後的心理健康狀況 21 years later: Study on Tangshan earthquake orphans mental health status*	賈福軍、楊德森、王學義、張本、徐廣明	健康心理學雜誌 2000 年 03 期 Healthy Psychology Magazine	瞭解唐山地震孤兒 21 年後的心理健康狀況。孤兒心理狀況和生活品質與對照組相比無明顯差異 ,也無明顯的性別和年齡差異。結論　地震孤兒的心理健康水準與非孤兒倖存者無明顯差別 This study examines the Tangshan Orphan's mental health status and quality of life. The study group wa compared with a control group(no earthquake exposure)No significant difference between them.	使用事件影響量表、SCL—90、MMPI、應激源和應激反應問卷及生活品質問卷等工具 ,在唐山地震 21 年後對 67 名孤兒和 67 名非孤兒倖存者進行心理健康狀況調查。 Using the Impact of Event Scale, SCL-90, MMPI, stressors and stress responses such as questionnaires and quality of life questionnaire tool in the Tangshan earthquake 21 years after. A comparison was made between 67 orphans and 67 non-orphans. Case Control study	IIIb

Code	Name of Article	Author	Journal	Description	Studies types	Quality** of Evidence
C11	大地震創傷後應激障礙患者的心理與神經內分泌變化 A study on mental, neurological and endocrine changes in PTSD victims post Great Earthquakes*	張本、徐廣明、馬文有、孫賀祥、劉秀花、孫太起、於振劍、苗麗玲、牛俊紅	中國心理衛生雜誌 2002 年 12 期 Chinese Mental Health Journal	研究唐山大地震所致慢性創傷後應激障礙患者基礎血清皮質醇濃度和地塞米松抑制試驗。兩組基礎血清皮質醇水準比較差異無統計學顯著性 ,各組男女之間基礎血清皮質醇水準分別比較差異亦無統計學顯著性。兩組服用相同劑量的地塞米松後 ,研究組血清皮質醇水準低於對照組和對血清皮質醇的抑制作用高於對照組 ,差異均有統計學顯著性。各組男女之間的基礎血清皮質醇水準、服用地塞米松後血清皮質醇水準和對地塞米松的抑制率比較差異無統計學顯著性。結論 :唐山大地震所致慢性大地震創傷後應激障礙患者的心理與神經內分泌變化 This study examined chronic post-traumatic stress disorder due Tangshan Earthquake. Serum cortisol concentration level and dexamethasone suppression test were collected from study sample population. No statistically significant difference were found between the outcomes for the serum cortisol level or men versus. women for chronic PTSD patients.. For the dexamethasone test, statistical differences were found between the chronic PTSD study and control group. The chronic PTSD study group was found to have higher serum cortisol level. No differences were found between men and women in each group. Conclusion: The Tangshan Earthquake caused chronic PTSD	唐山大地震所致創傷後應激障礙 35 例 (研究組)和 33 例正常人(對照組)接受了基礎血清皮質醇水準的測定和地塞米松抑制試驗。 35 cases of post-traumatic stress disorder (study group) resulted from Tangshan Earthquake and 33 normal subjects (control group) were compared for serum cortisol levels and dexamethasone results of suppression test. Case control Study	III-2

Code	Name of Article	Author	Journal	Description	Studies types	Quality** of Evidence
C31	唐山大地震所致慢性創傷後應激障礙臨床研究 Study on chronic PTSD patients of Tangshan earthquake*	王麗萍、張本、薑濤、徐廣明、於振劍、王恩燕、鄭琳	中國心理衛生雜誌 2005 年 08 期 pg 517-520 Chinese Mental Health Journal	研究唐山大地震所致慢性創傷後應激障礙(PTSD)患者臨床特徵和心身健康狀況。PTSD 組不由自主地回想受打擊的經歷、反復出現有創傷性內容的惡夢、反復出現觸景生情的精神痛苦並產生生理反應、入睡困難或睡眠不深、過分地擔驚受怕、極力不去想有關創傷性經歷的人和事、避免參加能引起痛苦回憶的活動或避免到會引起痛苦回憶的地方、不願與人交往對親人變得冷漠、興趣愛好範圍變窄、對未來失去希望和信心的症狀較對照組明顯。SCL-90 總分和軀體化、強 This study examined the clinical features and mental and physical health in patients with chronic post-traumatic stress disorder (PTSD) associated with Tangshan Earthquake. PTSD group involuntarily recall experience of recurrent post-traumatic content of nightmares, recurring flashback of the mental anguish and produce physiological responses, difficulty falling asleep or sleep is not deep, excessive fear. This group tried to avoid questions about traumatic experiences people and things, refrain from participating in the activities can cause painful memories to the cause or to avoid painful memories of the place, and are unwilling to contact relatives turns cold and narrow range of interests and hobbies, to lose hope and confidence for the future than in the control of symptoms significantly. SCL-90 total score and somatization showed significant outcomes	35 例唐山大地震所致慢性 PTSD 患者(PTSD 組)和 33 例經歷過唐山大地震的非 PTSD 患者(對照組)接受了 PTSD 症狀頻度和心身健康問卷的評定。 Comparison between 35 cases of chronic PTSD patients (PTSD group), 33 patients experienced the Tangshan earthquake in the non-PTSD patients (control group). PTSD symptom frequency and physical and mental health outcomes were assessed in questionnaire Comparative case-control study	III-2

Code	Name of Article	Author	Journal	Description	Studies types	Quality** of Evidence
C58	唐山地震 26 年後倖存脊髓損傷患者的社會調查 A social survey of patients with spinal cord injury 26 years after Tangshan earthquake	李建軍、周紅俊、劉根林、劉松懷、趙超男、宓忠祥、崔志茹、鄭櫻、郝春霞、熊宗勝、馬洪路、周天健	中國康復理論與實踐 2005 年 02 期 Chinese Journal rehabilitation, theory and practice, Feb 06 Vol 11. No. 2	瞭解唐山地震 26 年後倖存脊髓損傷(SCI)患者的生活狀況。對比兩次調查結果,唐山地震 SCI 患者的生活狀況已有了顯著改善,主要表現在居住環境(100%的患者現居住在經過特殊改造的房屋)和醫療服務(輪椅使用率從 38.1%上升到 100%),大多數患者心理處於適應期,收入增加(21.1%的患者從事各種職業),業餘生活豐富,SCI 常見併發症減少。 This study examined lifes of Tangshan earthquake spinal cord injury(SCI) survivors after 26 years. Comparison were made with findings in 1988. Results indicated that since 1988 Tangshan earthquake in patients with SCI had a significantly improved living conditions, mainly in the living environment (100% of the patients are now living in a specially modified housing) and medical services (wheelchair usage rose from 38.1% to 100%). The majority of patients was still in mental adjustment period, with revenue increased (21.1% of patients had engaged in various occupations), living a fruitful life. SCI common complication appeared to have reduced when compared with 1988 study..	從 14 個療養院中隨機選取 4 個療養院,並隨機抽取 1 個城市社區(城市組)和 1 個農村鄉鎮(農村組),調查其中的唐山地震 SCI 患者。向被調查者發放問卷,內容包括居住環境、收入、精神狀態等 41 項;將調查結果與 1988 年的調查相比較。 From 14 randomly selected nursing homes in four nursing homes, and randomly selected one urban community (city group) and a rural township (rural group) to investigate one of the Tangshan earthquake in patients with SCI. Questionnaires include 41 item on living environment, income and mental state. Study findings are compared with 1988 results. Cohort, comparative study	III-2

Code	Name of Article	Author	Journal	Description	Studies types	Quality** of Evidence
C60	唐山地震倖存脊髓損傷患者心理及婚姻狀況調查 Survey of marriage and mood of patients with spinal cord injury survived after Tangshan earthquake	劉松懷、李建軍、周紅俊、宓忠祥、趙超男	中國康復理論與實踐 2005 年 02 期	探討婚姻關係對雙方均為唐山地震倖存脊髓損傷(SCI)患者夫婦的生活滿意度和心理狀況的影響。結果已婚組 SCI 患者對目前生活的滿意度明顯高於未婚組(P<0.01); 對自己生活品質的評估與未婚組無顯著性差異(P<0.05); 焦慮平均得分高於未婚組(P<0.05);抑鬱平均得分與未婚組無顯著性差異(P<0.05)。婚姻對提高唐山地震倖存 SCI 患者的生活滿意度和心理狀況的影響。 The relationship between the two sides were exploring marriage survived the Tangshan earthquake in spinal cord injury (SCI) patients with the couple's life satisfaction and psychological condition. Results indicated that married SCI patient group showed significantly higher life satisfaction than unmarried group (P <0.01); No quality of life differences (P <0.05); anxiety scores higher than the average unmarried group (P <0.05); for the average depression score and the unmarried group, no significant difference (P <0.05). Married SCI survivors of the Tangshan earthquake had increased life satisfaction and psychological condition.	調查 1976 年唐山地震倖存 SCI 患者 40 名,其中,生活在截癱康復村已婚者 20 名(男、女各 10 人),生活在療養院未婚者 20 名(男、女各 10 人),比較婚姻狀況對兩組患者的生活滿意度、生活品質、焦慮和抑鬱情緒狀況的影響。 Survey of 1976 Tangshan earthquake in 40 SCI patients, who live in the village paraplegic rehabilitation. Study sample included 20 married (male and female each 10) and unmarried persons living in nursing homes 20 (male and female each 10), Comparison of life satisfaction, quality of life, anxiety and depression condition. was made between the two groups of patients in Cross-sectional survey, case-control study	IV

Code	Name of Article	Author	Journal	Description	Studies types	Quality** of Evidence
C63	唐山大地震所致孤兒心理創傷後應激障礙的調查 A study of post-traumatic stress disorder in Tangshan earthquake orphans*	張本、王學義、孫賀祥、馬文有、徐廣明、於振劍、孟雪梅、劉曉芸、劉秀花	中華精神科雜誌 2000 年 02 期	調查唐山大地震所致孤兒的心理創傷後應激障礙的發生情況。57 例中有 2 7 例 (47%)符合 ASR 診斷標準 ,13 例 (23%)符合 PTSD 診斷標準。與正常組比較 ,患者組 SAS 的總粗分和標準總分高 (P<0.05) ,對支持的利用度分 A survey examined prevalence of post-traumatic stress disorder in Tangshan earthquake orphans . 57 cases have 27 cases (47%) fulfilled the ASR diagnostic criteria, 13 cases (23%) consistent with PTSD diagnostic criteria. Compared with the control group, the overall SAS score of the study patient group are significantly higher. (P <0.05).	應用中國精神疾病分類方案與診斷標準第 2 版修訂本中的急性應激反應 (ASR)和心理創傷後應激障礙 (PTSD)診斷標準 ,於 1998 年 3 月對 57 例地震所致孤兒進行診斷 ,按有無 PTSD 分為患者組和正常組 ,採用焦慮自評量表 (SAS)、症狀自評量表 (SCL 90)、明尼蘇達多相個性測查表 (MMPI)等進行測評和比較。 57 cases of earthquake orphans were evaluated with the diagnostic criteria 2nd edition revised version of the acute stress reaction (ASR) and psychological post-traumatic stress disorder (PTSD) diagnostic criteria in March 1998. Self-rating anxiety scale (SAS), symptom checklist (SCL 90), Minnesota Multiphasic Personality Inventory (MMPI) were used for as tools for the evaluation and comparison.	IV

Code	Name of Article	Author	Journal	Description	Studies types	Quality** of Evidence
C81	胎兒期經歷唐山大地震的青少年心理狀況 Psychological status in adolescents who experienced Tangshan earthquake during fetal period	王學義、王晶晶張本、馬文有、江濤、孫賀祥	中國臨床康復 2006 年 06 期 Chinese journal of rehabilitation. Feb 2006, Vol 10 Number 6.	通過胎兒期經歷唐山大地震的青少年症狀自評量表評分研究,探討胎兒期經歷大地震對青少年心理狀況的遠期影響。其中①胎兒期經歷過唐山大地震,出生時間為1976-07-29/1977-04-28,測評時年齡滿 18 周歲的高三學生 611 例為實驗組,男 295 例,女 316 例。將實驗組分為 3 個亞組:1976-07-29/1976-10-28 出生的為早孕組(地震時母親已懷孕 7～9 個月);1976-10-29/1977-01-28 出生的為中孕組(地震時已懷孕 4～6 個月),1977-01-29/1977-04-28 This study examined long term psychological state of teenagers who experienced great Tangshan Earthquake during perinatal period.. psychological status of young people long-term effects. date of birth as 1976-07-29/1977-04-28, measuring at least 18 years of age when the age of 611 cases of high school as experimental group, 295 cases of male and female 316 cases. The experimental group was divided into three subgroups: 1976-07-29 / 1976-10-28 births for early pregnancy group (an earthquake, when my mother was pregnant 7 ~ 9 months); 1976-10-29/1977-01-28 born to the pregnant group (an earthquake pregnant 4 ~ 6 months), 1977-01-29 / 1977-04-28.	1994/1995 對唐山市 14 所學校年滿 18 周歲的高中三年級學生,進行 90 項症狀自評量表測評。 1994/1995 of 14 schools in Tangshan City, at least 18 years old junior high school students were examined with 90 SCL-questionnaires. Comparative, case-control study	III-2

Code	Name of Article	Author	Journal	Description	Studies types	Quality** of Evidence
C84	唐山大地震所致截癱患者遠期心身健康狀況調查研究 Long term effects of Tangshan earthquake on psychosomatic health of paraplegic suffers	張本、王學義、孫賀祥、馬文有、徐廣明、孟雪梅、於振劍、毅岩、劉秀花 Zhang et al	中國心理衛生雜誌 2002 年 01 期 CHINESE MENTAL HEALTH JOURNAL	研究唐山大地震所致截癱患者遠期心身健康狀況。64 例截癱患者中有 6 例患延遲性應激障礙 (posttraumatic stress disorder ,PTSD)。PTSD 現患率為 9 38%,顯著高於正常人群中 PTSD 的抽樣調查結果。64 例截癱患者有 32 例地震後發生急性應激性反應 (acutestressreaction ,ASR)。目前截癱患者心身健康程度顯著低於對照組 ,表現在 SCL -90 中唐山大地震所致截癱患者遠期心身健康狀況調查研究的總分和部分因數分 ,SDS 總分和標準分 ,SAS 總分和 This study examined the long-term physical and mental health status of patients with paraplegia post Tangshan earthquake. Results indicated that among the 64 cases of paraplegia sample, 6 patients suffering from delayed stress disorder (posttraumatic stress disorder, PTSD). PTSD prevalence rate of 9.38%, significantly higher than the normal population in the PTSD sample survey results. 32 cases had acute stress reaction (acute stress reaction, ASR). The current level of physical and mental health in patients with paraplegia were significantly lower than the control group, as reflected in the SCL -90 in the Tangshan earthquake in patients with paraplegia caused by long-term mental health status of investigation and study sub-total score , SDS total score and standard scores and SAS total score.	6 4 例唐山大地震所致截癱患者和 6 4 例對照組完成了唐山大地震心身健康調查問卷和標準化評定工具的調查、評定和診斷。 64 Tangshan earthquake Paraplegic patients were compared with 64 normal controls completed the Tangshan earthquake in Psychosomatic health survey questionnaire and standardized assessment tools, investigation, evaluation and diagnosis. Cross-sectional, case-control comparative study	III-2

Code	Name of Article	Author	Journal	Description	Studies types	Quality** of Evidence
C85	張北尚義地震後創傷後應激障礙隨訪研究 Longitudinal Study of Earthquake-related PTSD in North China	赵丞智、汪向东、高岚、李俊福、张华彪、沈渔邨 Zhao et al	中国心理卫生杂志 2000年06期 pg 361-363. Vol 14 No 6 CHINESE MENTAL HEALTH JOURNAL	纵向研究地震后创伤后应激障碍(PTSD)的发病率及其特点。结果:初始暴露程度较高而受灾后支持较好的群体PTSD发病率低,震后9月,两村PTSD发病率分别为19.8%和30.3%,就总体而言,震后9月PTSD发病率为24.4%。结论:中国灾后PTSD发病率及持续时间与在其它地区研究的结果一致,及时、实际、有效的灾后干预能够减缓创伤性经历的不良心理影响,降低PTSD的发生率. (Abstract as published) After the earthquake longitudinal study of post-traumatic stress disorder (PTSD) the incidence and characteristics. Results: The initial exposure to a higher degree and post-disaster support groups better low incidence of PTSD after the earthquake in September, the two villages the incidence of PTSD were 19.8% and 30.3%, on the whole, after the earthquake in September PTSD incidence rate of 24.4%. Conclusion: China post-disaster PTSD incidence and duration of the study in other regions with consistent, timely, practical, and effective post-disaster interventions to reduce traumatic experience adverse psychological effects, reduce the incidence of PTSD.	研究对象随机选自距震中不同距离的两个村,分别有181人和157人在震后3个月、9个月时接受调查,并以DSM-IV对PTSD进行诊断,同时测查了WHO-QOL和SCL-90的三个分量表。 Subjects were randomly selected from different distances from the epicenter of the two villages, respectively, 181 and 157 people in 3 months after the earthquake, 9 months for investigation, and to DSM-IV diagnosis of PTSD, while measuring investigation of the WHO-QOL, and SCL - 90 of the three sub-scales Cohort, prospective follow up	III-2

Code	Name of Article	Author	Journal	Description	Studies types	Quality** of Evidence
C89	唐山大地震所致截癱患者社會支持和生活品質與心身健康的對比研究 Life style and psychosomatic health in paraplegic suffers of Tangshan earthquake	張本、徐廣明、王學義、孫賀祥、馬文有、於振劍、毅岩、孟雪梅、劉秀花 Zhang et al	中國心理衛生雜誌 2002 年 01 期, Vol 16, No 1 pg 26-29 CHINESE MENTAL HEALTH JOURNAL	研究截癱患者生活方式、社會支持、生活品質與心身健對康復村的患者 (n =31)和市截癱療康之間的關係。兩組患者在地震中所遭受的軀體損傷和養院的患者 (n =33)進行了唐山大地精神創傷的嚴重程度是相似的 ,康復村患者近 8 年時間震心身健康調查問卷、90 項症狀自裘生活方式、社會支持、生活品質不同于截癱療養患評量表 (SCL -90)、康奈爾醫學指數者。目前 ,截癱病院患者心身健康程度顯著低於康復村(CMI)和社會支持評定量表 (SSRS)患者 ,表現在 33 例患者中有 6 例患 PTSD ,另外 ,在 SCL的調查和評定。 -90 總分和諸多因數分、CMI 總分和諸多因數分均 (Abstract as published) Studies in patients with paraplegia of lifestyle, social support, quality of life and the relationship between the physical and mental health. Two groups of patients in the earthquake suffered physical injury and the severity of trauma is similar to the rehabilitation village, nearly eight-year period in patients with lifestyle, social support, quality of life is different from the convalescent patients with paraplegia. At present, the degree of physical and mental health in patients with paraplegia Hospital rehabilitation of the village were significantly lower than patients in the performance of 33 patients, 6 patients suffering from PTSD, In addition, the total score and a number of factors SCL -90 points, CMI total score and a number of factors are subanalysis.	The village of rehabilitation patients (n = 31) and municipal nursing home patients with paraplegia (n = 33) for the Tangshan earthquake in Psychosomatic health survey questionnaire, 90 symptom checklist (SCL -90), Cornell Medical Index (CMI) and the Social Support Rating Scale (SSRS) the investigation and assessment of Comparative, Case-control study.	III-3

Code	Name of Article	Author	Journal	Description	Studies types	Quality** of Evidence
C92	地震後 17 個月受災青少年 PTSD 及其相關因素 Prevalence and Correlated Factors of PTSD in Adolescents 17 months after Earthquake	趙丞智、李俊福、王明山、範啟亮、張富、張華彪、汪向東 Zhao et al	中國心理衛生雜誌 2001 年 03 期 pg 145 CHINESE MENTAL HEALTH JOURNAL	研究地震後 17 個月受災青少年創傷後應激障礙 (PTSD)的發生率、症狀分佈及其相關因素。災後 17 個月 PTSD 發生率為 9 4% ,女性明顯高於男性。PTSD 症狀出現頻率較高, 似乎事件重現的動作或感受 (74.5%)、警覺性過高(68.8%) ,強烈的生理反應 (66.7%)、強烈的心理痛苦和煩惱(63.0%)及反復閃入的痛苦回憶(60.9%) ,出現較少的症狀是情感範圍有所限制 (10.4%)、脫離或覺得他人陌生的感覺 A study of prevalence, symptoms distribution and related risk factors of post-traumatic stress disorder (PTSD) 17 months after the earthquake disaster in teenage and young adults. PTSD rate was 9.4% with women was significantly higher than males. High frequency of PTSD symptoms included: incident recurring action or feelings (74.5%), alertness is too high (68.8%), a strong physiological responses (66.7%), a strong psychological distress and annoyance (63.0%), and repeated into the pain of memories (60.9%), there is the emotional range of symptoms of less restriction (10.4%), off, or feel a strange sense of others	在張北地震震中一所中學隨機抽取 205 名中學生 ,進行 DSM -IVPTSD 診斷檢查及相關量表的測查。 A random sample of 205 secondary school students was carried out in Chang's quake epicenter. DSM-IVPTSD diagnostic tests and related measurement scale were used for the investigation. Randomized, cross-sectional survey comparative analysis	III-3

Code	Name of Article	Author	Journal	Description	Studies types	Quality** of Evidence
C99	唐山地震 21 年後截癱者的心理狀況及生存品質 Twenty one year follow up psychological survey of patients with paraplegia caused by Tangshan earthquake	賈福軍、徐廣明、張洪、張本、楊德森	中國臨床康復 2002 年 10 期 Chinese journal of clinical rehabilitation may 2002 Vol6, No 10	瞭解唐山地震所致截癱者 21 年後的心理健康狀況及生存品質。截癱者的心理健康狀況和生存品質與對照組相比有明顯差異。結論地震截癱者的心理健康水準和生存品質明顯偏低。 To examine the mental health outcomes and quality of life of paraplegia in after 21 years from Tangshan earthquake. Paraplegia's mental health status and the quality of life compared with the control group. Conclusion The psychological health of paraplegia due to earthquake had significantly lower mental health outcomes and lower quality of life.	方法使用事件影響量表、症狀自評量表(SCL-90)、應激源和應激反應問卷及生存品質問卷等工具,在唐山地震 21 年後對 60 例地震截癱者和 60 例正常倖存者進行心理健康狀況調查 Impact of Event Scale, Symptom Checklist (SCL-90), stressor and stress reaction questionnaire and the quality of life questionnaires were used to compared 60 paraplegic survivors and 60 normal survivors(non-paraplegia) 21 years after the Tangshan earthquake. Comparison study, descriptive analysis	III-3

Code	Name of Article	Author	Journal	Description	Studies types	Quality** of Evidence
C100	唐山地震 25 年截癱病人死亡原因調查與分析 25 years Retrospective Mortality Analysis of paraplegic patients resulted from Tanghshan Earthquakes	劉滿合	傷殘醫學雜誌 Vol 9, No.4 2001 Disability medical journal*	唐山大地震造成 24 萬人死亡、16 萬人傷殘, 4000 人成事後回溯法截癱，研究 79 例震後造成脊髓損傷患者的死亡原因，Retrospective, descriptive analysis. 褥瘡或泌尿系統感染後敗血症有 21 例，佔,26.58%(震後 15 年內死亡有 13 例), 死於心腦血管疾病 10 例 (12.66%)，意外及自殺共 4 例(5.06%)，其他如糖尿病、癌症有 5 例(6.33%)。 Tangshan earthquake, which resulted in 24 million deaths, 16 million disabled, 4000 paraplegia. This study examined the cause of death of 79 Spinal Cord Injury(SCI) patients after the earthquake. 21 cases(26.58% died within 15 years after the earthquake there were 13 cases) were accounted for Bedsores or urinary tract infection septicemia ,10 patients (12.66%) died of cardio-cerebral vascular diseases in, accidents and 4 (5.06%) due to suicide,, others such as diabetes, cancer, 5 cases (6.33%)		IV

** These English titles were not available and were translated for easy referencing in this study.*

***Level of evidence: I Evidence obtained from a systematic review of all relevant randomized controlled trials, II Evidence obtained from at least one properly-designed randomized controlled trial, III-1 Evidence obtained from well-designed pseudo-randomized controlled trials(alternate allocation or some other method), III-2 Evidence obtained from comparative studies(including systematic reviews of such studies) with concurrent controls and allocation not randomized, cohort studies, case-control studies, or interrupted time series with a control group, III-3 Evidence obtained from comparative studies with historical control, two or more single arm studies, or interrupted time series without a parallel control group, & IV Evidence obtained from case-series, either post-test or pre-test/post-test.*

Table 8 Summary of English Literature review

Code	Name of Article	Author	Journal	Description	Studies types	Quality* of Evidence
P 3	Prevalence of psychiatric disorder following the 1988 Yun Nan (China) earthquake--the first 5-month period	Cao H. McFarlane AC. Klimidis S.	Soc Psychiatry Psychiatr Epidemiol (2003) 38 : 204–212	In this study, 1294 people were examined at 5 months after the 1988 Yun Nan earthquake in order to explore the psychiatric impact of this disaster. Patient were assessed with a number of instruments, including the General Health Questionnaire (28-item version), the Life Event Inventory, and the Post-traumatic Stress Disorder section of the Diagnostic Interview Schedule. Three groups were examined according to their distance from the epicenter of the quake. . Their responses were compared with an additional sample of 908 people from a general population living 520 kilometers away from the epicenter.	Comparative study, cross-sectional	III-3

Code	Name of Article	Author	Journal	Description	Studies types	Quality* of Evidence
P 15	Post-earthquake quality of life and psychological well-being: longitudinal evaluation in a rural community sample in northern China	Wang X. Gao L. Zhang H. Zhao C. Shen Y. Shinfuku N.	Psychiatry Clin Neurosci. 2001 Apr;55(2):165	The subjects, from two villages at different distances from the epicenter, were assessed using the brief version of the World Health Organization Quality of Life Assessment (WHOQOL-BREF) and three subscales of a symptoms checklist at 3 months (n=335) and 9 months (n=253) after the earthquake, respectively. Exposure to the earthquake was associated with multidimensional impairment in QOL, including physical, psychological and environmental domains at 3 months, and psychological and environmental domains at 9 months. The victims also suffered significantly more psychological distress in terms of depression, somatization and anxiety. At both assessment points the group that experienced lower initial exposure but then received less post-disaster help reported poorer QOL and psychological well-being. The two victim groups also differed significantly in changing trend along time. The group that received more support showed a general improvement in post-disaster well-being from 3 months to 9 months. The results confirm that post-disaster variables could be as important to post-disaster psychosocial outcomes as variables of pre-disaster vulnerability and disaster per se. A comprehensive and prospective assessment of disaster effects is imperative for the better organization of disaster relief programs and psychosocial interventions.	Prospective study, randomized comparison Cohort	III-1
P 19	Longitudinal study of earthquake-related PTSD in a randomly selected community sample in north China	Wang X. Gao L. Shinfuku N. Zhang H. Zhao C. Shen Y.	Am J Psychiatry 157:1260-1266, August 2000	Subjects were randomly sampled in two villages at different distances from the earthquake epicenter. A total of 181 and 157 subjects were assessed at 3 months and 9 months after the earthquake, respectively, for PTSD by using both DSM-IV and DSM-III-R criteria. The brief version of the World Health Organization Quality of Life Assessment and three subscales of the SCL-90-R were also administered at both assessment points.	Cohort study, randomized comparison	III-2

Code	Name of Article	Author	Journal	Description	Studies types	Quality* of Evidence
P 20	The health effects of earthquakes in the mid-1990s	Alexander D.	Disasters. 1996 Sep;20(3):231-47	This paper gives an overview of the global pattern of casualties in earthquakes which occurred during the 30-month period from 1 September 1993 to 29 February 1996. It also describes some of the behavioural and logistical regularities associated with mortality and morbidity in these events. Of 83 earthquakes studied, there were casualties in 49. Lethal earthquakes occurred in rapid succession in Indonesia, China, Colombia and Iran. In the events studied, a disproportionate number of deaths and injuries occurred during the first six hours of the day and in earthquakes with magnitudes between 6.5 and 7.4. Ratios of death to injury varied markedly (though with some averages close to 1:3), as did the nature and causes of mortality and morbidity and the proportion of serious to slight injuries. As expected on the basis of previous knowledge, few problems were caused by post-earthquake illness and disease. Also, as expected, building collapse was the principal source of casualties: tsunamis, landslides, debris flows and bridge collapses were the main secondary causes. In addition, new findings are presented on the temporal sequence of casualty estimates after seismic disaster. In synthesis, though mortality in earthquakes may have been low in relation to long-term averages, the interval of time studied was probably typical of other periods in which seismic catastrophes were relatively limited in scope.	Descriptive/Discussion	IV

Code	Name of Article	Author	Journal	Description	Studies types	Quality* of Evidence
P 39	A renal function survey in paraplegic patients of the Tangshan earthquake	Zhou TJ.	Zhonghua Wai Ke Za Zhi. 1989 Aug;27(8):482-3, 510	The writers had investigated 307 patients with paraplegia caused by Tangshan earthquake on July 28, 1976 and analysed their renograms. The results showed that the incidence of the abnormal renogram was 22.8% and significantly higher in the males and the patients with urinary incontinence than in the females and patients with urinary regularly. The renography was compared with the ultrasonography and their coincidence ratio was 93.5%. The relation among the abnormal renogram, urinary incontinence and sex is discussed.	Cross-sectional	IV
P 88	Study on environmental health strategy after earthquake	Lin Y.	Biomed Environ Sci. 1989 Dec;2(4):331-4.	The first task in prevention of diseases after an earthquake is to quickly provide an adequate source of safe drinking water. Otherwise, the incidence of infectious intestinal diseases in the disaster area residents will increase rapidly. Additional health measures, such as disinfecting drinking water, protecting the water source, and treating disaster area residents, must be taken at the same time. The sensory test of meat is a useful index of meat decomposition levels. Corpse alkali is a kind of toxic chemical, and personal protective measures must be taken in handling corpses. In general, all of these measures are important not only for achieving the goal of "no severe epidemic after strong earthquake disaster" in the affected areas, but also for enriching knowledge of disaster medicine.	Discussion paper	IV

Code	Name of Article	Author	Journal	Description	Studies types	Quality* of Evidence
P 92	Medical support in the Tangshan earthquake: a review of the management of mass casualties and certain major injuries	Sheng ZY.	J Trauma. 1987 Oct;27(10):1130-5.	The Tangshan earthquake was probably the worst catastrophe in this century. It took a death toll of 242,769, with 164,851 injured in addition. This presentation describes the organization of disaster relief work after the earthquake, the rescue of buried victims, the organization of medical resources, and the sanitation work to forestall epidemics. It also presents the author's reflections on the management of three major injuries, namely, crush syndrome, fracture of pelvis, and traumatic paraplegia, by reviewing the available data pertaining to these injuries. The author concurs with the prevailing opinion that fasciotomy plays an important role in the successful management of crush injury. It not only prevented acute renal failure subsequent to intracompartmental increase of pressure, but also the occurrence of Volkmann's ischemic contracture as a late sequela. Herbs to induce catharsis and diuresis were used to alleviate intracompartmental pressure. For the management of pelvic fractures, two newly developed treatment techniques are described. On analysis of clinical data, it is the author's opinion that traumatic paraplegia should not be given the priority of early surgery in the circumstances of mass casualties. The primary concern should be the stability and restoration of normal curvature of the spine, especially in cases of complete paraplegia. Decompression of the spinal cord through an anterolateral approach gave promising results in hyperflexion type of spinal fracture.	Discussion paper	IV
P 96	A physical interpretation of the Haicheng earthquake prediction	Scholz CH	Nature. 1977 May 12;267(5607):121-4	A possible explanation for the successful prediction of the 1975 Haicheng earthquake is that the earthquake was triggered by a deformation front that propagated 1,000 km through NE China at a velocity of about 110 km yr(-1). The various phenomena that were used to predict the earthquake can be explained by the deformation front.	Discussion paper	IV

**Level of evidence I Evidence obtained from a systematic review of all relevant randomized controlled trials, II Evidence obtained from at least one properly-designed randomized controlled trial, III-1 Evidence obtained from well-designed pseudo-randomized controlled trials(alternate allocation or some other method), III-2 Evidence obtained from comparative studies(including systematic reviews of such studies) with concurrent controls and allocation not randomized, cohort studies, case-control studies, or interrupted time series with a control group, III-3 Evidence obtained from comparative studies with historical control, two or more single arm studies, or interrupted time series without a parallel control group, & IV Evidence obtained from case-series, either post-test or pre-test/post-test*

Appendix II Critical Appraisal Framework

EPHPP QUALITY ASSESSMENT TOOL FOR QUANTITATIVE STUDIES

(Please refer to http://www.ephpp.ca/tools.html for details)

COMPONENT RATINGS A) SELECTION BIAS

Ref ID: _____
Author: _____
Year: _____
Reviewer: _____

(Q1) Are the individuals selected to participate in the study likely to be representative of the target population?

Very Likely Somewhat Likely Not Likely

(Q2) What percentage of selected individuals agreed to participate?

80 - 100% 60 – 79% Less than 60% Not Reported Not Applicable Agreement Agreement Agreement

Rate this section (see dictionary)	Strong	Moderate	Weak

B) ALLOCATION BIAS

Indicate the study design

RCT Quasi-Experimental Case-control, Before/After study,
(go to i) (go to C) No control group, or Other:
_____ (go to C)

(i) Is the method of random allocation stated? Yes No
(ii) If the method of random allocation is stated is it appropriate? Yes No

(iii) Was the method of random allocation reported as concealed? Yes No

Rate this section (see dictionary)	Strong	Moderate	Weak

C) CONFOUNDERS

(Q1) Prior to the intervention were there between group differences for important confounders reported in the paper?

Yes No Can't Tell Please refer to your Review Group list of confounders.

See the dictionary for some examples. Relevant Confounders reported in the study:

Rate this section (see dictionary)	Strong	Moderate	Weak

(Q2) If there were differences between groups for important confounders, were they adequately managed in the analysis?

Yes No Not Applicable

(Q3) Were there important confounders not reported in the paper?

Yes No

Relevant Confounders NOT reported in the study:

Rate this section (see dictionary)	Strong	Moderate	Weak

D) BLINDING

(Q1) Was (were) the outcome assessor(s) blinded to the intervention or exposure status of participants?

Yes No Not Reported Not Applicable

Rate this section (see dictionary)	Strong	Weak	Not Applicable

E) DATA COLLECTION METHODS (Q1)

Were data collection tools shown or

are they known to be valid? Yes No

(Q2) Were data collection tools shown or are they known to be reliable?

Yes No

Rate this section (see dictionary)	Strong	Moderate	Weak

F) WITHDRAWALS AND DROP-OUTS

(Q1) Indicate the percentage of participants completing the study. (If the percentage differs by groups, record the lowest).

80 -100% 60 - 79% Less than Not Reported Not Applicable 60%

Rate this section (see dictionary)	Strong	Moderate	Weak	Not Applicable

G) ANALYSIS (Q1) Is there a sample size calculation or power calculation?

Yes Partially No

(Q2) Is there a statistically significant difference between groups?

Yes No Not Reported

(Q3) Are the statistical methods appropriate?

Yes No Not Reported

(Q4a) Indicate the unit of allocation (circle one)

Community Organization/ Institution Group Provider Client

(Q4b) Indicate the unit of analysis (circle one)

Community Organization/ Institution Group Provider Client

(Q4c) If 4a and 4b are different, was the cluster analysis done?

Yes No Not Applicable

(Q5) Is the analysis performed by intervention allocation status (i.e. intention to treat) rather than the actual intervention received?

Yes No Can't Tell

H) INTERVENTION INTEGRITY

(Q1) What percentage of participants received the allocated intervention or exposure of interest?

80 -100% 60 - 79% Less than 60% Not Reported Not Applicable

(Q2) Was the consistency of the intervention measured?

Yes No Not reported Not Applicable

SUMMARY OF COMPONENT RATINGS

Please transcribe the information from the gray boxes on pages 1-3 onto this page.

A SELECTION BIAS

Rate this section (see dictionary)	Strong	Moderate	Weak

B STUDY DESIGN

Rate this section (see dictionary)	Strong	Moderate	Weak

CONFOUNDERS

Rate this section (see dictionary)	Strong	Moderate	Weak

D BLINDING

Rate this section (see dictionary)	Strong	Weak	Not Applicable

E DATA COLLECTION METHODS

Rate this section (see dictionary)	Strong	Moderate	Weak

F WITHDRAWALS AND DROPOUTS

Rate this section (see dictionary)	Strong	Moderate	Weak	Not Applicable

G ANALYSIS Comments

H INTERVENTION INTEGRITY Comments

WITH BOTH REVIEWERS DISCUSSING THE RATINGS:

Is there a discrepancy between the two reviewers with respect to the component ratings?

No Yes

If yes, indicate the reason for the discrepancy

1Oversight

2Differences in Interpretation of Criteria

3Differences in Interpretation of Study

Appendix III. Provider Structured Interview Survey- Kashmir Pakistan Earthquake

Date:

Your NGO is: Local/National/international/Don't know/Refused to Answer

	Question	Circle the answer applicable
Background		
A1.	Does your relief service involve in medical/health/mental health service provision?	Yes/No/Don't Know/Refused to Answer
A2.	Does your target population include population in all age?	Yes/No/Don't Know/Refused to Answer
A3.	Does your program/consideration consider older people as special vulnerable groups?	Yes/No/Don't Know/Refused to Answer
A4.	Are you aware of any guidelines related to management of older people issues? (e.g. "Older people in disasters and humanitarian crises: Guidelines for best practice (2005)", internal guidelines)	Yes/No/Don't Know/Refused to Answer
A5.	Does your relief intervention/program following the suggestions proposed by the guidelines?	Yes/No/Don't Know/Refused to Answer

Does your relief intervention have:

	Question	Circle the answer applicable
General: HAI Potential relief health Interventions according to older health needs		
G1.	Gender sensitive outreach medical service?	Yes/No/Don't Know/Refused to Answer
G2	Geriatric Doctor/Nurse?	Yes/No/Don't Know/Refused to Answer
G3	Trained health care workers for effective management of chronic medical needs?	Yes/No/Don't Know/Refused to Answer
G4	Psychosocial Care Program/other specialist mental care for older people?	Yes/No/Don't Know/Refused to Answer
G5	Discussion with agency in the location to sensitize, coordinate, advocate and provide technical support on putting older people's special concerns and need into post-earthquake rehabilitation effort?	Yes/No/Don't Know/Refused to Answer
Specific: Related to clinical service		
S1	Does your clinic have special days for older people?	Yes/No/Don't Know/Refused to Answer
S2	Does outreach health service available for the housebound older patients?	Yes/No/Don't Know/Refused to Answer
S3	Are drugs availability to treat the common causes of morbidity amongst older people?	Yes/No/Don't Know/Refused to Answer
S4	Are major disability recorded within the camps?	Yes/No/Don't Know/Refused to Answer
S5	Are your providing services, indiscrimination of age?	Yes/No/Don't Know/Refused to Answer
S6	Are your providing services, indiscrimination of gender?	Yes/No/Don't Know/Refused to Answer
S7	Are there availability of mobility aids?	Yes/No/Don't Know/Refused to Answer

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"Both clinical remission and radiographic non-progression are achievable goals in patients with early severe rheumatoid arthritis within 1 year of combined treatment with etanercept plus methotrexate."

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The untold stories of the Sichuan earthquake

Emily Y Y Chan took part in the relief effort after the Sichuan earthquake in May. She reports on the short-term needs of those affected and the medical and public-health challenges that will be faced by the Chinese population as rehabilitation and reconstruction continues.

On May 12, 2008, an earthquake that measured 8·0 on the Richter scale, hit the Chinese province of Sichuan. Tremors were felt as far away as Beijing and even Hong Kong. Soon the media were reporting hundreds and thousands of lives lost. Particularly dreadful was the loss of life of the pupils attending afternoon lessons in the 7000 schools which collapsed. As of the end of June, 2008, the official mortality figures had reached 70000, but millions of others have been and continue to be affected both indirectly and directly by the earthquake's impact.

The main difference between the response to the Sichuan earthquake and the 1976 Tangshan earthquake—the quake with the highest mortality in the 20th century[1]—has been in China's progressive openness[2] towards information and media access. Recent economic development has also enhanced the country's capacity to respond effectively to major natural disasters.

Within hours of the earthquake, local Communicable Disease Centres (CDCs) had become involved in disaster relief, and the national network, built up as a response to SARS, was used to bring in public-health help from other regions. In an email sent to the director at Chinese University of Hong Kong a few days after the disaster, the director of the CDC in Chongqing wrote, "I was sent to the epicenter in Yingxiu Town, Wenchuan County as an expert to direct activities of epidemics prevention after earthquake. The epidemics prevention group from our center is the first one to arrive in the epicenter zone. We conduct water surveillance, medical aid and environmental protection (eg, sprinkling disinfectant) activities in the earthquake areas...many groups are organised from CDCs across the nation to battle in the front line against epidemic outbreaks."

As someone involved in disaster relief in Asia for the past decade, I was asked to join the Médecins Sans Frontières team that was offering assistance. The experience provided an opportunity to assess not only the short-term needs of those affected, but also the medical and public-health challenges that will face the Chinese population in the post-earthquake rehabilitation and reconstruction effort.

The first days

We arrived at Chengdu by nightfall on day 3 after the disaster carrying drugs donated by colleagues and plastic bags overflowing with donated snacks and water bottles from flightcrew and passengers. Chengdu, the provincial capital of Sichuan and a few hours drive away from the earthquake epicentre of Wenchuan, was where most of the 45000 medical relief volunteers from outside the province first assembled to obtain access to the affected sites.[3,4] Although high-rise buildings in the city did not seem to be damaged, an unspoken emptiness was in the air since most citizens had temporarily moved to rural areas to avoid any potential collapse of the massive urban structures within the city.

Although the Chinese Government was generally receptive to offers of outside support and help, in practice, it was cautious about civilian-based relief efforts from outside mainland borders because of concerns about the overall efficiency of operations. Even within the country, dozens of relief teams from other provinces were not given official facilitation to reach the relief sites. No civilian airtravel was granted into the disaster area. Meanwhile, although roads were monitored by the People's Liberation Army, this did not stop many people trying to rush to the destruction zone to offer their help. The British consul in Chongqing later told me he found himself doing most of his search for wounded British citizens in a series of hitch-hiked lifts. However, the government granted our civilian medical team, largely composed of Chinese nationals from Hong Kong who had relevant earthquake-relief experience, immed-

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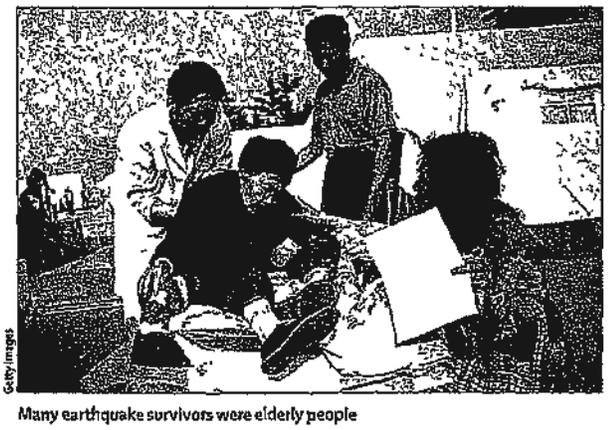
A collapsed section of the elevated expressway near Yingxiu Town, Wenchuan County

iate facilitation with travel permits, endorsement letters for participation in relief efforts, and the flexibility to choose the site where we might best support the medical-relief effort. We travelled from Chengdu by road and, in contrast to other Asian relief settings, highway travel was well managed by troops, with no traffic or security problems. En route, huge road-side propaganda billboards and banners were prominently displayed as encouragement to victims and relief teams alike.

During our first day in the disaster zone (day 4 after the earthquake), we visited several relief medical facilities, and our rapid assessment of health and medical needs revealed no apparent lack of medical supplies. However, the effectiveness of the medical response seemed to be impaired by suboptimum organisation of the medical facilities, mismatch of clinical specialties, and a general lack of skill mix in the field-relief teams. In some sites, although the patient to doctor ratio was 1:3, 80% were orthopaedic surgeons and too few anaesthesiologists were available to assist operations or manage pain control. Many sites had no generalist physicians to manage underlying common chronic medical conditions[5] and no mental-health specialists to deal with post-disaster psychological needs during the first week. The lack of multidisciplinary teams or a more holistic approach meant that some survivors who had no immediate surgical needs but who had potentially life-threatening medical conditions (eg, unstable arrthymias or hypertension) did not always receive best management despite the availability of drugs and resources. As a consequence, a patient entering trauma surgery might have no pre-operative assessment and poor management of underlying unstable chronic medical conditions.



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Many earthquake survivors were elderly people

Treating elderly patients

That evening, we arrived at Guanghan San Shiu Triage Referral Hospital—one of the six airlift triage sites that had been receiving patients evacuated by helicopter from the areas which experienced the greatest devastation: Wehchuan, Ching Ping, Mengzhu, Beichuan, and ShiFang. The site was originally a modern maternal and child health centre and had been turned into a triage site 2 days after the earthquake. Its workforce consisted of both local and out-of-province volunteer doctors, none with previous experience in disaster response or preparedness training. Overwhelmed and working with limited resources, the existing team quickly incorporated us into the medical-relief operations. We soon found ourselves at the front line of care, receiving patients and assessing their injuries and general medical conditions.

Providing adequate medical treatment for our patients was challenging since many were seriously injured, having been trapped in the rubble for at least 48 h, anxious about their families, and in mental shock. Unlike affected populations in other large-scale disasters in Asia such as the 2004 Indian Ocean tsunami and 2005 Pakistan earthquake, many patients were older, reflecting the socioeconomic environment in rural China, where many people of working age have migrated to urban settings for better job opportunities, leaving behind a population in which older people, women, and children are over- represented. Although the official total mortality had not yet been released, the media had tended to focus their reports on mortality among young people in the collapsed schools. However, the greatest morbidity will probably be among those over 60 years who lived in low-density houses which collapsed. Despite military triage before patients were airlifted, which gave priority to those with the highest chance of survival, the median age of our patients was 79 years. Similar age patterns were observed in other government and civilian relief sites, with 40% of patients older than 60 years[5] Although no major outbreak of tetanus has been reported in Sichuan, this is inevitably a risk, and our survey[6] found that 78% of the population older than 60 years were not vaccinated.

Elderly people in rural Sichuan will be heavily dependent on the post-disaster reconstruction programme, which will have major implications for their future. In addition to the challenge of rebuilding their socioeconomic support systems, they face not only the typical needs after an earthquake related to orthopedic trauma, but also the continuing needs for clinical management of complex chronic conditions. However, past experience in Japan, the Pakistan earthquake, and Hurricane Katrina[7–9] suggests that chronic medical needs post disaster are often inadequately managed and can result in increased rates of complications and indirect morbidity after a disaster. The issues about payment for such conditions within a health system recently reorganised to provide some but not all, medical health-care costs can potentially increase the stress and anxiety of survivors as they struggle to rebuild their lives. Additional medical costs will pose a substantial financial burden for people caring for their families, if not for themselves.

Mental-health needs

Not only will chronic diseases pose a burden, but the mental-health needs of patients, which were apparent in

the immediate aftermath of the quake, will also need long-term treatment and support.

Typically, patients first arrived with an excessive eagerness to tell us how they survived through the ordeal but as they settled after a few hours, their emotional state was obvious, ranging from abnormal positivity towards their rehabilitation after the earthquake to uncontrollable crying, and even attempted suicide. The lack of experience and training in mental-health needs perhaps limited patient care and sensitivity in this phase of the emergency response. The imbalance of the doctor:patient relationship in rural China, where doctors are credited with powerful professional status, perhaps contributed to a lack of sensitivity to patients' psychological needs, but the health-care staff themselves also had their own needs. Chronically fatigued and emotionally disturbed by the traumas they had witnessed, our role as more experienced disaster-relief workers included providing support to members of our local medical team.

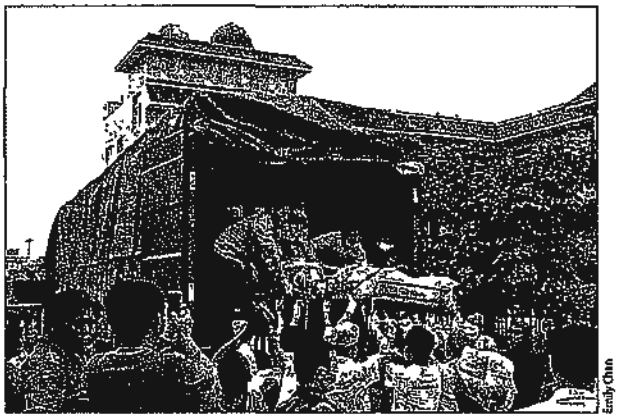
Although the mandate at the triage site was to stabilise patients after their aeromedical transfer and to quickly redirect them out to other hospitals at the city or provincial level, by May 17, the third day of the triage centre's operation, the hospital was overflowing with patients. Transfer to the well equipped secondary hospitals designated for major operations was just not possible since these tended to be multistorey buildings, and their use was prohibited because of fear of structural instability. Our work was also further complicated by the frequency and magnitude of aftershocks. We could only work on the ground floor of our three-storey building after an aftershock measuring 6·3 on the Ritcher scale occurred. Indeed, at midnight on day 5, the government, worried about further aftershocks, issued an evacuation order to move all patients outside the building onto the street. Within 2 h we had transferred 100 seriously injured patients to hastily erected hospital field tents, each one with different manufacturers' instructions.

Such experiences highlight the mental and physical stress that health relief personnel were under. In addition to their heavy clinical duties under suboptimum conditions and resources, teams had no preparedness training, little rest, and were working under ad-hoc arrangements. Dis-agreements about protocols for clinical management, quality of care, and level of expertise inevitably emerged, adding to the pressures. However, the team shared a common goal: helping survivors. And everyone held great respect for our site coordinators, who tried their best to support our work in difficult circumstances. The team spirit helped alleviate the discomforts of our shared makeshift home, where regardless of rank or gender, we slept in the open air on the streets, next to the tents where our patients were crammed together. When it rained we created makeshift shelters using thin plastic sheets, which kept us partially dry but offered little protection from the cold when the ambient temperature fell to below 10°C. The sound of falling cement, the movements of aftershocks, and patients moaning made an unlikely lullaby.

Our work at the triage site came to an end on day 14 after the disaster as the government decided to close down all triage sites and send all patients either to tertiary hospitals in Chengdu or Chongqing or out of the province for severe cases.

Post-emergency medical issues

Reflecting on the experience several lessons emerge. The rapid and effective response by the government should be commended, but the region's preparedness was insignificant, even though Sichuan is known to be at risk of earthquakes and had a major quake with human mortality in 1981.[10] The patterns of morbidity revealed a large burden on older people, whose chronic long-term conditions required additional care over and above the disaster response. Their rehabilitation will pose particular challenges—not least how their care will be paid for.



Emily Chan

Patients are transferred out of the Sichuan Province by simple trucks

Survivors expressed their concerns about medical costs and the associated treatments. To quote a 49-year-old man with multiple rib and hip fractures who was sent to Guangzhou to receive surgical intervention: "I don't know how we will get back to Sichuan. Things were so expensive in Guangzhou and we have nothing left. Everything is buried under the rubble. We have no resources to survive in the city and to pay for the treatment." Almost 10% of the most severely injured patients were sent out of province for treatment and it was not clear how they might pay for their daily living maintenance, rehabilitation after surgery, or return expenses to Sichuan after a potentially long stay for treatment despite the ongoing generosity and public support from richer parts of China.

Migrant workers among these internal displaced people could also face lack of entitlement to free medical services after the disaster. In the immediate aftermath, the government provided free access to services, irrespective of place of origin or status. Yet migrant workers, who make up 15% of the population in the affected area, tend to be from the lowest socioeconomic strata[11] and could face uncertainty about entitlement to

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Survivors evacuate through the rubble of Yingxiu on their way out of the epicentre

health services once the immediate emergency relief is over.

In addition to physical needs, mental health after the disaster will need to support not only survivors but also those involved in the relief process, including health-care workers themselves. And, as the acute phase of disaster relief comes to an end, the challenge of long-term policy and planning for rehabilitation services for populations with long-term disabilities becomes an additional need. Earthquakes are known to cause comparatively high mortality but low morbidity.[12] Injury patterns reported[13] in Sichuan seem to be similar to other earthquakes and survivors who are left with permanent disabilities might face challenges in physical recovery as well as having psychological needs. A month after the earthquake Chok Wan Chan, the president of the International Pediatric Association visited specific medical facilities for child survivors in the affected area. On his return he commented: "Children are housed in temporary tents where daytime temperatures can reach up to 40°C. Although their health conditions are stable, most of them are very frightened and many [are] left with disabilities. In addition to their mental health, the wellbeing, rehabilitation and protection of these orphaned children needs to be highlighted." Indeed, the media reports a police crack down on infant traffickers who prey upon lost children and orphans in hospitals. Concerns for "orphaned" older people should run in parallel. Social service and primary health-care facilities with an understanding of geriatric services will be needed to bridge the service gaps and prevent complications which could arise from a lack of medical treatment and care for their often multiple chronic diseases.

Conclusion

Most media and the international community have witnessed and commented positively on how China has responded to the Sichuan earthquake, the most severe natural disaster of the 21st century to date. The long-term health issues that China will need to address include sensitivity to the demographic profile and its implications for affordable treatment, rehabilitation, and long-term care at both ends of the age spectrum including concerns about mental health.

The successful avoidance of epidemics of infectious disease and provision of basics for public health such as clean water and food were commendable, and the efforts of volunteers and local organisations heroic. However, while the immediate rescue and response was managed in a swift and effective manner, the lack of emergency preparedness and training for medical staff to face the challenges of a natural disaster in a high-risk geographic area should signal an important lesson for future policy development.

Finally, as in other major disasters and human-security crises, the traumatic events will inevitably fade into the background and be forgotten by the media as other world events unfold.[14] The most difficult challenge in 2008 will be for the public to celebrate the Beijing Olympics while remembering the plight of those survivors who face long-term consequences and must rebuild their lives and communities.

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Chronic health needs immediately after natural disasters in middle-income countries: the case of the 2008 Sichuan, China earthquake

Emily Y.Y. Chan and Jackie Kim

Few studies have focused on chronic health needs immediately after natural disasters in middle-income countries. This study examines chronic medical needs during the acute phase after the 2008 Sichuan earthquake. A descriptive, cross-sectional study was conducted in an emergency triage clinic in Sichuan, China. Information on physical, social, and public health preparedness was collected in predesigned templates. Descriptive and Pearson's χ^2 association analyses were conducted. One hundred and eighty-two evacuees were received at the triage site. Of these, 54% required trauma treatment and 77% of evacuated patients who required care had underlying chronic medical conditions. Tetanus immunizations and the possession of chronic health medication were low, particularly among older patients. Chronic health needs constituted a significant proportion of emergency care during the acute phase in the study population. Effective post-disaster assistance requires attention to demographic and epidemiological population profiles. *European Journal of Emergency Medicine* **00:000–000 © 2010 Wolters Kluwer Health | Lippincott Williams & Wilkins.**

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Keywords: acute emergency phase, China, chronic diseases, disaster relief, humanitarian aid, middle-income and low-income areas, natural disasters, Sichuan

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Background

Recent disaster studies [1–7] have shown that chronic medical conditions are important health needs during the recovery phase of natural disasters. However, owing to the lack of data, chronic health needs and clinical profiles of survivors during the acute phase of natural disasters (first 2 weeks) are rarely reported. The patterns of emergency clinical needs during the acute disaster relief phase are uncertain, and information gaps may impede the clinical preparedness, resource allocation, and effectiveness of post-disaster medical response.

On 12 May 2008, an earthquake measuring 7.9 on the Richter scale occurred in Wenchuan in Sichuan, China. The earthquake, with a death toll of at least 80 000 [8], is considered to be one of the most destructive earthquakes till date. [9] This study examines the health and chronic disease burden presented during the acute emergency phase of the Sichuan earthquake.

Methodology

A descriptive, cross-sectional study was conducted in an emergency triage center in the 14 days after the Sichuan earthquake (13 May–28 May). Record-based data were collected from San Shui Triage Hospital, a maternal and child health care center turned emergency triage center that received helicopter-evacuated patients from the earthquake epicenter. The hospital provided emergency clinical care and stabilization and redeployment of patients to tertiary hospitals (within or out of province). Owing to damaged structural stability, only 15 patient beds were safe for patient care. Nevertheless, a total of 182 patients were admitted before the site rejected further patient admissions and the patients were managed in make-shift beds. When the site closed down after 15 days of emergency operation, all patients were either discharged or transferred to other sites. Clinical records were registered on predesigned templates. Anonymous patient information including background, physical health, social well-being, and proxies for public health preparedness and planning was collected. Descriptive analyses were conducted to assess morbidity patterns and health care needs of survivors. The association between demographic variables and health outcomes was examined using Pearson's χ^2 tests. Analyses were carried out using Microsoft Excel (Windows Microsoft Excel, Microsoft Corporation, Redmond, Washington, USA) and STATA 10.0 (StataCorp LP, College Station, Texas, USA).

Results

During the acute post-disaster phase (days 2–7), 182 patients were evacuated to this triage center. Among these

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evacuees, 12% (21 patients) were discharged on initial examination as no clinical medical needs were established, whereas another 16% (29 patients) were diverted to a tertiary hospital for life-saving surgeries. The study analyses thus focus on the 132 (73%) patients who were retained for clinical reasons in the triage center. It is worthy of note that no death occurred at the site during the study period.

Table 1 shows the demographic characteristics of patients in the triage center during the study period. Overall, older women constituted the majority of the patients. In general, there were more women (55%) than men (45%) among the evacuees. The median age for patients after triage was 79 years. Although most of the evacuees (82%) originated from the earthquake-affected zone were women (68%), 73% of the migrant subgroup was men.

Among the 132 patients (73% of total 182 evacuees) who required clinical management onsite, 54% of patients required trauma/surgical management, and 46% of patients had nonsurgical-related clinical needs. Trauma pattern analysis showed that 12% had trauma injury in multiple sites and that the extremities (12%) was the most common site for trauma injury. Patients who required chronic noncommunicable disease (NCD) management represented 30% of the clinical burden.

Table 2 shows a detailed breakdown of chronic NCD health needs, and emergency preparedness planning. The majority of admitted patients had at least one underlying NCD (77%). One-fifth of those had more than NCD, whereas another 12% were unaware of their NCD condition before this clinical encounter. Hypertension (47%) and diabetes mellitus (24%) represented the largest NCD disease burden. It is worthy of note that 54% of the NCD patient subset had clinical complications as a result of either disease exacerbation or lack of medication and required active clinical management.

Patients accompanied by family were found to have a more positive outlook on the future than those who were at the site alone. Findings show significant associations between reported future confidence and patient with accompanied person ($P = 0.03$), and between reported future

Table 1 Patient demographic and health needs profile

Patient profile	Male (%)	Female (%)	Total (%)
	N=82	*N*=100	*N*=182
Median age (range)	78 (2 month–95 years)	80 (12 days–93 years)	79
Origin			
Local (epicenter)	67 (45)	82 (55)	149 (82)
Proximal areas (Cheung Xia/Chung Ching)	7 (32)	15 (68)	22 (12)
Out of province migrant workers/travelers	8 (73)	3 (27)	11 (6)
Total	82 (45)	100 (55)	182
Transferred upon arrival	*N*=26	*N*=24	*N*=50
No clinical indication of care needed	16	5	21
Needed rediversion owing to other treatment	10	19	29
Total	26	24	50
Patients requiring management and hospital care	*N*=56	*N*=76	*N*=132[a]
Trauma/surgical (*n*=71)			
Main site of trauma:			
Head/face	2	2	4 (3)
Cervical	2	0	2 (2)
Spinal	2	4	6 (5)
Chest (ribs)	3	7	10 (8)
Pelvic	3	6	9 (7)
Extremities (arms/legs) (include joints)	9	7	16 (12)
Hand/feet (include joints: wrist and ankle)	5	3	8 (6)
Multiple trauma (which include more than one site with at least one of the following: cervical/chest/spinal/pelvis)	6	10	16 (12)[b]
Nontrauma related/but required hospitalization (*n*=61)			
Noncommunicable diseases without injury related treatment needs	13	26	39 (30)[c]
Need secondary clinical support (e.g. exhaustion, dehydration, nutritional wound infection)			
Pneumonia	1	2	3 (2)
Gastrointestinal infection	1	1	2 (2)
Wound infection	1	2	3 (2)
Exhaustion/dehydration	1	3	4 (3)
Patient requiring outpatient care (*n*=10)			
Need simple management and managed as outpatient (e.g. minor cuts, wound infection)	7	3	10 (8)
Total	56	76	132 (100)[d]

Among the 182 patients, 21 patients were discharged right away upon initial examination as no clinical medical needs were established. Ten patients had minor injury (such as cuts and bruises, which required wound dressing only and were managed as outpatients. Twenty-nine patients were rediverted to tertiary hospital for life-saving surgeries because of hemodynamic instability. Thus, a total of 50 were excluded in this analysis as their medical records were incomplete or medical reasons for evacuation were not established.

[a]One hundred and thirty-two patients were included in the analysis.

[b]Of note, 16 patients had multiple trauma and their injuries profiles were not listed in details to avoid double counting.

[c]Thirty-nine patients had no orthopedic injuries but chronic disease, which needed management.

[d]Rounded up to complete figures.

Table 2 **Health care needs for patients in the triage site ($n=102$)**

Chronic disease	Known history	Newly diagnosed (no earlier awareness)[a]	Total (%)	Treatment need (among NCD cases) (%)	Patients with medication (among NCD cases) (%)
Diabetes mellitus	20	4	24 (23)	15 (63)	3 (13)
Hypertension	42	6	48 (47)	29 (60)	5 (10)
Heart arrhythmia/health failure	15	2	17 (17)	10 (59)	4 (24)
Other conditions (required chronic medication)[b]	13	NA	13 (13)	5 (38)	2 (15)
Total	90	12	102 (100)	59 (58)	14 (14)
More than one chronic medical condition	20	NA	20 (20)		NA
Confidence about future		Yes	No	Total	OR (95% CI)**
Accompanied by someone	Yes	17	4	21	1.28 (0.073–2.48)
	No	32	27	59	$P=0.031$
Family/friends/relatives to rely on after disaster	Yes	28	14	42	2.01 (1.005–3.03)
	No	8	30	38	$P<0.001$
Emergency preparedness		≤ 60 years old	>60 years old	Total	
Tetanus[c]	Positive	36	5	41	
	Negative	62	52	114	
	Do not know	11	16	27	$P=0.013$*
	Total	109	73	182	

CI, confidence interval; NA, not applicable; NCD, noncommunicable disease; OR, odds ratio.
[a]Two independent spot blood glucose and blood pressure measurements, repeated in 24 hours. Spot glucose test was done 2 h after meal, cut off value: 7.0 mmol/l; blood pressure cut off values at 140/90 mm Hg.
[b]Example: thyroid supplements.
[c]One hundred forty-two with uncertain status/not immunized status; 77% not immunized.
*P value of Pearson's χ^2 is less than or equal to 0.05.
**P value of Pearson's χ^2 is less than or equal to 0.005.

confidence and someone to rely on ($P < 0.01$). Patients with perceived social support were 2.01 (95% confidence interval; odds ratio: 1.00–3.24) times more likely to report confidence with regard to the future.

Emergency preparedness in terms of tetanus immunization was low, particularly among the older age group. Over 60% of evacuees onsite were never immunized and 15% were not sure about their status. A significant difference in tetanus immunization status was found when comparing the age group of less than or equal to 60 years with those over 60 years of age.

Discussion

Chronic disease needs immediately after natural disasters in developing countries are rarely examined or reported on. Furthermore, medical needs during disasters observed in developed nations [1–4] may not be translatable to developing areas with suboptimal surveillance systems. Lack of management of chronic conditions may affect wound healing, hemodynamic suitability for surgery, and long-term complications. A clinical service utilization study in Banda Aceh, Indonesia post 2004 Tsunami showed that chronic disease medical needs [6] made up 43.5% of all medical service needs 1 month post disaster. Our study found that NCDs constituted 77% of immediate health need post earthquake, which is much higher than the 48.6% national NCD burden reported in 2008 [10].

To effectively address needs during the 'emergency phase' of natural disasters, preparedness, and planning are essential. As illustrated in the findings, there is a wide range of challenges for managing patients with chronic disease in developing countries. Some issues include patient unawareness of their clinical condition, inability to afford medication, medication lost during evacuation, and lack of medication stock-up for disasters/events. It is worthy of note that there might also be patients that are indirectly affected by the disaster owing to the collapse of medical infrastructure. Specifically, in China [11] the lack of possession in chronic disease medication and limited coverage of tetanus vaccinations indicate that emergency preparedness was limited in the study population. With the aging population and change in epidemiological disease profile of low-income and middle-income countries, the burden of chronic disease has become a major health need post disaster. Patients should be advised to stock up on necessary chronic disease medication in the event of an emergency to avoid preventable clinical complications. In addition, for effective response, dietary and allied medical support should be included in disaster response, as it enhances the recovery potential of patients. The decision to operate also depends on the mandates and guidelines [12] of agencies.

Limitations of this study include its small sample size and the lack of baseline comparison. Similar challenges were reported in other postdisaster epidemiological studies of health studies of internally displaced populations during the emergency phase in China [13], the south-east Asian Tsunami [6] and the Pakistan and Kashmir earthquakes [7]. True incidence rates could not be obtained for this study, as local surveillance systems were unable to capture the high levels of population movement immediately after the earthquake. The sample did not include fatalities or information related to victims' causes of death. As there are neither published reports nor explicit triage criteria for the acute rescue phase operations, inconsistencies may have affected the health and disease profile of survivors. However, the study attempted to provide the best available evidence to describe patterns of disease and health

needs immediately post disaster. It is worth noting that the template-based study design offered an unobtrusive opportunity to obtain relevant information. Not only did this provide data for further research analysis, but it also assisted relief operations in providing evidence of real-time program planning support. For instance, the original operation mandate did not include chronic disease management at the relief site. Nevertheless, with the available data, the evidence helped reprioritize needs, make medical assessments, and distribute related treatments.

Conclusion

The findings of this study highlight that while it is important to address acute trauma during the emergency phase post disaster, chronic clinical needs may constitute a significant proportion of emergency care needs immediately post earthquake in low-to-middle-income settings in China. The results serve as an important reminder for disaster emergency responders in developing countries that the management of NCD is complicated. Preexisting epidemiological profiles of the population, local infrastructure, and long-term sustainability in the affected areas should be taken into account to ensure effective and meaningful responses.

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Remote mobile health service utilization post 2005 Kashmir–Pakistan earthquake

Emily Y.Y. Chan and Jacqueline J. Kim

Aims **Limited published studies have examined patient characteristics and disease patterns served by mobile clinics in remote areas post natural disaster. By comparing users of a remote mountainous stationary clinic and a mobile helicopter outreach clinic in Neelam Valley, 4 months post Pakistan–Kashmir earthquake, this study aims to: (i) compare the demographic and disease profile of health service users, (ii) examine how acute and chronic disease patterns vary with clinical settings, and (iii) discuss the potential implications to mobile emergency clinical service planning acute phase of natural disaster in remote areas.**

Methods **Cross-sectional, retrospective record-based study in two remote clinical settings in Neelam Valley, Kashmir–Pakistan. Patients who presented to clinics from 21 January to 20 February, and whose diagnoses were available, were included in the study. Descriptive statistics and χ^2 significance tests were conducted.**

Results **Different users and disease profiles were found between mobile and stationary clinics. While older age, female sex, living further way from clinics, earthquake- related trauma, wound and gastrointestinal infections were found to be more significantly associated with mobile clinic users, stationary clinics patients tended to be younger, living closer to the clinic site, and disease profiles were predominantly chronic in nature.**

Conclusion **In addition to the provision of acute and chronic medical clinical service, mobile clinics operating during post acute emergency phase of natural disaster in remote areas should be sex sensitive, with highly trained and experienced staff as well as the capacity to provide trauma care.** *European Journal of Emergency Medicine* **00:000–000 © 2009 Wolters Kluwer Health | Lippincott Williams & Wilkins.**

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Keywords: air ambulances, disasters, earthquakes, emergency medical services, health services, health services needs and demands, Pakistan, relief work, remote areas, rural health

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Introduction

Published studies [1–8] have indicated that one of the major challenges after natural disasters in developing countries is the lack of access to health services in rural areas. Outreach medical services are a potential service provision modality that may improve access to health services in secluded and remote environments. Except for one published study on mobile health clinic utilization in conflict settings [9], there is no other published literature on the patient profile or disease pattern of mobile clinic users in remote areas after a natural disaster.

On 8 October 2005 at 08:50 h an earthquake measuring 7.6 on the Richter scale struck Pakistan's autonomous state of Kashmir and part of Indian-administered Kashmir [10]. In Neelam Valley, a mountainous region in Pakistan-administrated Kashmir close to the earthquake's epicenter, disaster destruction was close to 100% [11]. Using attendance in mobile clinics as a proxy indicator for expressed medical needs, this study compares retrospective clinical attendance data in a remote mountainous stationary clinic and a mobile helicopter outreach clinic to: (i) examine the demographic and disease profile of health service users in different settings, (ii) examine how acute and chronic disease pattern vary with clinical settings, and (iii) discuss the potential implications of emergency planning for mobile clinical services in the acute phase after natural disasters.

Methods

This cross-sectional, retrospective, record-based study was conducted in two remote clinics in Neelam Valley 2–4 months after the Kashmir–Pakistan earthquake. Relief clinical services in the two study clinics were set up and provided by the same relief organization [12] during the acute phase (the first 8 weeks after the earthquake). Similar treatment provision standards and management were ensured. Of note, the two study sites were the only clinical treatment facilities available in the area during the initial 4 months post earthquake, so it was assumed that health needs were captured by clinic attendance during the study period. Patients who visited clinics from 21 January to 20 February, and whose diagnoses were available, were included in the study.

Table 1 describes the research design and general characteristics of data collected in the two remote clinics post disaster. Data set 1 was collected from a mountainous

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Table 1 A description of research design and utilization pattern of clinical attendees in various health-care setting according to clinical records from January to February, 2006

Location	Border Mountain Clinic[a] at Sarli Sacha	Outreach clinic[b] reachable only by helicopter
Methods	Retrospective review of clinical records from 21 January to 20 February, 2006	Retrospective review of clinical records from 21 January to 20 February, 2006
Data collecting tool	Information table (clinic operation dates, patient case code, age, sex, distance of area of residence from clinics (by hours) and main diagnosis)	
Total record available	3097	145
Record included in the analysis	2942 (95%)	142 (98%)
Data (brief overview)	Average age of sample=38 years Age range=0–83 years	Average age of sample=35 years Age range=0–72 years Five full-day helicopter clinic sessions were made during the study period
Service taken up by older people[c]	14%	9%
Male/female	7:3	4:6

[a]Merlin's P3, Sarli Sacha Clinic.
[b]Merlin's P1, Panjkot outreach medical clinic.
[c]According to UNHCR, population aged 45 years constituted to about 19% of the population in that area. Old age can be defined in many ways, particularly between different societies. In rural Pakistan, it would be impractical to define old age by adopting the United Nation's chronological definition of older people as 60 years or above because the official life expectancy in 2009 was reported to be 63.4 and 65.64 years for male and female, respectively. Taking into consideration functional capacity, and social expectations of people in rural Pakistan who tend to marry young and become grandparents in their mid-forties, the definition of old age in the study setting was context specific and set to be 45 years or above.

border clinic at Sarli Sacha and data set 2 was solicited from outreach clinical services serving three rural areas (Zabbar, Konka and Tèlegra) around Neelam Valley reachable only by helicopter post earthquake. Five episodes of helicopter clinic sessions were made during the study period. One of the authors (EC) visited and collected clinical attendance data in February 2006, 4 months after the Kashmir–Pakistan earthquake. Previous published studies have documented the methodological limitations of the setting [4,11].

Clinical records were reviewed and data were entered anonymously into a manually input information table, which recorded clinic operation dates and patient information. Patient data included patient case code, age, sex, distance of area of residence from clinics (by hours), and main diagnosis. In total, 3097 (site 1) and 145 (site 2) clinical records were available for analysis. After review, 5% (site 1) and 2% (site 2) were excluded owing to illegible handwriting and missing information. For the final analysis, 2942 (95%) and 142 diagnoses (98%) were included. The data did not show evidence of selection bias in the recording of diagnoses and any nonrecording was assumed to be random.

All basic calculations were performed on-site. Information collected was categorized into various variables for analysis. Four age categories: less than 5, 6–44, greater than 45, and greater than 65 years were constructed. Sex of the patient was reported as a binary variable. Proximity to clinic was grouped into four groups: less than 30 min, 30 min to 1 h, 1–4 h, and greater than 4 h. Clinical diagnosis was divided into four main groups, namely: trauma/injury (earthquake related and nonearthquake related), infection (wound, respiratory, gastrointestinal-related, skin), chronic conditions (diabetes mellitus, hypertension, heart related conditions, arthritis, pain), as well as nonspecific medical complaints.

Descriptive statistics and χ^2 significance comparisons were conducted to examine and compare the patient profile and disease patterns between the two remote clinics. Pakistan national data were also obtained from a public database to compare demographic characteristics and disease profile [13]. Data entry, management, and analyses were conducted using Windows Microsoft Excel (Microsoft Corporation, Redmond, Washington, USA) and statistical packages EPI Info [United States Department of Health and Human Services, Centers for Disease Control and Prevention (CDC), Atlanta, Georgia, USA] and STATA 10.0 (StataCorp LP, College Station, Texas, USA).

Results

A total of 2942 and 142 consultation records from the mountainous clinic (site 1) and the remote area outreach medical services (site 2), respectively, were reviewed and analyzed in this study. Results are presented in the following sections according to: (i) the comparison of demographic and disease profile of health service users in the two study sites and (ii) comparison of acute and chronic disease patterns in these remote settings.

Comparison of demographic and disease profiles of health service users in the two remote clinical sites

Table 2 shows the results by comparing user demographic characteristics and diagnoses of stationary clinic versus mobile clinic after the acute phase of 2005 Kashmir earthquake in remote areas. Overall, significant differences were found in the comparison. The average age of stationary clinic users (38-years-old) was slightly higher than those at the mobile clinic (35-years-old). While 44% of the stationary clinic were from the extreme of age (<5 and >45-years-old) as compared to 32% in the mobile clinic, the mobile clinic had twice as many patients older

Table 2 Chi-square comparison between user characteristics of stationary clinic versus mobile clinic post acute phase of 2005 Pakistan–Kashmir earthquake in remote areas

	Stationary clinic (n=2942)	Mobile clinic (n=142)	χ^2 test	
Demographic information	% (95% CI)	% (95% CI)	P value*	National statistics (%)
Age				
<5 years old	30 (28–32)	23 (16–30)	0.09	15[a]
6–45 years old	56 (54–58)	23(16–30)	0.07	71
>45 years old[c]	14 (13–15)	9 (4–14)	0.09	14[a]
>65 years old[c]	3 (2–4)	6 (2–10)	0.09	3[a]
Mean age, years (range)	38 (0–83)	35 (0–63)	NA	N/A
Sex				
Female ratio (%)	3:7, 30 (28–32)	5:4, 56 (47–64)	<0.01	49[a]
Proximity to clinic (travel time from home)				
<30 min	25 (23–27)	15 (9–21)	0.01	NA
>30 min to <1 h	35 (33–37)	25 (18–32)	0.02	NA
>1 to <4 h	30 (28–32)	40 (32–48)	0.01	NA
>4 h	10 (9–11)	20 (13–27)	<0.01	NA
Main diagnosis				
Trauma/injury	15%	25%	NA	
Trauma/injury earthquake related	10 (9–11)	18 (12–24)	<0.01	41.2 (95% CI: 32.2 50.0) per 1000[b]
Trauma/injury nondisaster related	5 (4–6)	7 (3–11)	0.28	
Infection	35%	51%	NA	
Wound	5 (4–6)	15 (9–21)	<0.01	NA
Respiratory (include pneumonia, URTI)	22 (21–23)	20 (13–27)	0.52	NA
Gastrointestinal (watery diarrhea, bloody diarrhea)	5 (4–6)	15 (9–21)	<0.01	NA
Skin/Scabies	3 (2–4)	1 (0–2)	0.11	NA
Chronic conditions	42%	21%	NA	
DM	2 (1–2)	3 (0–4)	0.50	NA
HT	8 (7–9)	9 (4–14)	0.62	NA
Heart conditions	2 (1–2)	2 (0–4)	0.93	NA
Arthritis	13 (12–14)	3 (0–6)	<0.01	NA
Pain (back, stomach, head)	17 (16–18)	4 (1–7)	<0.01	NA
Nonspecific medical condition	8 (7–9)	3 (0–6)	0.02	NA

CI, confidence interval; DM, diabetes mellitus; HT, hypertension; NA, not applicable; URTI, upper respiratory tract infection.
[a]Rural areas, Pakistan Demographic Survey 2003, Federal Bureau of Statistics, Government of Pakistan.
[b]Rural unintentional injuries per year, National Health Survey Pakistan 1990–1994.
[c]Old age can be defined in many ways, particularly between different societies. In rural Pakistan, it would be impractical to define old age by adopting the United Nation's chronological definition of older people as 60 years or above because the official life expectancy in 2009 was reported to be 63.4 and 65.64 years for male and female, respectively [10]. Taking into consideration functional capacity, and social expectations of people in rural Pakistan who tend to marry young and become grandparents in their mid-forties, the definition of older age in the study setting was context specific and set to be 45 years or above.
*P value is rounded up to two decimal places.

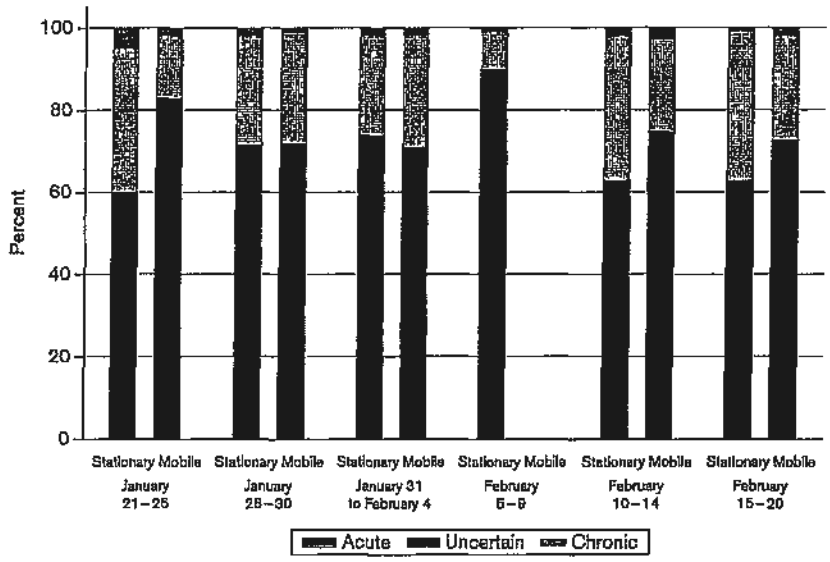
than 65-years-old [stationary (3%) vs. mobile (6%), $P = 0.03$]. Fifty-six percent of mobile clinic users were female compared with 30% in the stationary clinic ($P < 0.011$). Travel distance was also found to be significantly longer at the mobile clinic than the stationary clinic ($P < 0.01$ in all categories), with 20% of mobile clinic users living in areas more than 4 h away as compared with 10% in the stationary clinic group.

Except for respiratory disease, which was the largest single diagnoses group and constituted 20–22% of caseload in both the clinics, disease patterns were different between the sites. Mobile clinic attendees tended to have more earthquake-related trauma [mobile (18%) vs. stationary (10%), $P < 0.01$], wound infections [mobile (15%) vs. stationary (5%), $P < 0.01$], and gastrointestinal diseases [mobile (15%) vs. stationary (5%), $P < 0.01$]. Meanwhile, stationary clinics had tripled the number of patients presented with chronic conditions than mobile clinics. Arthritis [stationary (13%) vs. mobile (3%), $P = 0.01$] and various forms of pain (including stomach, head and back) were found to be significantly different between the two sites [stationary (17%) vs. mobile (4%), $P = 0.01$]. In addition, more nonspecific medical conditions were presented at stationary clinic as compared with mobile clinic [stationary (8%) vs. mobile (3%), $P = 0.02$].

Difference in acute versus chronic disease patterns in clinical settings

As indicated in Table 2, chronic diseases constituted 42% of caseload in the stationary clinic, which was double that of the mobile clinic (21%). Figure 1 shows a comparison of the proportion of chronic and acute diseases per week within the study period. 'Acute conditions' consisted of trauma/injury (earthquake related and nonearthquake related) and infection (wound, respiratory, gastrointestinal related, skins), whereas 'chronic conditions' included diabetes mellitus, hypertension, heart-related conditions, arthritis, and pain. Nonspecific medical complaints were grouped as 'uncertain group' within the figures. In general, although more chronic conditions were presented in the stationary clinic than the mobile clinic, descriptive results indicated that diagnosis of acute conditions remained as the majority cause of clinical visits (approximately 50–75%) for both remote clinics during the post acute phase of the disaster.

Fig. 1



A comparison of the proportion of acute and chronic diseases presented at the two study sites in remote areas per week during the study period. A total of 2942 and 142 consultation records were reviewed from the mountainous clinic (site 1) and the remote area outreach medical services (site 2), respectively during the defined study period from 21 January to 20 February 2006. Acute conditions consisted of trauma/injury (earthquake related and nonearthquake related) and infection (wound, respiratory, gastrointestinal related, skins), chronic conditions included diabetes mellitus, hypertension, heart-related conditions, arthritis, pain and nonspecific medical complaints was grouped as uncertain group within the figures.

To summarize, the findings indicate a different demographic and disease profile between mobile clinic and stationary clinic attendees in remote settings during the acute emergency phase of a natural disaster. Older age, female sex, living further way from clinics, patients with earthquake-related trauma, wound infection, and gastrointestinal conditions were found to be more significantly associated with mobile clinic users. Meanwhile, users of stationary clinic tended to be younger, living closer to the clinic site, and having disease profiles, which were predominantly chronic in nature.

Discussion

The findings coincide with a previous study of mobile medical units after Hurricane Katrina struck in New Orleans, USA [8]. Among the underserved population in affected areas, commonly encountered diseases included respiratory illnesses, skin conditions, and minor injuries. A high proportion of visits were for vaccine administration and chronic medical problems including hypertension, diabetes, and asthma. Our study of mobile service users post earthquake in remote Pakistan suggests that in addition to acute and chronic medical needs, trauma and wound care are needed in areas served by mobile clinic, which presumably are more remote and secluded. In addition, the user demographic patterns also imply that sex-sensitive services should be organized to cater to the traditional and conservative culture in rural areas.

There seems to be an underreporting of chronic disease health needs (<30%) when compared with other post disaster health-care utilization studies of the 2005 Indian Ocean tsunami [6], the El Salvador earthquake [1–3], as well as the Kashmir earthquake [4,14,15], which reported caseloads of 43–79%. A possible explanation for this discrepancy may have been the lack of awareness of underlying medical problems and lack of clear protocol for documentation in this study. A review of clinical records showed an absence of clear documentation of underlying common chronic diseases. In addition, while most relief health care settings had the necessary drug procurement for basic treatment of common chronic medical problems (e.g. diabetes mellitus or hypertension), the lack of awareness of underlying medical problems and the absence of technical expertise may have contributed to a general reluctance in managing nonacute conditions [16]. Although evidence shows suboptimal care and a missed opportunity for populations with noncommunicable chronic conditions to receive quality clinical treatment [17], there are currently limited standards and guidelines for the management of existing chronic diseases to complement the management of acute situations. For example, the second edition of Sphere project recommends that only life-saving therapy should be given post disaster for patients with chronic conditions [18]. With the complexity of clinical management and potential implications on sustainability of treatment post disaster,

further research study is warranted to examine issues related to the scope and management of chronic diseases post emergency in resource-deficit and expertise-deficit settings.

Although mobile services might be an effective initiative to improve access to emergency health services for disaster-affected populations, it is important to highlight certain limitations [9]. Similar to mobile clinics in conflict zones, mobile services post natural disaster in remote areas are generally expensive to run and require extensive logistical and operational support including helicopters, medication, or equipment supply chains. To be effective, mobile clinics should always have the ability to send patients to a referral facility and carry out medical evacuations as necessary. Mobile clinic service providers should be highly trained and experienced as they are gatekeepers to expensive patient transfer procedures and specialized services. Before services are commissioned, it would be important to preassess the disease pattern in served areas to prioritize services.

The findings had several study limitations. First and foremost, technical and situational resources were the major challenges encountered during the Kashmir field health needs assessment [4,11]. Our access to clinics was subject to difficult terrain, weather uncertainty and constant environmental risks such as landslides. These challenges posed major difficulty in planning and impeded our assessment team from venturing into home settings in remote mountains. As a result, only attendance to the two study clinical sites was used as a proxy for expressed health needs. Of note, the choice of sites for fixed and mobile clinical service-by-service provider was dictated mainly by logistic feasibility and government recommendations. The remote fixed clinic was established at a collapsed government high mountain outpost post earthquake where a helicopter-landing pad was available for transportation purpose. The helicopter mobile clinical service was supposed to outreach population that had major access difficulty to the fixed clinic and the choice of mobile clinical provision sites was governed by the potential remote population coverage, area remoteness, weather conditions, and landing feasibility. Although our study design attempted to explore health needs of remote population post earthquake, it nevertheless suffered from intrinsic population selection bias and captures no information for understanding the experiences of the most vulnerable that were presumably unable to reach clinics owing to immobility or distance [19]. In addition, while local counterparts attempted to inform potential attendees about clinic dates and location, the helicopter mobile service was irregular and limited by weather conditions. It is uncertain how information dissemination regarding the timing of mobile clinic availability and mobile clinical services site selection might also have affected patient access.

In addition, information bias might have stemmed from clinical diagnostic inaccuracies owing to the limited clinical expertise, the lack of relevant diagnostic equipments (e.g. blood glucose monitoring), potential equipment instability (subzero temperatures), and unawareness of the importance of good audit data collecting and record keeping of medical information. As a cross-sectional study, it was impossible to examine the dynamic nature of the post relief experience. For instance, even though user comparison was made during the same study period and these clinical services had no service provision competitors, the stationary clinical service was made available 5 weeks post earthquake and the helicopter mobile unit was only available after 8 weeks because of the concern of access and well-being patients in the secluded area. It was unclear how this may have affected the attendance and ultimately user characteristics. Last but not least, with limited published literature on this topic, no comparison could be made related to the findings of emergency clinical service delivery in the post acute phase of natural disasters. Nevertheless, the findings of this study may help enhance the understanding of clinical emergency responders to health needs in remote rural settings in developing countries.

Conclusion

Findings indicated a different disease profile in mobile clinics when compared with stationary clinics during the acute emergency phase after a natural disaster. To effectively address acute and chronic health needs in remote areas after a natural disaster, mobile clinic operating during acute emergency phase should be sex sensitive, have highly trained and experienced staff, and provide trauma and wound care.

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obtained from patients and had obtained ethical approval by relief organizations: Merlin and HelpAged International.

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Characteristics and health outcomes of internally displaced population in unofficial rural self-settled camps after the 2005 Kashmir, Pakistan earthquake

Emily Y.Y. Chan and Jacqueline J. Kim

Objectives **No published study, to date, has examined the characteristics and health outcomes of natural disaster-affected populations in unofficial rural self-settled internally displaced camps. By examining resident profiles in various unofficial rural displaced settlements after the 2005 Kashmir, Pakistan earthquake, this study aims to (i) describe the demographic and epidemiological characteristics of residents, (ii) compare their health outcomes with those of residents in official displaced camps, and (iii) highlight health needs and discuss implications for future disaster health relief operations.**

Methods **A cross-sectional, cluster-sampling, face-to-face household survey was conducted in 167 households in various forms of internally displaced camps within a 185 km radius around Muzafarabad city 4 months after the 2005 Kashmir, Pakistan earthquake. Demographic characteristics, earthquake damage, and *self-reported* health outcomes were collected from these camps, and descriptive statistics were determined and χ^2 significance comparison conducted.**

Results **Significant differences in demographic characteristics and health outcomes were found according to the size of the unofficial internally displaced camps. Although residents of larger unofficial self-settled camps seemed to have similar characteristics and health outcomes to residents of official camps, those living in smaller unofficial camps had the largest average family size; received the least assistance and resources to sustain livelihood; had less access to information, medical service, and chronic disease medication for underlying medical problems; and worse self-reported health outcomes.**

Conclusion **The study results indicate that future post-earthquake medical relief operations should evaluate health needs and consider delivery of direct medical assistance to small unofficial self-settled camps in affected rural communities. *European Journal of Emergency Medicine* 00:000–000 © 2009 Wolters Kluwer Health | Lippincott Williams & Wilkins.**

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Keywords: developing countries, disaster, earthquakes, health services needs, internally displaced population, Pakistan, rural health, rural population, self-settled camps, unofficial camps

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Introduction

Disasters tend to affect the most vulnerable population subgroups in developing countries. Owing to logistic difficulties, disaster-affected populations in rural areas often rely on community resources instead of external assistance for post-disaster relief and recovery [1]. Post-disaster, many rural residents have to seek refuge in self-settled unofficial internally displaced population (IDP) camps. Although an accurate figure is difficult to ascertain, in 2006 there was an estimated 24.5 million IDP worldwide [2]. IDPs are a heterogeneous group as their experiences vary with their length of stay, the resources available, and the political situation. Yet, many IDP camp settlers experience difficulty in accessing assistance and relief resources, and they often have to face higher risk for negative health outcomes, such as diseases, death, violence, and problems related to poor general public health [3–5]. Although there are published studies that report the health status and experiences of populations in temporary 'official' IDP camps, no published study has examined the health outcomes of residents of 'unofficial' self-settled camps, which often consist of fewer than 50 tents in rural areas. Specifically, as these small self-settlements have no official status, their residents are typically forgotten in the relief system. Residents are frequently excluded in policy, and are ineligible to receive external assistance or medical support [1].

On 8 October 2005 at 08 : 50 h, an earthquake measuring 7.6 on the Richter scale struck Pakistan's autonomous state of Kashmir and part of Indian-administrated Kashmir [6]. A field health need study was undertaken in February 2006 [7], 4 months after the earthquake in

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Neelam Valley, a mountainous region close to the epicentre where disaster destruction was close to 100% [8]. By examining resident profiles in various unofficial rural displaced settlements after the earthquake, this study aims to (i) describe the demographic and epidemiological characteristics of these camp residents, (ii) compare their health outcomes with those of official camp residents, and (iii) highlight health needs and discuss implications for future disaster health relief operations.

Methods

A cross-sectional, cluster-sampling, face-to-face, household-based survey was conducted 4 months after the 2005 Kashmir, Pakistan earthquake. A total of 167 households in internally displaced camps located within a 185 km radius of Muzafarabad city were included in the study. There were nine unofficial self-settled camps with less than 50 households in the area, and with the assistance of the largest local NGO disaster response group that had accessed these settlements, all nine unofficial self-settled camps were included in the sampling frame. For cluster-sampling purposes, the study team artificially divided the nine camps into three main clusters according to the number of households (1–15 households; 16–30 households, and 31–49 households) within these camps. One camp was randomly selected from each cluster size and a total of three unofficial camps were invited to participate in this study. The household response rate post-invitation was 98% and a total of 85 'unofficial camp' households were included in this study. For the final analysis, the 'unofficial camp' sample included 49 households (392 residents) for the 31–49 household cluster, 28 households (238 residents) for the 16–30 household cluster, and eight households (66 residents) for the 1–15 household cluster. To serve as a baseline comparison and to identify potential differences between official and small unofficial self-settled camps, a rural 'official' registered IDP camp with 276 households (1932 residents) was also invited to participate in the study. Through snowball sampling, 82 households (30% of the official camp) were recruited and interviewed.

Face-to-face structured interviews were conducted over 10 days in February 2006 to collect information related to demographic characteristics, earthquake damage, self-reported health outcomes of study participants with regard to physical, mental, and social health status, and expressed needs post-disaster. The survey was designed in English and translated by bilingual speakers (Urdu and English). Sex-specific interviewers obtained the information, and all interviews were conducted by interpreters and healthcare workers who spoke both Urdu and English. The questionnaires were piloted and the reliability of the tool was tested. The reported information was crosschecked with local healthcare workers to ensure the quality of translation. As illiteracy rates are high in the region (80%), verbal instead of written consent with witness verification was obtained from all patients interviewed during the field assessment.

The challenges encountered during the study are reported in detail in another study [7]. Descriptive statistics and χ^2 significance comparisons were conducted between different camps. Data entry, management, and analyses were conducted using Windows Microsoft Excel (Windows Microsoft Excel, Microsoft Corporation, Redmond, Washington, USA) and the statistical packages Epi Info [United States Department of Health and Human Services, Centers for Disease Control and Prevention (CDC), Atlanta, Georgia, USA] and STATA 10.0 (StataCorp LP, College Station, Texas, USA).

Results

Overall, the results indicate that resident characteristics and post-disaster profiles varied with camp size. In general, greater similarities in resident profiles were found between official self-settled camps and the larger unofficial self-settled camps. Demographic characteristics; earthquake-related impact; physical, mental, and social health; and expressed needs are discussed in the following section. Tables 1–3 show the results for selected demographic characteristics, earthquake-related, and health-related status comparison, respectively, among the various types of rural self-settled IDP camps.

Demographic characteristics

Table 1 shows the comparison of demographic characteristics among official and unofficial internally displaced camps. The households in the smaller unofficial camps tended to be headed by women (percentage of men, in order of smallest to largest self-settled camp: 45, 55, 70%), had larger family sizes (average family size, in order of smallest to largest self-settled camp: 9,8,8), had a larger percentage of elderly residents than the larger camps (60 vs. 50% and 50%, respectively), and originated from local areas (in order of smallest to largest self-settled camp: 60, 35, 30%). Smaller camps were also more likely to be the first settlement for residents 4 months post-disaster (first settlement in order of smallest to largest self-settled camp: 80, 48, 40%).

Earthquake-related damage

Table 2 reports on the difference in reported earthquake-related damage among various official and unofficial internally displaced camps. Smaller self-settled camps tended to have residents who sustained more severe property/possession loss (smallest self-settled camp 80% vs. official camp 70%, $P = 0.09$), reported more family deaths (smallest camps 60% vs. official camp 40%, $P < 0.01$), and received less assistance post-earthquake (aggregated small camp 49% vs. official camp 70%,

Table 1 Demographic characteristics among the IDP camps

	IDP 1 (n=392)	IDP 2 (n=238)	IDP 3 (n=66)	Combined (C)[a] (n=696)	Official (O)[b] (n=574)	1×O	2×O	3×O	C×O
Number of households	49	28	8	85	82	P value (χ^2 test)			
Average household size (number of people)	8	8	9	8	7				
Respondents head of household	55 (50–60)	60 (54–66)	100 (100–100)	61 (57–65)	55 (53–57)	1.00	0.19	<0.01	0.03
Sex (respondents)									
Male	70 (65–75)	55 (49–61)	45 (33–57)	63 (59–66)	70 (68–72)	1.00	<0.01	<0.01	<0.01
Originally from									
Local (within 30 min)	30 (25–35)	35 (29–41)	60 (48–72)	35 (31–38)	35 (33–37)	0.10	1.00	<0.01	0.87
Other city (>30 min from site)	20 (16–24)	15 (10–20)	10 (3–17)	17 (15–20)	15 (13–17)	0.04	1.00	0.27	0.26
Rural/mountainous area (>30 min from site)	40 (35–45)	50 (44–56)	30 (19–41)	42 (39–46)	55 (53–57)	<0.01	0.19	<0.01	<0.01
Is this the first settlement?	40 (35–45)	48 (42–54)	80 (70–90)	47 (43–50)	40 (38–42)	1.00	0.04	<0.01	0.02
< 5-year-olds	30 (25–35)	30 (24–36)	20 (10–30)	29 (26–32)	30 (28–32)	1.00	1.00	0.09	0.71
Older people (>45-years-old)	50 (45–55)	50 (44–56)	60 (48–72)	51 (47–55)	35 (33–37)	<0.01	<0.01	<0.01	<0.01

Data are expressed as percentages (95% CI) and values are rounded off.
CI, confidence interval; IDP, internally displaced population.
[a]Combined represents the sum of unofficial IDP 1, IDP 2, and IDP 3 (1, 2, 3 being the IDP camp numbers).
[b]82 out of 276 (30% response rate) households were included in the rural official IDP camp sample. The total number of residents in the official 276 household camp was 1932.

Table 2 Earthquake-related damage among the IDP camps

	IDP 1 (n=392)	IDP 2 (n=238)	IDP 3 (n=66)	Combined (C)[a] (n=696)	Official (O)[b] (n=574)	1×O	2×O	3×O	C×O
						P value (χ^2 test)			
Households reported to have received some form of assistance post-earthquake	60 (55–65)	40 (34–46)	20 (10–30)	49 (46–53)	70 (68–72)	<0.01	<0.01	<0.01	<0.01
Loss of possessions									
House (non-repairable or in serious doubt about safety)	65 (60–70)	75 (69–81)	80 (70–90)	70 (66–73)	70 (68–72)	0.10	0.16	0.09	0.95
Cannot sustain livelihood (loss of farmland, livestock, products/goods)	60 (55–65)	85 (80–90)	90 (83–97)	71 (68–75)	65 (63–67)	0.11	<0.01	<0.01	0.01
Financial									
Household income of some sort after earthquake (includes financial assistance)	35 (30–40)	30 (24–36)	10 (3–17)	31 (27–34)	35 (33–37)	1.00	0.17	<0.01	0.12
Experience death (at least one family member/ close relatives)	40 (35–45)	40 (34–46)	60 (48,72)	42 (38–46)	40 (38–42)	1.00	1.00	<0.01	0.49

Data are expressed as percentages (95% CI) and values are rounded off.
CI, confidence interval; IDP, internally displaced population.
[a]Combined represents the sum of unofficial IDP 1, IDP 2, and IDP 3 (1, 2, 3 being the IDP camp numbers).
[b]82 out of 276 (30% response rate) households were included in the rural official IDP camp sample. The total number of residents in the official 276 household camp was 1932.

$P < 0.01$). It is of concern that these small self-settled IDP residents (aggregated small camps 71% vs. official camp 65%, $P = 0.01$) also had less means to sustain livelihood and household income post-disaster.

Health-related impact

Table 3 illustrates the health outcomes of residents in various official and unofficial internally displaced camps. Residents of the official camp was nearly twice as likely to report better well-being as those residing in the smallest camp (60 vs. 35%, $P = 0.01$). No statistical difference in earthquake-related injury incidence rate was detected among different self-settled camps (30–35%), although the official camp reported a lower incidence of earthquake injury. When comparing self-rated health status before and after the disaster, 50% of the smallest self-settled unofficial camp residents claimed that their health had worsened compared with 35% in the largest unofficial self-settled camp.

Although infectious disease patterns were comparable among small unofficial self-settled camps, when compared with official camps, detailed differential analysis showed that residents in smaller unofficial self-settled camps experienced more gastrointestinal infections (smallest camp 65% vs. official camp 45%, $P < 0.01$) and skin infections (smallest camp 60% vs. official camp 40%, $P < 0.01$) after the earthquake. Although the proportion of the population with chronic conditions was similar across these studied camps, 85% of residents in the smallest unofficial camp had no available drugs to manage their chronic medical conditions as compared with their counterparts residing in larger rural unofficial (40%) and official camps (25%).

Table 3 Health-related issues among IDP camps

	IDP 1 (n=392)	IDP 2 (n=238)	IDP 3 (n=66)	Combined (C)[a] (n=696)	Official (O)[b] (n=574)	1×O	2×O	3×O	C×O
						P value (χ^2 test)			
Health-related problems									
Self-reported health status									
Well being (0–5 point scale)	60 (55–65)	40 (34–46)	35 (23–47)	51 (47–55)	60 (58–62)	1.00	<0.01	<0.01	<0.01
Loss weight	40 (35–45)	40 (34–46)	60 (48–72)	42 (38–46)	50 (48–52)	<0.01	0.01	0	<0.01
Eating problems	40 (35–45)	36 (28–41)	30 (19–41)	37 (34–41)	50 (48–52)	<0.01	<0.01	<0.01	<0.01
Health status as compared with that before the earthquake									
Better	26 (21–29)	15 (10–20)	10 (3–17)	20 (17–23)	25 (23–27)	1.00	<0.01	<0.01	<0.01
Similar	30 (25–35)	40 (34–46)	25 (15–35)	33 (29–36)	30 (28–32)	1.00	0.01	0.40	0.26
Worsen	35 (30–40)	30 (24–36)	50 (38–62)	35 (31–38)	35 (33–37)	1.00	0.17	0.02	0.91
No comments	15 (11–19)	15 (10–20)	15 (6–24)	15 (12–18)	10 (9–11)	0.02	0.04	0.21	0.01
Reported injuries	30 (25–35)	30 (24–36)	35 (23–47)	30 (27–34)	25 (23–27)	0.09	0.14	0.08	0.08
Medical problems related to earthquake									
Reported of at least 1 household member post earthquake who had acute conditions and required medical attention									
Gastrointestinal	45 (40–50)	30 (24–36)	65 (53–77)	42 (38–45)	45 (43–47)	1.00	<0.01	<0.01	0.25
Skin	40 (35–45)	30 (24–36)	60 (48–72)	38 (35–42)	40 (38–42)	1.00	0.01	<0.01	0.58
Wound	25 (21–29)	25 (19–31)	25 (15–35)	25 (22–28)	25 (23–27)	1.00	1.00	1.00	1.00
More than 1 of the above	20 (16–24)	20 (15–25)	45 (33–57)	22 (19–25)	20 (18–22)	1.00	1.00	<0.01	0.30
Family members with known chronic conditions and on medication before earthquake (include diabetes mellitus, hypertension, arthritis, heart disease, hyperthyroidism)	35 (30–40)	40 (34–46)	40 (28–52)	37 (34–41)	35 (33–37)	1.00	0.18	0.42	0.42
With no available drugs to manage conditions	40 (35–45)	60 (54–66)	85 (76–94)	61 (47–55)	25 (23–27)	<0.01	<0.01	<0.01	<0.01
Psychological-related problems									
Depressed	30 (25–35)	25 (19–31)	45 (33–57)	30 (26–33)	30 (28–32)	1.00	0.15	0.01	0.91
Felt helpless	20 (16–24)	35 (29–41)	50 (38–62)	28 (25–31)	20 (18–22)	1.00	<0.01	<0.01	<0.01
Anxious	35 (30–40)	40 (34–46)	45 (33–57)	38 (34–41)	35 (33–37)	1.00	0.18	0.11	0.33
Sleeplessness	50 (45–55)	40 (34–46)	50 (38–62)	47 (43–50)	50 (48–52)	1.00	0.01	1.00	0.22
Poor appetite	30 (25–35)	45 (39–51)	50 (38–62)	37 (33–41)	30 (28–32)	1.00	<0.01	<0.01	0.01
In fear for another disaster	45 (40–50)	30 (24–36)	55 (43–67)	41 (37,44)	30 (28–32)	<0.01	1.00	<0.01	<0.01
Social health-related problems									
In contact with other family members (beyond the immediate circle)	65 (60–70)	40 (34–46)	20 (10–30)	52 (48–56)	65 (63–67)	1.00	<0.01	<0.01	0.49
In contact with at least one friend/colleague/ neighbour	65 (60–70)	60 (54–66)	45 (33–57)	61 (58–65)	70 (68–72)	0.10	0.01	<0.01	<0.01
Felt supported by network and the community	70 (65–75)	55 (49–61)	55 (43–67)	63 (60–67)	75 (73–77)	0.09	<0.01	<0.01	<0.01

Data are expressed as percentages (95% CI) and values are rounded off.
CI, confidence interval; IDP, internally displaced population.
[a]Combined represents the sum of unofficial IDP 1, IDP 2, and IDP 3 (1, 2, 3 being the IDP camp numbers).
[b]82 out of 276 (30% response rate) households were included in the rural official IDP camp sample. The total number of residents in the official 276 household camp was 1932.

With regard to psychological health, there was a significant difference in reported psychological symptoms when comparing rural official and unofficial camps. Although complaints of sleeplessness (40–50%) were similar among residents of various camp types, more residents in rural unofficial small camps were found to be feeling depressed (45% in smallest camps vs. 30% in official camp, $P = 0.01$), helpless(50% in smallest camps vs. 20% in official camp, $P < 0.01$), and to be experiencing poor appetite (50% in smallest camps, vs. 30% in official camp, $P < 0.01$) post-earthquake. Furthermore, residents in smaller camps reported having more fear of another disaster (55% in smallest camps, vs. 30% in official camp, $P < 0.01$).

For social health and well-being, although settlers in the largest unofficial rural camp were comparable with those in official camps in terms of establishing post-disaster contact with family (for both: 65%), only 20% of settlers in the smallest camp were in contact with other family members. In addition, only 55% of the smallest rural camp residents reported having felt supported by network and community when compared with the larger unofficial rural (70%) and official camps (75%).

Expressed needs were also studied, and were found to be different among residents of the different camp types. For the smallest unofficial camp, medical, financial, and access to information were regarded as the most immediate needs 4 months after the earthquake (33% reported for each). The second smallest unofficial camp cited household utensils (45%), the largest rural unofficial camp cited psychological (55%) services, and the official rural camp reported both psychological services (45%) and utensils (45%) as the most important needs that would support their well-being in the study period.

Summary of the results

Significant differences in settlers' demographic characteristics and health outcomes were found according to the

size of the unofficial IDP camps. Although larger unofficial self-settled camps seemed to have similar characteristics and health outcomes to official camps, the most vulnerable population groups, who had the largest average family size and received the least assistance and resources to sustain livelihood, were found in the smaller unofficial camps. These residents exhibited the worst self-reported physical, mental, and social health outcomes. It is noteworthy that the results also indicated that the populations in the smaller unofficial camps experienced less access to information, medical services, and chronic disease medication for underlying medical problems.

Discussion

Overall, our results indicate differences in population characteristics and health outcomes among residents of different types of rural small self-settled camps 4 months post-earthquake. The findings reveal that vulnerability, in terms of extremes of age, access to assistance, information, medication, and various health outcomes, is inversely related to the size of the internally displaced camp post-natural disaster. The most vulnerable population subgroups are found in the smallest rural unofficial self-settled camps. Unfortunately, owing to various policy and logistic reasons, major relief groups have frequently focused their relief efforts on official camps [1]. Furthermore, disaster-affected populations in the small unofficial relief camps are frequently ineligible for official assistance. These marginalized groups are often left to fend for their own relief resources and health assistance. For instance, this study has found that residents in the smallest unofficial camps are four times less likely to obtain chronic medication to manage their underlying chronic medical illness 4 months post-earthquake than their counterparts living in official camps. Given the demographic characteristics, limited access to assistance, chronic medical conditions, and lack of information in smaller unofficial IDP camps, disaster response efforts that aim to target vulnerable populations should include service modalities (e.g. health information dissemination and outreach clinics) that may cater to the health needs of populations in these unofficial self-settled camps.

Recent studies have highlighted the fact that populations in official IDP camps post-conflict are susceptible to infectious diseases. [9,10] Physical and mental health statuses were also found to be associated with deprivation of basic goods and services, traumatic events, and fear and uncertainty among displaced and crisis-affected populations [11,12]. Although specific patient characteristics and health patterns were identified in small unofficial camps post-earthquake in this study, it is essential to highlight again that limited published studies have been conducted among populations in small unofficial self-settled camps, post-conflicts or natural disasters. More research is needed on this topic to obtain a better understanding of how the most vulnerable population subgroups in rural settings might be affected and assisted during medical relief operations post-disaster.

Difficult terrain, weather uncertainty and constant landslides posed major difficulty in assessment planning and time management. The field study was also affected by the unstable political climate, with major demonstrations protesting against the Danish cartoon incident taking place across the Muslim world during the study period. There were several occasions when our assessment team encountered potential security risk of inciting sentiments with the sight of foreigners inside a motor vehicle.

In addition to assessment challenges, there are a number of study limitations. First and foremost, the study was conducted 4 months post-earthquake, and respondents may have been suffering from recall bias related to acute post-disaster experiences. It is also uncertain how a cross-sectional study may capture the dynamic nature of experiences post-disaster. In addition, one of the major shortcomings of the study is the lack of comparable research in small unofficial IDP settings post-earthquake as most existing studies focus on official IDP camps post-conflict in Africa [4,5,8–13]. Further study in these areas is needed to obtain a greater understanding of small unofficial IDP camp experiences and to better formulate potential interventions that address health needs and vulnerabilities.

Conclusion

Significant differences in settlers' demographic characteristics and health outcomes were found according to the size of various IDP camps 4 months post-earthquake. Issues related to disparities in overall health outcomes, access to assistance, lack of information, limited contact with family and friends, and lack of access to chronic disease medications were identified. More research will be needed to enhance the understanding of health needs in these unofficial vulnerable population subgroups. The study results indicate that future post-earthquake medical relief operations should evaluate health needs and consider the delivery of medical assistance to small unofficial self-settled camps in affected rural communities.

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Conflicts of interest: none declared.

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ORIGINAL ARTICLE

Why are older peoples' health needs forgotten post-natural disaster relief in developing countries? A healthcare provider survey of 2005 Kashmir, Pakistan earthquake

Emily Ying Yang Chan, BS, SM PIH, MBBS, DDM, DFM

Abstract

Although older people may be recognized as a vulnerable group post-natural disasters, their particular needs are rarely met by the providers of emergency services. Studies about older people's health needs post disasters in the South East Asia Tsunami, Kashmir, Pakistan, China, and United States has revealed the lack of concern for older people's health needs. Recent study of older people's health needs post the Kashmir Pakistan earthquake (2005) found older peoples' health needs were masked within the general population. This survey study examines the providers' perceptions of older people's vulnerabilities post-2005 Pakistan earthquake. It aims to understand the awareness of geriatric issues and issues related to current service provision/planning for older people's health needs post disasters. Specifically, service delivery patterns will be compared among different relief agencies.

Cross-sectional, structured stakeholder interviews were conducted within a 2 weeks period in February 2006, 4 months post-earthquake in Pakistan-administrated Kashmir. Health/medical relief agencies of three different types of organizational nature: international nongovernmental organization (INGO), national organization, and local/community group were solicited to participate in the study. Descriptive analysis was conducted.

Important issues identified include the need to sensitize relief and health workers about older people's health needs post disaster, the development of relevant clinical guidelines for chronic disease management postdisaster in developing countries and the advocacy of building in geriatric related components in natural disaster medical relief programs. To effectively address the vulnerability of older people, it is important for governments, relief agencies, and local partners to include and address these issues during their relief operations and policy planning.

Key words: older people's health needs, clinical provider survey, disaster medical relief earthquake, Kashmir Pakistan

Introduction

Physical and mental health problems, reduced income, and limited mobility can pose challenge for older people to support themselves and their dependants in emergencies.[1] Although older people may be recognized as a vulnerable group[2] in post-natural disasters, studies about older peoples' health needs post-disasters in South East Asia,[3] Kashmir, Pakistan[4], China,[5] and the United States[6,7] revealed that most health needs of older people were often forgotten.

On October 8, 2005 at 08:50, an earthquake measuring 7.6 on the Richter scale struck Pakistan's autonomous state of Kashmir and part of Indian administrated Kashmir. In Neelum Valley, a nearby mountainous region close to the epicenter, the destruction was close to 100 percent. Research[8] found that, while older populations composed 9-26 percent of the patient load in the disaster affected areas, their specific health needs were not met by emergency services providers. The goal of this study was to examine the

perception of healthcare providers toward older people vulnerabilities, to understand the provider's awareness of geriatric issues and current provisions for/planning for older people's health needs postdisasters. Specifically, service delivery patterns would be compared among different types of relief agencies to identify gaps and discrepancies in awareness and implementation of geriatric related services in developing countries.

Methods

These were cross-sectional, structured stakeholder interviews which were conducted within a 2-weeks period in February, 2006, 4 months postearthquake in Pakistan-administrated Kashmir. Health/medical relief agencies were of three different types of organizational nature: international non-governmental organizations (INGO), national organizations, and local/community groups were solicited to participate in the study. Except for the nature of the organization, the identity of the organization remained anonymous to ensure confidentiality. The data collecting tool was a structural interview questionnaire, developed according to the HelpAge International guidelines[9] for best practices for older people in disasters and humanitarian crises. The questionnaire had three subsets of questions that assess (i) organization operational background (five questions), (ii) general awareness and planning of older peoples' issues (five questions), and (iii) information related to the provision of geriatric related clinical service (six questions). **Appendix 1** shows the list of questions in the structured interview.

Results

A total of 15 participants participated in the study: five from international organizations, five from national organization, and five local community responders. . Interviews were conducted in field offices of related organizations in February 2006 and each lasted for approximately 15-30 minutes. Because of the small sample size, only descriptive analysis of the results was conducted. Findings were organized according to: (a) perception of older people's vulnerabilities, (b) awareness toward older people's health needs, and (c) capacity, human and material resources for provision of geriatric related services. Table 1 shows selected results of the provider survey.

Perception of older peoples' vulnerabilities

Among the respondents, 73.3 percent (11/15) of responding agencies had direct health/medical/mental health components in their relief programs. Nine of the 15 agencies claimed to provide service that were age indiscriminating. Interestingly, while 93 percent regarded older people as a vulnerable group, only 6.6 percent of responding providers had relevant planning/considerations in their program implementation related to older peoples' needs.

Awareness of older people issues

An increasing awareness of medical relief guidelines for older people was found among local groups, national organizations, and INGOs. Findings indicated local groups had the least awareness regarding availability, of guidelines for geriatric service planning and program implementation. Although 40 percent INGOs claimed to have heard of relevant guidelines, none of these international agencies had planned for geriatric specific services or had related policies in their programs. In comparison, while only one national agency was aware of related guidelines for care of older people during emergencies, the organization did consider geriatric needs in its earthquake relief programs.

Capacity, human, and material resources

In terms of capacity, none of the agencies provided geriatric specific clinical services within their emergency programs. Although none of the providers had medical staff trained in geriatric subspecialties, 40 percent of the responding agencies had trained staff to manage chronic medical needs. In addition, 60 percent and 20 percent of the clinical service providing agencies had drugs that were useful to treat common geriatric morbidities as well as mobility aids to support injured people. Although none of the respondents were providing geriatric-specific clinical services or psychological care during the study period, some respondents explained that their general clinical services and outreach services should have covered general medical

Appendix 1. Provider Structured Interview Survey—Kashmir Pakistan earthquake

Date:

Your NGO is: Local/National/International/Don't know/Refused to Answer

	Question	Circle the answer applicable
Background		
A1.	Does your relief service involve in medical/health/mental health service provision?	Yes/No/Don't Know/Refused to Answer
A2.	Does your target population include population in all age?	Yes/No/Don't Know/Refused to Answer
A3.	Does your program/consideration consider older people as special vulnerable groups?	Yes/No/Don't Know/Refused to Answer
A4.	Are you aware of any guidelines related to management of older people issues? (e.g. "Older people in disasters and humanitarian crises: Guidelines for best practice (2005)", internal guidelines)	Yes/No/Don't Know/Refused to Answer
A5.	Does your relief intervention/program following the suggestions proposed by the guidelines?	Yes/No/Don't Know/Refused to Answer
Does your relief intervention have:		
	Question	**Circle the answer applicable**
General: HAI potential relief health interventions according to older health needs		
G1.	Gender sensitive outreach medical service?	Yes/No/Don't Know/Refused to Answer
G2.	Geriatric doctor/nurse?	Yes/No/Don't Know/Refused to Answer
G3.	Trained healthcare workers for effective management of chronic medical needs?	Yes/No/Don't Know/Refused to Answer
G4.	Psychosocial care program/other specialist mental care for older people?	Yes/No/Don't Know/Refused to Answer
G5.	Discussion with agency in the location to sensitize, coordinate, advocate and provide technical support on putting older people's special concerns and need into post-earthquake rehabilitation effort?	Yes/No/Don't Know/Refused to Answer
Specific: Related to clinical service		
S1.	Does your clinic have special days for older people?	Yes/No/Don't Know/Refused to Answer
S2.	Does outreach health service available for the housebound older patients?	Yes/No/Don't Know/Refused to Answer
S3.	Are drugs availability to treat the common causes of morbidity amongst older people?	Yes/No/Don't Know/Refused to Answer
S4.	Are major disability recorded within the camps?	Yes/No/Don't Know/Refused to Answer
S5.	Are your providing services, indiscrimination of age?	Yes/No/Don't Know/Refused to Answer
S6.	Are your providing services, indiscrimination of gender?	Yes/No/Don't Know/Refused to Answer
S7.	Are there availability of mobility aids?	Yes/No/Don't Know/Refused to Answer

Table 1. Key findings of healthcare provider survey for older people health needs post-Kashmir Pakistan Earthquake (2005)

Related question	Overall*	Local	National†	International
Background: Awareness of geriatric related issues and guidelines				
Have direct health/medical/mental health components?	73.3 percent (11/15)	80 percent (4/5)	60 percent (3/5)	80 percent (4/5)
Consider older people‡ as vulnerable groups?	93 percent (14/15)	100 percent (5/5)	80 percent (4/5)	100 percent (5/5)
Aware of any older people related guidelines in emergency relief and response?	20 percent (3/15)	0 percent	20 percent (1/5)	40 percent (2/5)
Are programs planning/implementation follows some guidelines related to older people?	6.6 percent (1/15)	0 percent	20 percent (1/5)	0 percent
Geriatric Service provision				
Providing service indiscrimination of age	60 percent (9/15)	80 percent (4/5)	40 percent (2/5)	60 percent (3/5)
Providing relevant geriatric related clinical services	0 percent	0 percent	0 percent	0 percent
Providing outreach services for older people§	40 percent (6/15)	40 percent (2/5)	20 percent (1/5)	60 percent (3/5)
Providing psychosocial care specifically for older people§	0 percent	0 percent	0 percent	0 percent
Providing clinical service indiscrimination of gender	60 percent (9/15)	80 percent (4/5)	60 percent (3/5)	40 percent (2/5)
Providing gender sensitive outreach service	33.3 percent (5/15)	20 percent (1/5)	40 percent (2/5)	40 percent (2/5)
Human and Material Resources				
Has geriatric Doctors/Nurses	0 percent	0 percent	0 percent	0 percent
Has trained healthcare workers for chronic medical needs	40 percent (6/15)	20 percent (1/5)	20 percent (1/5)	20 percent (3/5)
Has drugs treating common morbidity for older people	60 percent (9/15)	40 percent (2/5)	60 percent (3/5)	80 percent (4/5)
Has mobility aid for patients	20 percent (3/15)	20 percent (1/5)	40 percent (2/5)	0 percent

*15 organizations: five local (Muslim Hands, Chellabandi community group, Muzzafarabad regional hospital, Muzzafarabad community responders, Muzzafarabad city relief organizations) five National (Pakistan Red Crescent, Pakistan Ministry of Health, Pakistan Army) 5 International (Merlin, MSF, Turkey Red Crescent, UNHCR, UNICEF).
†Out of province groups.
‡According to 2005 estimated figures, people in Pakistan had life expectancy of 63 years, while 62.04 years for male and 64.01 years for female. In this study, older people was defined as people aged > 45 years.
§But for those respondents who provided relevant services, most services include older people group within their target (general adult population).

needs for older people.[10] Paradoxically, results revealed that the INGOs fared the worst among all provider subcategories regarding the provision of age- and gender-sensitive clinical programs. In addition, 80 percent of INGOs had the relevant drug supplies, but none of them provided geriatric-specific services and mobility aids. On the other hand, local (20 percent) and national (40 percent) counterparts provided mobility aids and 80 percent of the local groups reported having programs which were more gender sensitive when compared with INGOs (40 percent).

Discussion

The study showed the discrepancy between provider perception, awareness, and actual clinical service/program provision for older people's health needs post-natural disasters. The guidelines for best practice[9] for older people in disasters and humanitarian crises suggests five specific program considerations that might enhance older people's access to health services during emergencies. Specifically, emphasis has been placed on including special clinic days for older people, outreach health services for the housebound elderly, drug availability to treat the common causes of morbidity among older people, records on major disabilities within the relief camps, and the availability of mobility aids. As indicated in the study, despite drug availability (as a result of basic primary care drug procurement for basic treatment of common chronic medical problems), the lack of technical expertise and awareness of older people's health needs rendered this population subgroup as invisible in relief settings. Some may argue that the small patient load does not justify the provision of specific clinic days for older population. It is, nevertheless, important to ensure older people have equal access to all mainstream services.

Monitoring and evaluating indicators should be established to support the assessment and decision-making regarding older people's health needs postdisasters. Studies of older people's health needs postdisaster indicated older people had distinct health needs when compared with the general population and currently, there was a lack of specific clinical guidelines to deal with geriatric medical problems such as arthralgia, stomach problems, diabetes mellitus, and hypertension which required long-term management and were liable to polymedication. Traditional indicators and assessment benchmarks[11-13] were inappropriate and inadequate to monitor chronic medical needs and outcomes of patients. As highlighted in previous studies,[4] there was almost no report/record of common cardiovascular condition (such as hypertension, cardiovascular accident & diabetes mellitus) or concerns of nutritional status[14,15] of the older age groups within the clinical recording system Possible explanations for the lack of information regarding chronic medical problems include: active ignorance of doctors/healthcare workers toward underlying medical conditions, substandard clinical management[4] and the absence of basic anthropometric measures (such as weight, height, blood pressure, blood glucose) to guide clinical decision-making. It was uncertain about how these issues had affected the quality of healthcare but the questionable quality of medical care presented a missed opportunity for older patients to receive good quality clinical treatment and chronic disease management.

With the aging of world's population,[16] resources available during rehabilitation phase present a good opportunity[17] to put geriatric and chronic disease management agenda within the rebuilding/reconstruction policy of the healthcare system in the disaster-affected communities, which tend to be in rural areas and with limited resources.[1,18] Carefully designed medical relief programs may help to train local staff, support early recovery of healthcare systems and, most important of all, help in preventing avoidable admissions as a results of interruption/absence of chronic disease medical treatment or iatrogenic causes.

Study limitations include small sample size, bias in respondent recruitment as well as the difficulty in generalization to other disaster settings from the specific context of Kashmir. Nevertheless, while the small sample size might render statistical analysis beyond descriptive study inappropriate, the descriptive comparisons still reveal beliefs and practices of disaster relief agencies toward older people issues in Pakistan Earthquake. Of note, this study shows that although INGOs have better awareness and resources (training and drugs) for dealing with geriatric issues, their

actual programs might be the least age/gender sensitive when compared with local/national providers.

Conclusion

Studies of older people's health needs in conflicts and disasters had clearly shown a distinct epidemiological characteristic when compared with general public. The study shows a discrepancy between awareness and implementation of older people's issues. Despite most stakeholders regarding older people as vulnerable group, only a minority had reported special consideration to their specific needs. The result implies that, while awareness raising and skill training are important to deal with geriatric issues, more emphasis should be placed on actual implementation programs to effectively address this major gap during postdisaster medical relief. With the aging[19] of global populations and demographic characteristics in rural settings, disaster relief agencies must rethink program planning to address the most vulnerable groups and ensure that the older population group is not forgotten and receives adequate care during emergencies.

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Literature review of health impact post-earthquakes in China 1906–2007

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ABSTRACT

Background Over the last 100 years, China has experienced the world's three most fatal earthquakes. The Sichuan Earthquake in May 2008 once again reminded us of the huge human toll geological disaster can lead to.

Methods In order to learn lessons about the impact of earthquakes on health in China during the past century, we conducted a bilingual literature search of the publicly available health-related disaster databases published between 1906 and 2007.

Results Our search found that research was limited and there were major gaps in the published literature about the impact on health in the post-earthquake period. However, the experiences recorded were similar to those of other parts of the world. The available studies provide useful information about preparedness and rapid early response. Gaps identified included care of chronic disease.

Conclusion Our literature review highlights the paucity of literature on the impact on health post-earthquake in China between 1906 and 2007. Disaster mitigation policies need to reflect the needs not only of the disaster-related impacts on health but also of the ongoing health needs of the chronically ill and to establish safeguards for the well-being of the vulnerable populations.

Keywords China, disaster epidemiology, earthquake, human impact, literature review

Introduction

On 12 May 2008, Wenchuan Township, Sichuan province of China was hit by an earthquake registering 8.0 on the Richter scale. The earthquake was the most destructive to occur in the People's Republic of China (PRC) since its formation in 1949. By 16 June 2008, the State Council of China had pronounced that 69 170 people had died, 17 426 were missing, 374 159 were injured and 45 509 241 were affected, among which 1 390 833 were evacuated.[1]

According to international data, earthquakes remain the least predictable and most lethal of natural disasters.[2] Table 1 shows that in the 20th century, Asia has had twice as many as other continents. But whilst China has experienced the highest mortality rates, there is limited literature available about the impact of earthquakes to allow comparison with other countries such as Japan and the USA, where the human impact of earthquakes has been extensively studied. This paper reviews the existing literature about the human impact of earthquakes occurring in China prior to the 2008 Sichuan earthquake and assesses what lessons were relevant for medical response to the recent disaster.

Methods

Publicly available information to describe the human impact of earthquakes in mainland China was obtained from the following sources: the publicly accessible Emergency Events Database (EM-DAT) database of CRED that provides descriptive information of earthquakes in China giving dates of occurrences, geographic distribution and the impact on human lives and academic databases that include Chinese

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Table 1 Earthquakes sorted by continent from 1906 to 2007[a]

Continent	Number of events	Killed		Injured		Homeless		Total affected		Damage US (000's)	
		Total	Average[b]	Total	Average[b]	Total	Average[b]	Total	Average[b]	Total	Average[b]
Africa	68	21 012	309	59 258	871	894 874	13 160	1 655 155	24 341	11 073 899	162 852
America	234	214 789	918	446 107	1906	3 515 418	15 023	24 800 145	105 984	46 262 306	197 702
Asia	461	1 382 064	2998	996 446	2162	12 242 213	26 556	68 438 958	148 458	183 247 859	397 501
Europe	217	363 929	1677	135 601	625	2 280 947	10 511	11 984 231	55 227	72 795 316	335 462
Oceania	38	439	12	767	20	19 820	522	88 161	2320	2 509 419	66 037

[a]Created on: 19 July 2006. Data version: v06.05. *Source*: EM-DAT: The OFDA/CRED International Disaster Database, Université catholique de Louvain, Brussels, Belgium.

[b]Average per event.

local journal full-text databases [Chinese Journal Full-text Database (CJFD) and Wanfang Database] and English international databases (PubMed, Medline and ELDIS) and Google Internet.

Since 1988 the WHO Collaborating Centre for Research on the Epidemiology of Disasters (CRED) has maintained the EM-DAT, created with the initial support of the WHO and the Belgian Government. EM-DAT was accessed on line to provide core data on the occurrence and effects of over 12 800 mass disasters in the world from 1900 to the present. The database is compiled from various sources, including UN agencies, non-governmental organizations, insurance companies, research institutes and press agencies. Disasters are defined as events that result in more than 10 deaths, more than 100 people affected, or a request for international assistance after the declaration of state of emergency.[3] Of relevance to our study, the EM-DAT database contains information about earthquakes in China. We chose to start our literature search from 1976 as it is difficult to access to information before this time period in China since information was limited for political reasons. We have however included studies relating to the 1976 Tangshan earthquake which had, previous to the Sichuan earthquake, caused the greatest loss of life in the 20th century. We recognize that there might still be under-reporting of the human impact of this earthquake since reporting was restricted as Chairman Mao was on his deathbed and there was a furious succession battle involving the Gang of Four.[4] These incidents probably had diverted the attention of the press away from the suffering caused by the quake.

Our literature search was conducted in May 2008 and again on December 2008. It included relevant articles from two Chinese local journal full-text databases CJFD and Wanfang Database], three English international databases (PubMed, Medline and ElDIS) and Google Internet. A search algorithm was developed to identify literature on the health impact of earthquake in China. Earthquake-related keywords include earthquake, after earthquake and disaster; whilst mortality (rate), death (rate), injury (rate), morbidity (rate), quality of life, mental (health), psychological (health), socio-psychological (health) and post-traumatic stress disorder (PTSD) were used as keywords for health impact. In addition, the location of the earthquake is limited to mainland China when searching the international databases. Scientific studies (both original articles and literature reviews), field reports and documents from organizations providing medical disaster relief available in these databases were also reviewed in this study. Exclusion criteria include articles regarding non-human impact-related studies and opinion columns. Two of the authors (E.C., Y.G.) conducted independent literature search in the databases and findings were compared to determine the final list of papers to be evaluated in details. All relevant papers were then read and examined by E.C. and Y.G. independently to elicit relevant information regarding human health impact and lessons learnt in emergency medical responses post-earthquake in China during the study period (1906–2007).

Results

Figure 1 shows the search results in both Chinese and English databases. We selected articles published after 1976, and a limited number of articles were found related to earthquakes in China (only eight written or translated into English) and most of them were published after 1990. Two major reasons may result in the limited articles and the publication time after 1990: one is the fact that the available Chinese local journal databases only covered publications after 1994 and the other one is likely to be related to the open door policy as China opened its door to international

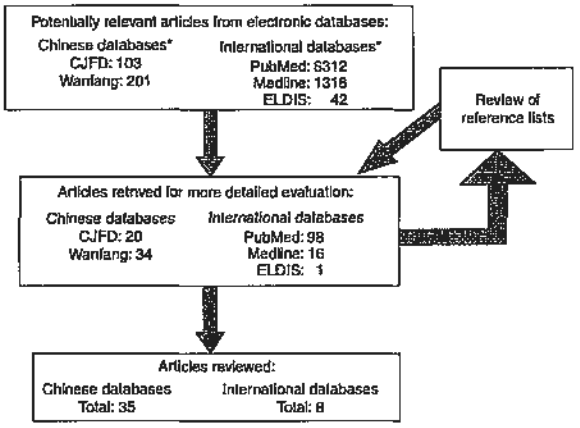

Fig. 1 Diagram of literature search flow. *CJFD (covered 1994–2006). Wanfang (covered 1998–2006). English database covered publications since mid-1950s to 2006. Search conducted in May 2008.

community only after the 1980s. In addition, before the current 'Provisions of the PRC on the Disclosure of Government Information' coming into force on 21 May 2008, information related to earthquakes, a type of disaster, was regarded as national secrets and therefore publishing such information was restricted. Appendices 1 and 2 list the Chinese articles reviewed.

A specific search of Google Scholar (among biology, life sciences and environmental publications) located 338 articles for 'China and earthquake'. After reviewing the results of the Google internet search engine, we decided not to include these as they mainly focused on building engineering and earthquake prediction and were insufficiently rigorous or relevant for this paper.

From the search of EM-DAT, a total of 108 earthquakes were described in China from 1906 to 2007. Earthquakes regularly rattle the vast Tibetan plateau, including Tibet and the far west region of Xinjiang and Qinghai provinces. They are also common in southwest Yunnan province. Earthquakes are relatively rare in central China and along the eastern seaboard, but the northwest is frequently hit by tremors.

According to the historical data, China's most devastating earthquake in recorded history hit northern Shaanxi province in 1556, killing an estimated 830 000 people.[5] During the 20th century, the Tangshan earthquake that occurred on 27 July 1976 claimed the highest toll in human lives of some 242 000 people.[6] This earthquake registered 7.8 on the Richter scale and its destruction was equivalent to 400 Hiroshima nuclear bombs.[7] In the three decades since Tangshan, there have been 83 reported earthquakes in China that resulted in human casualties. China's state media has reported that more than 610 000 people were killed by these earthquakes. Table 2 shows the mortality and chronology of some of the China's biggest earthquakes since

Table 2 Mortality related to the major earthquakes in China (1976–2007)[a]

Location	*Date*	*Killed*	*Richter scale*[b]
Tangshan, Pek.,Tientsin	27 July 1976	242 000	7.8
Lancang, Menglian counties (Yunnan province)	6 November 1988	939	7.6
Lishui, Ninglang, Haping counties (Lijian prefecture), Zhongdian (Diqing prefecture), Heqing, Jianchuan (Dali precture), Lanping (Nujiang prefecture)—Yunnan province	3 February 1996	309	7.0
Jiashi (Payzawat), Bachu, Yuespuhu, Yingjisha, Maigati, Shule, Shufu, Kashi districts (Xinjiang region)	24 February 2003	268	6.4
Sichuan province	24 January 1981	150	6.9

[a]Created on: 19 July 2006. Data version: v06.05. *Source*: EM-DAT: The OFDA/CRED International Disaster Database, Université catholique de Louvain, Brussels, Belgium.

[b]A logarithmic scale ranging from 1 to 10, used to express the total amount of energy released by an earthquake. In this scale an increase of 1 represents a 32-fold increase in released energy.

Table 3 Recorded mortality related to major earthquakes from 1906 to 2007[a]

Country	*Date*	*Killed*
PRC	27 July 1976	242 000
PRC	22 May 1927	200 000
PRC	16 December 1920	180 000
Japan	1 September 1923	143 000
Soviet Union	5 October 1948	110 000
Italy	28 December 1908	75 000
Pakistan	8 October 2005	73 338
PRC	26 December 1932	70 000
Peru	31 May 1970	66 794
Pakistan	31-May-1935	60 000

[a]Created on: 19 July 2007. Data version: v06.05. *Source*: EM-DAT: The OFDA/CRED International Disaster Database, Université catholique de Louvain, Brussels, Belgium.

Tangshan in 1976. Table 3 shows that Tangshan, along with two other earthquakes in China in the 1920s, ranks top of the 10 most devastating earthquakes in the world for loss of human life between the years 1906 and 2006, but as pointed out previously reports of earthquakes before China's opening up need to be interpreted with caution due to incomplete reporting.

Most studies result from the 1976 Tangshan earthquake and show that the causes of death from earthquakes of magnitude between 6.5 and 7.4 in China are similar to earthquakes of that scale outside China.[8] Most mortality occurs in the first 6 h after the earthquake. Although limited study has reported on the fate of vulnerable groups such as children and older individuals, post disaster, findings did indicate that there were significantly increased numbers of deaths at extreme of age.[9] Children are particularly vulnerable and the highest death rate occurs in babies and children under 4 years old where burns and cold are the likely causes of death. For older people (72–89 years old), most deaths result from the exacerbation or complications of underlying chronic diseases. Of note, there are no available studies on indirect mortality after earthquakes in China, although several studies on earthquakes in Japan have shown chronic medical problems account for medium- to long-term post-earthquake mortality.[10] Physical and structural environmental reasons are major causes of injuries that lead to mortality. One study analyzing principal causes of death from earthquakes (6–9 on the Richter scale) in rural Karshi area (Xinjiang) from 1955 to 1998 shows that poor anti-seismetic capacity of buildings was the leading cause of death in the lower seismetic earthquakes, whereas population density is the first cause in the higher seismetic zones.[11]

Post-disaster studies have also been reported as clinical specialty research articles, most of them following the 1976 Tangshan earthquake. One study on the long-term heath impact of disaster-affected individuals showed that renal complications were the main physical morbidity post-earthquake.[12] Another study investigated high school students in Grade 3 (aged 18 years old or above) who were fetuses during and after the Tangshan earthquake and observed lower cognitive function among those whose mothers carried them during the earthquake, especially those *in utero* in the second (3–6 months) and third (6–9 months) trimesters.[13] There is limited information on other morbidity patterns. A study[14] on earthquake-related PTSD and mental health in northern China in 1998 using the DSM-IV criteria found that the Chinese population has comparable prevalence of PTSD post-earthquake to other countries. Another study of quality of life (QoL) post-1998 Hebei earthquake found the exposure to earthquake was associated with multi-dimensional impairment of QoL. Victims suffered significantly more psychological distress of depression, somatization and anxiety.[15] We found no study of the patterns of physical injury pattern post-disaster.

Discussion

Major findings of this study

Overall, there is limited published research-based literature in the public domain on the human impact of earthquakes in China before 2007. This is partly due to limited availability of information before the mid-1980s when reporting was restricted and perhaps, the general lack of interest in research related to the impact of disasters such as earthquakes on health of the affected populations in China.

Whilst more health impact-related research should emerge after the 2008 Sichuan earthquake, published literature before 2007 may still offer important lessons and insights regarding earthquake responses in China. For example, the case study report from Qinglong county during the Tangshan earthquake[7] suggests that emergency preparedness and appropriate response can decrease the adverse impact of the natural disaster on the health of the affected community. When citizens were given warning and time to prepare for the disaster, more than 180 000 buildings were destroyed, yet according to records, only one person died. Since the mid-1990s, the Chinese government has set goals to improve disaster response and increase local disaster preparedness, passing laws and developing policies to improve emergency response to earthquakes. Table 4 gives the national earthquake-related laws, rules, regulations and standard documents.[16] Provincial governments have correspondingly establishing local administrative rules and regulations. In addition to improving building codes and earthquake predicting techniques, certain provincial governments have also stressed the importance of individual preparedness for disaster handling in recent years.[17] In Yunnan province where earthquakes historically have claimed high mortality, the provincial government is committed to equipping around 30% of the general population within the risk area with the capacity to provide basic disaster relief supplies within the first 24 h and to promote disaster response knowledge.[18] Similar policies have been developed for Sichuan, Inner Mongolia, Chongqing city and Tibet. Such preparedness may account for the rapid response to the devastating earthquake in Sichuan province in May 2008.

In addition, the findings of this study highlight gaps in understanding of the characteristics of survivors, morbidity,

Table 4 *National earthquake-related law, rules, regulations and standard document in China*

Law, rules, regulations	*Issued number*	*Issued date*
National law, administrative rules and regulations (5)		
Environmental Protection Regulations on Earthquake Monitoring Facilities and Earthquake Observation	Promulgated by Decree No. 140 of the State Council of the PRC	10 January 1994
Emergent Response Regulations on Destructive Earthquakes	Promulgated by Decree No. 172 of the State Council of the PRC	11 February 1995
Law of the PRC on Protecting Against and Mitigating Earthquake Disasters	Order of the President of the PRC (No. 94)	29 December 1997
Regulations on Administration of Earthquake Predictions	Promulgated by Decree No. 255 of the State Council of the PRC	17 December 1998
Regulations on Administration of Seismic Safety Evaluation	Promulgated by Decree No. 323 of the State Council of the PRC	15 November 2001
Regulations on Administration of Earthquake Monitoring	Promulgated by Decree No. 409 of the State Council of the PRC	17 June 2004
Law of the PRC on Emergency Responses	Order of the President of the PRC (No. 69)	30 August 2007
Regulations of the PRC on the Disclosure of Government Information	Order of the President of the PRC (No. 492)	5 April 2007
Scientific and technological rules, regulations and standard document (7)		
Regulations on Proclamation of Evaluation of Post-earthquake Trend	中国地震局令第 2 号 Promulgated by Decree No. 2 of the China Earthquake Administration	29 December 1998
Regulations on Administrative Law Enforcement on Earthquake	中国地震局令第 3 号 Promulgated by Decree No. 3 of the China Earthquake Administration	10 August 1999
Regulations on Administrative Reconsideration on Earthquake	Promulgated by Decree No. 4 of the China Earthquake Administration	10 August 1999
Regulations on Administrative Legal Supervision on Earthquake	Promulgated by Decree No. 5 of the China Earthquake Administration	18 January 2000
Ordinance concerning the Procedures for the Formulation of Administrative Regulations on Earthquake	Promulgated by Decree No. 6 of the China Earthquake Administration	18 January 2000
Management Regulations on Requirement for Earthquake Resistance Protection of Construction Engineering	Promulgated by Decree No. 7 of the China Earthquake Administration	28 January 2002
Qualification Management Regulations on Seismic Safety Evaluation	Promulgated by Decree No. 8 of the China Earthquake Administration	27 February 2002

injury patterns and long-term rehabilitation of survivors of Chinese earthquakes. Previous studies in other developing countries such as Armenia,[19,20] Guatemala,[21] Turkey,[22] Philippines[23] and Italy[24] during the time period had indicated that specific risk factors such as building types and response management might have a major impact on population survival. More research in this area should be undertaken.

What is known on this topic

The impact of a natural disaster is based on two principal factors, hazard and vulnerability. Hazard is fixed as it is based on geological, meteorological or ecological characteristics of a region, but the vulnerability of a population can potentially be alleviated. Protective interventions should be targeted at identifying and reducing vulnerabilities in order to prevent unnecessary injury and death. Vulnerability includes physical, social, economic and environmental factors. Analysis has shown that disasters have greater impact in poorer countries[2] and there have been various hypotheses of how poverty and the impact of disasters are linked. In China, the costs of damage, the loss of productivity and life, are difficult to estimate since they are compounded by the rapid economic growth that is occurring.[25] However one example of estimated costs from the literature studied suggested that the estimated costs of the earthquake in the southeast of Jiashi in Xinjian on 24 February 2003, which registered 6.8 on the Richter scale was 1.4 billion RMB. The earthquake resulted in the death of 268 people and injury to 4853, including 2058 severe injuries. About 49 656 families, 205 079 people, were displaced from their homes. The affected region amounted to 21 498 km^2, covering 6 counties or cities, 37 towns and 931 villages.

What this study adds

Of note, a major gap in both the Chinese and international literature that is often overlooked is the impact of disasters such as earthquakes on populations suffering from chronic diseases.[26,27] In a study of health concerns in 100 households following earthquakes in El Salvador, 79% of households contained a member who had experienced exacerbation of a chronic disease.[28–30] Experience from Japanese earthquakes found that a strong link between the extent of damage due to the catastrophic earthquake and an increase in morbidity rates for both acute (pneumonia and peptic ulcer) and acute on chronic disease (such as asthma).[31] *Tomita*[32] reported asthma worsened after the Tottoir-Ken Seibu earthquake in 2004. Among the 156 asthmatic patients studied the acute asthma attack rate increased within the first week after the earthquake and 11% had an exacerbation within 1 month after the earthquake. Following the Great Hanshin Earthquake in 1995, more patients were admitted with acute-on-chronic respiratory failure and acute exacerbation of bronchial asthma.[33] With an aging population and increasingly heavy burden of the chronic disease in China,[34] understanding the post-earthquake needs of those with chronic disease will be important to address in future disaster relief efforts.

Limitations of this study

There are several potential study biases in this study. First, our literature search algorithm may have unintentionally excluded related articles as it did not include gray literature sources (local governmental reports, media/newspaper) and other non-health literature database sources. For instance, whilst highly relevant, a related study report of the 1988 Yunnan earthquake[35] does not show up in our search strategy as the journal was not within the search reach of the health literature database. Furthermore, the scope of focus of this study was based on historical records and potential reporting bias may have resulted. Last but not least, although the WHO definition of health normally includes physical, mental and social well-being of an individual, the health impact of this study only focused on examining the negative impact of earthquake on physical and psychosocial health. Social well-being and other related determinants of health outcomes were not included.

Conclusion

China remains the country that has suffered the greatest human impact from earthquakes.[36] The human toll in the recent Sichuan Earthquake in May 2008 once again reveals the destructive power of the geological disaster. Whilst China managed to mount a swift and effective emergency response to the Sichuan earthquake, analysis of the response highlights that not all lessons had been learnt from previous disasters.[37] The lack of emergency preparedness and of training for medical staff to face the medical challenges posed by natural disasters was highlighted by recent experience. In addition the needs of older people and people with chronic diseases were often ignored. This underlines the need for future policy development to learn from this and other disasters not only to meet the immediate but also the long-term needs of the affected population.

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Comparison of Health Needs of Older People between Affected Rural and Urban Areas after the 2005 Kashmir, Pakistan Earthquake

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Consent and Ethical Approval
This study had consent obtained from patients and approval by relief organizations: Merlin, HelpAge International, Muslim Hand.

Keywords: developing countries; disaster; earthquake; health needs; natural hazards; older people; rural areas

Abbreviations:
IDP = internally displaced person
NCD = non-communicable disease
NGO = non-governmental organization

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Abstract

Introduction: On 08 October 2005, an earthquake measuring 7.6 on the Richter scale, struck Pakistan's autonomous state of Kashmir and part of Indian-administrated Kashmir. The official death toll in Pakistan was 79,000, and nearly 1,400 in Kashmir. This study reports the findings of a three-week health needs assessment to understand the needs of rural, older people post-earthquake. This study was conducted in February 2006 in the Neelum Valley of Kashmir, Pakistan, four months after the earthquake.

Hypothesis: During emergency relief, the vulnerability and health needs of older people in rural settings are different than are those in of urban areas.

Methods: A comparative, descriptive study was performed using health information to compare the differences between rural and urban health needs and the utilization of services of older people after the earthquake. Semi-structured interviews were conducted to collect information regarding demographic background, medical and drug history, self-reported health status, healthcare access and utilization, and social/financial concerns. Clinical records were reviewed and physical indicators for older patients also were collected on site.

Results: The health profile, access to health care, service availability, and prevalence of non-communicable diseases differ between urban and rural settings. The greatest gap in health services at all sites was that non-communicable disease management was inadequate during non-acute, post-earthquake medical care. Health service utilization varied by gender, as in conservative rural areas, older, traditional women were less likely to receive medical services while older men were less likely to access psychological services in all sites.

Conclusions: This is the first study to compare the post-earthquake healthcare needs of older people in urban and rural settings. Findings highlight specific health needs and issues related to long-term, chronic disease management. Given the global pattern of aging of the population, it is important to strengthen the capacity to respond appropriately to medical disasters, which includes preparedness for treating the health needs of older people.

Chan EYY, Griffiths S: Comparison of health needs of older people between affected rural and urban areas after the 2005 Kashmir, Pakistan earthquake *Prehosp Disaster Med* 2009;24(5):365–371.

Introduction

According to the WHO, increased life expectancy is one of the major achievements of the 20th century.[1] Nevertheless, older people have different health needs compare to younger members of a community. During emergencies such as disasters caused by natural hazards and conflict, in low-income countries, those persons >45 years of age have been found to have high mortality rates and to be the most vulnerable.[2] Reports of the impact of the Indian Ocean tsunami on older people listed isolation, health difficulties, mobility problems, limited literacy, and a lack of proper documentation to prove ownership or claim right of access as major causes of vulnerabilities among older people.[3–7] Detailed health information about the experiences and health needs of

Study	Location	Methods	Sample	Data Collection Instrument
1	**Rural** Border Mountain Clinic at Sarli Sacha	a. Retrospective review of clinical records from 21 January–20 February 2006 b. Clinical interview and physical assessment of older people from 20–23 February 2006	a. Clinical Records = 2,942 Average age of sample = 38 Age range = 0–83 b. Physical assessment = 85 Average age of sample = 58 Age range = 45–83	a. Information table b. Questionnaire
2	**Urban** IDP camp 115 km from Muzzaffarabad city	a. Retrospective review of clinical records from 21 January–28 February 2006 b. Clinical interview and physical assessment of older people on 24–28 February 2006	a. Clinical Records = 392 Average age of sample = 39 Age range = 0–69 b. Physical assessment = 40 Average age of sample = 53 Age range = 45–69	a. Information table b. Questionnaire

Table 1—A description of research design for the field assessment (age in years; IDP = internally displaced person)

older people during disasters is limited. In particular, there is a dearth of available literature on the health needs of older populations in rural areas of developing countries, where the impact of humanitarian crises tends to be strongest, and the poorest suffer the most enduring damage.

On 08 October 2005 at 08:50 hours (h), an earthquake measuring 7.6 on the Richter scale struck Pakistan's autonomous state of Kashmir and part of Indian-administered Kashmir. As described by United Nations Environmental Programme (UNEP), 3.7% of Pakistan's 158 million population is >65 years of age.[8] To assess the health needs of older people in this disaster-prone area, a field study was performed in Neelum Valley, a mountainous region in Pakistan-administrated Kashmir, four months after the earthquake.[9] The region was close to the epicenter, and destruction was nearly 100%.[10] The aims of this study were to answer three major questions: (1) compare and understand the difference between the disease patterns of older people post-earthquake in affected rural and urban areas; (2) analyze the health service utilization pattern of the older population; and (3) discuss the current inequities experienced by older people during post-earthquake medical relief.

Methods

Study Design

This was a descriptive study performed in difficult circumstances, three months after the earthquake in Kashmir, Pakistan. Quantitative data were collected using a convenience sample of older patients who attended two different types of post-earthquake relief clinics during a 17-day field health needs assessment during February 2006. The data collection sites included:

1. *Rural (Site 1)*—A mountainous border clinic at Sarli Sacha, set up post-earthquake and supported by Merlin, a UK charity. The clinic provided services for a cohort of 30,000 rural residents of the sparsely populated Pakistan/India border area; and
2. *Urban (Site 2)*—An internally displaced person (IDP) camp, located with an in-camp clinic, 45 miles from Muzzafarabad city, organized by Muslim Hand at Chella Band, a local non-governmental organization (NGO). This clinic served 382 displaced people.

The research design for the field assessment conducted around Muzzafarrabad city and in rural Kashmir, Pakistan is described in Table 1.

Old age can be defined in many ways, particularly between different societies. In rural Pakistan, it would be impractical to define old age by adopting the United Nation's chronological definition of older people ≥60 years of age, because the official life expectancy in Pakistan in 2005 was 61.2 years for males and 60.9 for females.[8] Considering the functional capacity and social expectations of people in rural Pakistan who tend to marry young and become grandparents in their mid-forties, the definition of *older age* in this study was context-specific and defined as a self-reported age of ≥45 years.[2]

Data Collection Tools

Data were collected using research documentation tools designed for this context. These tools included a study questionnaire for clinic attendees and retrospective clinical information tables.

The questionnaire was designed to guide interviewers to capture the general health needs in both study sites. The survey included questions regarding demographic background, medical and drug history, self-reported health status, current and past symptoms, mental health, healthcare access and utilization, and post-earthquake livelihood-related issues. A mini mental health test and physical health indicators such as weight, height, mid-arm circumferences, spot blood glucose, spot blood cholesterol level, and blood pressure also were collected to detect potential underlying medical conditions not captured during previous clinical consultations. The physical examination consisted of measurements of height, and body weight, blood pressure, blood glucose level, and blood cholesterol. An information table also was designed to record retrospective clinical information from clinic medical records during the study period. Case number, dates of clinic attendance, gender, age, diagnosis, and medication/treatment given were recorded in the information table.

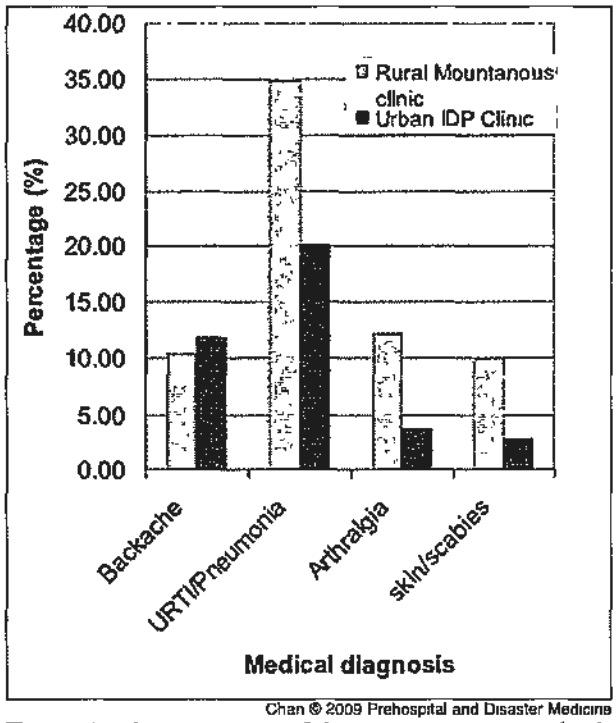

Figure 1—A comparison of the most common medical diagnoses* between rural and urban clinics as recorded in medical consultation records from January to February 2006

*Older patient: One among 2,942 medical records at Sarli Saccha mountain clinic; three among 392 medical records at the urban MH Chella Bandi IDP clinic

Data Collection

Translators converted questionnaires into Urdu from English. Both questionnaires were piloted with patients at each site the night before the actual interviews so that necessary modifications could be made in Urdu. Gender-specific healthcare workers fluent in Urdu and English were employed to administer the questionnaires, and the assessment team provided training to ensure consistency in data quality. Since illiteracy rates are high in the region (80%), verbal consent with witness verification was obtained from patients before interviews and physical examinations were conducted. Patients attending the consultations were invited to participate in the study and were reassured that their participation in the study would be independent of their eligibility to receive medical care/treatment. If the patient agreed to participate, a research team member conducted the interview while the patients were waiting for their consultation. All physical examinations and indicator measurements were performed by the assessment team physician (EC). Due to the instability of electronic appliances in areas of high-altitude and extreme temperature, all medical and health records were handwritten. Clinical records were reviewed manually and all basic calculations were performed on-site. Medical records from the previous month were reviewed on-site and relevant information was recorded in the information table.

Results

A total of 125 questionnaires and examinations were completed on-site (85 in the mountainous clinic and 40 in the IDP camps) (Table 1). In addition, the clinical records of 2,942 and 392 consultations from the mountainous clinic (Site 1) and the IDP medical services (Site 2) respectively, were reviewed, during the defined study period, 21 January–20 February 2006.

Specific Health Care Needs of Older People

The most common medical diagnoses and underlying medical conditions reported for older people in urban and rural setting are compared in Figure 1. Examination of the clinical records and the disease patterns among the older population were similar in both study settings. Backache/myalgia, upper respiratory tract infection (URTI)/pneumonia, heartburn/gastritis, and arthralgia were the most common medical conditions recorded. This pattern also was similar to that of urban older people. Dr. N.A. Sherich of Central Military Hospital, Muzaffarabad, the main referral hospital in the city, confirmed that the most common medical conditions observed that in the urban hospital during the study period were respiratory infections and skin infections such as scabies.

While the medical records showed similar disease patterns, a comparison of self-reported health status between older people in the remote mountainous area and IDP camps showed significant differences. Twice as many older people in the remote mountain area (68%) reported that their health was worse post-earthquake than did those in the IDP camp, although neither group of respondents sustained any injuries due to the earthquake. A chi-square comparison indicated that remote mountain respondents complained of higher frequencies and increased severity of clinical symptoms such as headache (40% vs. 23%, $p = 0.04$), psychosocial distress (72% vs. 44%, $p < 0.001$), and sleeplessness (65% vs. 45%, $p < 0.001$) when compared with affected individuals living in the IDP camps. In terms of specific physical complaints, older people from mountainous areas in Study 1 had more dental, hearing, eating, and visual difficulties compared to their IDP counterparts. The severity of dental problems was confirmed in reports of weight loss (75% vs. 50%, $p < 0.001$) and eating problems (87% vs. 50%, $p < 0.002$) among older people. The results of selected, self-reported health statuses and well-being of older people are in Table 2.

Of note, clinical records reviewed in all study locations showed a systematic absence of documentation of common chronic diseases. Specifically, records showed that only acute medical complaints were managed in these clinics. There was little or no record of common cardiovascular conditions (e.g., hypertension, cardiovascular accidents, or diabetes mellitus) or nutritional status of the older age groups in either the mountain clinics or the IDP camps, unless it was reported as a chief complaint during the consultations (e.g., hypertension). Chronic conditions such as diabetic mellitus and hypertension, and basic anthropometric data such as body mass index (BMI) were not recorded. On other hand, findings of the self-reported health surveys illustrated that 25–38% of the respondents were aware of the existence of at least one unmanaged, underlying medical problem. The three-day, on-site physical examination in the mountainous clinic confirmed this finding by indi-

	Rural Site Mountainous Clinic* (%)	Urban Site Internally Displaced Person Camp** (%)	*p*-value
Selected Physical Health-Related Problems			
Dental Problems	100	25	<0.0001
Visual Problems	75	38	<0.0001
Weight Loss	75	50	0.001
Eating Problems (indigestion, lack of appetite)	87	50	0.002
Hearing Problems	54	40	0.043
Other physical complaints			
Headache	40	23	0.043
Dizziness	34	20	0.07
Joint/Muscle Pain	54	50	0.10
With known underlying medical problems:	25	38	0.02
Of which:			
a. without treatment/never had treatment	65	30	<0.001
b. treatment before disaster	35	35	<0.001
Discontinue treatment post-disaster	80	40	<0.001
Selected Psychosocial Health-Related Problems			
Experience death (at least one family member/close relative)	90	40	<0.001
Loss of possessions			
Some	30	30	0.1
All	50	40	0.07
Refused to answer	20	30	0.06
Feeling depressed and helpless	72	44	<0.001
Sleeplessness	65	45	<0.001
Feeling lack of resources:			
Medical	60	20	<0.001
Food	25	5	<0.001
Clothes	20	5	<0.001
Shelter	70	20	<0.001
Financial support	90	55	<0.001
Social support	60	20	<0.001
Most cited other needs:			
Cooking utensils	40	5	<0.001
Overall worsening of health post-earthquake (4 months after)	68	34	<0.001
Social-Related Issues			
Currently living alone	10	2	<0.001
Living with family	50	70	0.04
Living with friends/neighbor	40	28	<0.01
Living in:			
Houses	30	10	0.03
Tents	60	90	0.02
Received assistance post-earthquake (aside from medical services)	50	100	<0.01

Table 2—Selected self-reported health status of older people in two different settings
*Results abstracted from mountainous clinic: 85
**Results abstracted from internally displaced person camp clinic: 40

Location	Rural Mountainous Clinic*	Urban IDP Camp**
Total attendees	2,942	392
Service taken up by older people†	14%	26%
Male/Female	7:3	3:4

Table 3—Utilization pattern of older people in various healthcare setting according to clinical records from January to February 2006
*Merlin's P3, Sarli Saccha Clinic
**Muslim Hand IDP camp in Chella Bandi
†According to UNHCR, population 45 years of age constituted to approximately 19% of the population in that area.

cating that 38% of the examined patients (31 of 85 patients) had at least one type of underlying chronic condition. Furthermore, the most common under-diagnosed or managed chronic condition found during on-site physical examination was diabetes mellitus (22%, 19 of 85 patients).

There also were increased disparities in access to care for chronic medical conditions among both study population groups post-earthquake. Before the earthquake, only 35% of older people living in the mountains had received medical management for their underlying chronic medical problems, compared to 70% of the older people who lived near the city IDP camp. Post-earthquake, among those who had chronic medical treatment prior to the earthquake, 80% of those living in the remote mountain reported losing access to chronic medical treatment compared to 40% of those who were living near the city IDP camp. Moreover, clinical records showed discrepancies between diagnoses and drugs prescribed and an over-prescription of antibiotics across all age groups.

Health Care Utilization of Older People in Different Settings

Healthcare services utilized by older people are in Table 3. Fewer older people attended the remote mountainous clinic (Site 1) compared to the IDP clinic. This suggested geographic access barriers may exist in remote areas. This also is supported by the internal survey of Merlin's airlifted, medical mobile clinic in the remote areas of Neelum Valley (Zabbar, Konka, and Telegra), which showed older people comprised approximately 45% of the consultations at the medical service outreach services to the remote area.[9]

Differences in gender utilization of health services by older people were found in both settings. Men were predominant users of services (70%) in the mountainous clinic (Study 1), but utilization by older women was inversely related to the travel distance to the clinic (i.e., the use of services was greater the shorter the distance from home).

Access Issues

On-site visits also indicated that although direct treatment costs were not a major issue for access to health/medical services for the respondent, an important unintended barrier to service access reported by urban and rural respondents was that men had no access to psychosocial support because most programs were targeted exclusively to women and children. In addition, a recurrent theme found among men in both clinics was "a feeling of limited access to international relief services because they are for the vulnerable groups: women and infant". On the other hand, another barrier to access for older women in rural areas was related to the gender of service providers. Clinic attendance records in mountainous clinic showed that during days when solely male doctors provided clinical services, medical services utilization decreased by 30%.

Discussion

Overall, post-earthquake health needs identified during the assessment were compatible with other findings of older people's health needs in crisis/unstable settings such as Darfur and Sierra Leone.[6,14] Although the burden of older people's post-disaster medical needs made up a significant proportion of the services utilized, particularly in the most remote areas, the main findings of this study indicate that the needs of older people were not formally considered during the first four months of the post-Kashmir earthquake relief effort.

Stakeholder interviews[9] conducted to understand how older people's issues were dealt with by NGOs in the Pakistan Kashmir relief and rehabilitation-planning phase showed that 95% of the stakeholders agreed that ">45 years old" was a reasonable definition for old age. While almost all of the relief stakeholders regarded older people an important population group, most respondents admitted, at most, a "reactive" approach toward the problems of older people was adopted as they assume the medical problems of older people would be dealt with by the medical relief groups and none of those interviewed were aware of the *HAI Guidelines for Best Practice for Older People in Disaster and Humanitarian Crises.*[4] Meanwhile, discussions with the medical relief groups indicated none of the medical relief groups had regarded older people as a separate group from general population. Thus, no special consideration was given to their needs such as chronic disease management and medication provisions. Some stakeholders believed older people issues were beyond their mandates and should be dealt with by development agencies.

In addition, findings show the post-disaster management of chronic disease was suboptimal and reveal a missed opportunity for older patients to receive good quality clinical treatment. For instance, although most relief healthcare settings had the necessary drug procurement for basic treatment of common chronic medical problems (e.g., diabetes mellitus or hypertension), there was a general reluctance to manage non-acute conditions. The lack of awareness of underlying medical problems and absence of technical expertise in the setting rendered most of the stockpile medication useless. The 2nd edition of the Sphere Project (2004) sets the minimum standard to be observed by relief groups and recommends that, although life-saving therapy should be given post-disaster for patients with chronic condition, there is a need to establish standards and guidelines for the management of existing chronic diseases to complement the management of acute situations. Strategies to address chronic diseases by promoting technological transfer (e.g., older patient management and health training for medical

and health personnel) and investment in local structures (e.g., dental, eye and psychosocial services) during the rehabilitation phase are needed.

In addition, gender inequality in health service access exists and agencies that are interested in the provision of services in rural setting should increase their sensitivity toward potential cultural barriers. This is particularly relevant as the health utilization pattern in this study confirms that in traditional conservative rural Pakistan, women do not travel far from their households

Data Collecting Challenges and Information Quality

Similar to other disaster field assessments,[12] the lack of technical and situational resources was the major challenges encountered during the Kashmir field health needs assessment. In terms of technical challenges, the efficiency of this field assessment was hampered by the lack of appropriate needs assessment tools and medical/health guidelines to deal with health needs of older people in disaster situations. Generic health assessment tools have limitations in eliciting information about older people's health problems and needs, capturing mental health status or adequately reflecting living hazards relevant to the setting (urban/rural/mountain life). In addition, language dialect and cultural specificity in the mountain region made a rapid, in-depth, qualitative analysis of health needs a daunting task. As a result, the combination and modification of several health needs assessment tools were necessary for this study; however these *ad hoc* assessment tools may raise questions about validity and consistency of the study results.

In addition, there is a lack of available, accurate baseline data. For example, the urban clinic was selected as it was considered by the United Nations Children's Fund (UNICEF) to be one of the largest IDP camps with 2,700 displaced people. However, this assessment identified, at most, 400 residents in the camp. This could have been due to population movement resulting from IDPs voluntary repatriation to their place of origin. Camp officials also admitted that there might be population inflation of clinical records by local indigenous populations to use the camp health services. This was compounded by a lack of accurate recording of clinical data. Possible explanations for the absence of recording within the clinical records could be the lack of relevant equipment (e.g., blood glucose monitoring), equipment failure (subzero temperature), or unawareness of the importance of collecting and keeping records of medical information.

Previous disaster studies have shown that cluster surveys are an appropriate methodology to capture populations during disasters.[13] However, given the situational challenges and time constraints in Kashmir, a formal cluster survey was rendered infeasible within the limited time frame. Difficult terrain, weather uncertainty, and landslides also posed major difficulty in planning and impeded this assessment team from venturing into home settings in the remote mountains. As a result, this limited the assessment team's ability to investigate the needs of the most vulnerable, immobile older population. Moreover, as helicopters were used as the primary mode of transportation in Neelum Valley, our access to clinics was subject to weather constraints and flight schedule limitations.

The assessment mission also was complicated by the unstable political climate with major demonstrations against the Danish cartoon incident occurring across the Muslim world.[13] There were several occasions when the assessment team unwillingly, but inevitably, had to drive through mobs of demonstrators in rural villages with a potential security risk of inciting sentiments with the sight of foreigners inside of a motor vehicle.

Limited timeframe, unavailability of certain key stakeholders for interviews, and logistic complications (e.g., expensive transportation) had posed further complications in the assessment.

Conclusions

There was an unmet need among rural, older people after the earthquake. Some examples of potential health interventions to address the needs gap include active management of chronic diseases, gender-specific outreach medical services, specific health services for psychosocial problems, dental care, and ophthalmology.

The quality of care could be enhanced through training activities, specialist support, and the presence of agencies that advocate on behalf of older people and coordinate older people's care.[9] Moreover, the ongoing, non-communicable disease (NCD) burden of local older populations could be reduced by establishing a long-term NCD strategy during the recovery phase. As most of the health issues of older people indicate the need for longer-term care, collaboration with local partners and technical groups would be important to ensure that older people are not forgotten during the recovery phase. In addition, to be effective, NGOs in relief settings should increase their sensitivity towards challenges faced by older people during disasters and plan their interventions accordingly.

Recent research on the roles that older people play in emergencies have shown that they make significant contributions both economically and socially to local relief efforts.[7] To maximize community potential and recovery, policy-makers should take the opportunity to invest in the health of older people so that they can continue to contribute to society.

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Medical Interventions following Natural Disasters: Missing out on Chronic Medical Needs

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Abstract

Although natural disasters may cause massive loss of human life and destruction of resources, they also present affected populations with a rare opportunity to access external resources. Nevertheless, many post-disaster medical relief intervention programmes only focus on the provision of acute medical services and the control of communicable diseases. Currently, no specific study has examined why chronic medical needs seem to be insufficiently addressed in disaster relief interventions. This paper review current knowledge about how natural disasters affect people with chronic medical needs, assess possible factors in disaster preparedness and response that pre-empt addressing chronic medical needs and suggest possible ways to overcome these barriers. Unawareness and insensitivity of relief workers towards chronic medical conditions, the practice of risk rather than need-based assessments, a focus on acute needs, the lack of reliable indicators and baseline information, and the multi-dimensional characteristics of chronic medical problems all pose serious challenges and probably deter the government and post-disaster relief agencies to deal with diseases of a chronic nature. It is important to increase the awareness and sensitivity of the stakeholders towards chronic medical problems during all phases of planning and intervention. Relevant assessment tools should be developed to rapidly identify chronic medical needs in resource deficit settings. Community partnership and collaboration that promote local ownership and technical transfer of chronic disease management skills will be essential for the sustainability of services beyond the disaster relief period. Potential programmes might include the technical training of local staff, establishment of essential drug and supply lists, and the provision of a range of medical services that may address chronic health needs. ***Asia Pac J Public Health 2007; 19(Special Issue): 45–51.***

Keywords: **Disaster medical relief, chronic disease, needs assessment, natural disaster, resource allocation, sustainability, community partnership, SPHERE.**

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Introduction

In 2000, the WHO reported that non-communicable diseases accounted for up to 59% of the total mortality in the world and 46% of the global burden of disease[1]. These diseases often have the greatest effect and worst consequences in the developing world and in the poorest segments of the population[2]. It is estimated that chronic conditions will be responsible for 78% of the disease burden in developing countries by 2020. With limited resources and expertise, many of these developing countries will have to concurrently respond to the double burden of both acute infectious diseases and chronic diseases

In recent years, the international disaster response guidelines such as the Sphere Project's Humanitarian Charter and Minimum Standards in Disaster Response[3] have advocated for the inclusion of non-communicable diseases as part of the minimum standards of humanitarian medical interventions. Nevertheless, many post disaster medical relief intervention programmes only focus on the provision of acute medical service and the control of communicable diseases. Moreover, it could be argued, that disasters not only cause massive loss of human life and the destruction of resources, but may also present the affected populations with a rare opportunity to access external resources and to improve access to services. Frequently, emergency medical relief agencies remain at a disaster affected region for more than six months post-disaster to provide assistance. With their technical expertise, resources and manpower, these external medical relief resources have significant potential to support the restoration, reconstruction and improvement of health services in disaster affected areas. For example, the low cost interventions that are geared towards disease prevention and reduction of chronic medical complications may be established alongside the emergency primary health care services provided during the relief phase.

Thus far, no specific study has examined if chronic medical needs can and should be addressed in the post-disaster interventions. If a case can be made to include chronic medical needs in the post-disaster emergency planning, it will also be useful to examine the factors that currently hamper the proper assessment of these needs and inclusion of appropriate interventions in the emergency response. We will explore these issues further in this paper. More specifically we aim to (1) review current knowledge about how natural

disasters affect populations with chronic medical needs, (2) analyse possible factors in disaster preparedness and response that pre-empt addressing chronic medical needs, and (3) suggest possible ways to overcome these barriers.

While a similar case can probably be made for addressing chronic medical needs in conflict-affected populations, the dynamics of conflict and the response options are sufficiently different, thus in this article we limit ourselves to natural disasters.

Methods

The WHO[1] has expanded the definition of chronic condition from traditional "non-communicable diseases" (e g. diabetes, cancer and asthma) to include conditions that require extended periods of health care support such as persistent communicable conditions, long-term mental disorders as well as ongoing physical impairments. However, for this study we limit the scope to "traditional non-communicable disease" only. In addition, due to the specific focus on natural disasters, we limited the literature search to natural disasters and deliberately excluded man-made disasters and conflicts. A medical literature search and web site review was conducted using PubMed, Medline, Eldis, Reliefweb and Google Internet search engine with keywords like: "chronic medical needs", "disaster", "heart disease and disaster", "diabetes mellitus and disaster", "asthma and disaster", "disaster medical guidelines". Sources of articles included a mix of scientific studies, field reports, and documents provided by the organisations for medical relief. Personal experience in many disaster response settings, in particular a recent exploratory mission of assessing older people's health needs after the Kashmir earthquake[4], has provided the necessary background. The disaster cycle model, as presented in Figure 1, proves a useful framework to discuss factors hampering the inclusion of chronic medical needs in the disaster response.

The following are some limitations to this study. i) the exclusive use of publicly available documentation in English, ii) inconsistencies in quality of the used materials, and iii) under-reporting on health experiences in post-disaster settings in developing countries.

Research analysis

The literature search initially yielded approximately 150 relevant articles related to various chronic medical needs in natural disasters. Eighty three percent of these studies were conducted in developed countries (e g the US and Japan), while most studies conducted in developing countries were only available as unpublished grey literature or agency technical reports. About 10% of the articles identified were in languages other than English, but with a translated title indicating relevance. Most of these were from countries that were prone to natural disasters, such as Japan and China. Given the sophistication of the earthquake related research in Japan and the high frequency of natural disaster occurrences in countries like China and India, a pitfall of our study was the necessary exclusion of these papers due to the language barrier.

We also conducted a literature search on health experience of the post-natural disaster older people as we believe the burden of chronic disease usually falls upon older people. The results of this additional search did not change the selection of articles as most of the studies on the post-natural disaster older people focused on the excessive mortality of the older population group[5-16] rather than on the chronic health conditions of the survivors.

Results

(I) How disasters affect populations with chronic medical needs?

Overall, there is great scarcity of literature addressing the issue of chronic medical needs during disasters. However, there is some evidence that people with chronic medical problems are negatively affected by natural disasters in both developing and developed countries. A study of the health status of populations affected by floods in China[17] from 1996-1999 reported a higher prevalence of eight chronic diseases in flooded areas when compared with non-flooded areas. In New Orleans, a post-flood study showed that about 25.4% of adults in the affected population had at least one or more chronic medical problem[18,19]. A study in Japan showed a 3.5 fold-increase of myocardial infarctions and double frequency increases of stroke cases in people living close to the epicentre of the Hanshin-Awaji earthquake in 1995 within the first four weeks, while an increase in cardiac mortality continued for about eight weeks after the earthquake[20]. Another Japanese study found a strong link between the extent of damage due to a catastrophic earthquake and an increase in morbidity rates for both acute (pneumonia and peptic ulcer) and chronic diseases (such as asthma)[21]. Furthermore, asthma was reportedly worse after the Tottoir-Ken Seibu earthquake in 2004, and acute asthma attacks were more likely to occur within the first week after the earthquake[22]. Acute and chronic respiratory failure and acute exacerbation of bronchial asthma each made up 6.8% of the total hospital admissions for respiratory problems one month after the Great Hanshin Earthquake in 1995[11]. Earthquakes might also trigger and exacerbate gastric ulcer[23,24], with bleeding often reported as a complication. Other studies showed that earthquakes adversely affect chronic renal failure requiring dialysis[25,26] During the Turkey's Marmara Earthquake in 1999, research showed that the earthquake had a negative impact on glycemic control and quality of life (QOL) of people with type 1 diabetes[27], while for the Kobe earthquake, Japanese researchers

revealed that chronic, life threatening stress as a result of a disaster worsened metabolic control (HbA1c) in patients with diabetes mellitus[28-30]. These studies also revealed that pre-quake quality of life levels only got re-established after the extended periods of time. Other research showed an increase in the number of newly diagnosed diabetes patients following the earthquakes in Los Angeles[31] and Armenia[32] respectively A CDC study in 2004 on needs and the health status of older people after Hurricane Charley showed that the disruption of medical care for pre-existing conditions (CVD, diabetes and physical disabilities) had led to a 32% increase of adverse effects of medical outcomes in some areas

The literature search leads to three conclusions First of all, although many clinical findings were based on aggregated data and the associations may be subject to ecological fallacy, the overall pattern indicates that the population groups with pre-existing chronic medical problems tend to be worse off post-natural disaster. Secondly, the pre-existing care for chronic medical needs may be seriously disrupted, with reported of adverse outcomes. Finally, most available documentation is from developed countries, and only limited information on the experience of populations with chronic medical problems in developing countries can be found. Although similar chronic disease complication patterns can be expected from patients regardless of country of origin, the lack of reporting may reflect the lack of understanding, concern and expertise to deal with people with chronic disease in the developing countries Further analysis in the following section attempts to show how factors in disaster preparedness and response processes may prevent the uptake of addressing chronic medical needs in field practice

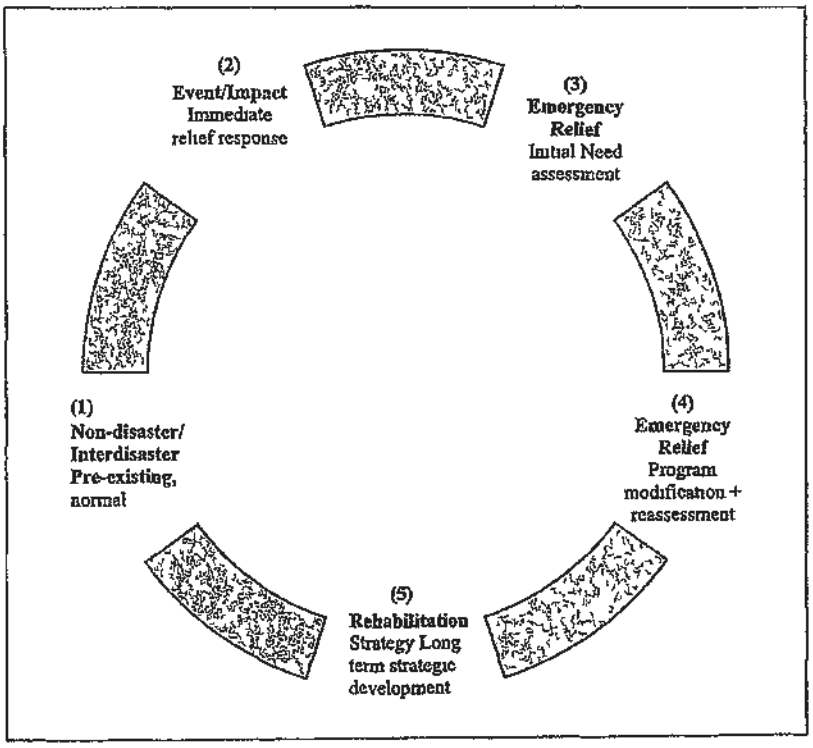
(II) Factors influencing attention to address chronic medical needs before and after a disaster

Figure 1 shows a model that highlights decision making moments in relief resource allocation post natural disaster This disaster-cycle model[32] views sudden impact disaster as a continuous time sequence of five different phases of operational importance: a pre-disaster phase, the immediate impact of the event; the initial relief response based on an initial needs assessment, followed by a relief programme modification based on further assessments; and finally work on longer term rehabilitation and reconstruction

(1) Pre-disaster

In general, the degree of socio-economic development will influence the availability of medical services and health resources for a particular population For developed countries that have resources and experience in dealing with chronic medical problems, services for chronic medical needs can be comprehensive, and disaster preparedness planning[33] should also include needs of patients with non-communicable diseases during emergency. However, in low-income developing countries, fragmented medical services and limited health resources typically limit access to appropriate care for people with chronic medical problems Frequently, in rural or poor regions, where a disaster tends to disproportionally affect the most vulnerable[34], patients may not even be aware of the existence of their chronic medical problems and needless to say, preparedness and awareness of chronic medical needs during disaster would be non-existent Thus, the ability for disaster affected populations to handle chronic the medical needs of post disaster varies vastly according to the pre-existing availability of services and care. This implies that if disaster medical relief groups attempt to address chronic medical service during relief interventions, they would have to overcome the lack of pre-existing local service structures, including human resources and technical knowledge, and the absence of a government strategy to sustain

Figure 1. Decision making moments in relief resource allocation post natural disaster



services created for chronic medical conditions during a relief operation. This set of constraints alone usually deters emergency relief agencies to venture into the arena of managing non-communicable chronic conditions.

(2) Impact

During a disaster, the massive loss of life, destruction of health services and structures have often impaired the ability of both government and relief agencies to provide relief beyond essential life saving procedures. Even for countries with disaster preparedness plans, resources for regular primary health care services may be re-directed to emergency services. As a result, chronic medical needs would be sidelined. As pointed out in the previous section, an association between exacerbation of chronic medical conditions and disasters is reflected in the literature. To further complicate the process, relief workers might also unknowingly complicate the medical condition of population groups through their insensitivity towards specific needs of patients with chronic medical conditions. For instance, adverse drug interactions may go unnoticed and dietary needs of diabetes and hypertensive patients may not be addressed in food distribution in disaster relief operations[4]. Unless sensitivity and knowledge of relief workers towards chronic medical needs increases, medical interventions will remain less efficient and effective.

(3) Initial needs assessment

While it is critical to respond quickly to save lives and prevent suffering, obtaining valid information to make evidence-based, appropriate and relevant relief decisions is just as important. Health needs are those needs that can benefit from a service or intervention along the pathway of care, namely, health protection, health education, disease prevention, diagnosis, treatment, rehabilitation and terminal care. Health needs assessment is a systematic method of identifying unmet health and healthcare needs of a population and making changes to meet these unmet needs. Although assessing health needs prior to intervention appears to be evidence-based, it should be noted that traditional needs assessment tends to focus on identifying health risks rather than health needs. These health "needs" assessments focus on minimising potential health risks or hazards (such as possible disease outbreaks) instead of supporting ongoing chronic medical/health needs which have been present prior to disaster.

In addition, most health need assessments only identify acute health problems[3]. Standardised essential data set of different agencies for rapid needs assessment did not identify chronic medical disease as essential data to be collected during assessment[35]. Despite the fact that 25% of people using health facilities following the earth-quake of Kashmir, Pakistan, were older people, none of their chronic health conditions were managed because these needs were not characterised or targeted during the initial relief assessment[4].

Furthermore, unreliable population data, highly mobile populations, poor security, difficult access, and extreme terrain will render direct, accurate collection of health statistics improbable. The lack of pre-existing information on prevalence of chronic problems makes estimation of needed resources more difficult. Proxy measures are often used instead. In the US, the use of the Behavioral Risk Factor Surveillance System (BRFSS) was reported in 2004 to estimate the prevalence and number of people with chronic diseases such as diabetes, heart disease, stroke, hypertension, and current asthma who lived in the New Orleans-Metairie-Kenner area. This information can assist the medical and public health community in assessing the needs of people with chronic diseases after disasters and in planning relief efforts. However, needs assessments in difficult areas like Iraq, South Sudan and Somalia, often come down to assessments of "availability of health facilities" or "presence/absence of health services"[36] Although these indicators may capture access to health services, they do not provide the information that truly reflects the health problems or related needs of the population.

Moreover, factors that affect health outcomes are multidimensional. Many health needs assessments focus on simple measures such as mortality and neglect other relevant health determinants that may have contributed to morbidity. Ill health may be caused by the lack of basic necessities for healthy living such as access to clean water and sanitation or food and nutrition, poor environmental factors, and inadequate housing and security. Relief operation recommendations drawn from single sector assessments will be inadequate to address all aspects of underlying health needs. It is also important to identify the capacity and performance of the local health services. Access to drugs and trained personnel will affect the health of the population. Challenges to the collection of field information will deter intervention planners from conducting in-depth assessments. Overly simplistic health indicators (mortality rates and malnutrition) are not sufficient to capture possible solutions to addressing real needs.

Despite the criticism of the relevance and accuracy of needs assessments, perhaps the most likely culprit in making chronic disease invisible during disaster relief intervention is the fact that formal assessment was not found to be the most important trigger for response. Results of formal assessments were often marginal to decision making[36]. In practice, many health interventions are based on normative needs determined by relief workers, rather than on unmet needs of the most vulnerable. If the relief workers are not sensitive to potential chronic medical needs of an affected population, it will be unlikely that decision makers in disaster relief programmes will include chronic medical needs.

Overall, the lack of awareness and insensitivity of relief workers and, needs based assessments that are primarily focused on health risks and acute needs, together with the lack of reliable indicators, baseline information, and multi-dimensional characteristics of chronic medical problems all pose serious challenges and deter government and relief agencies to deal with diseases of a chronic nature

(4) & (5) Programme modification and Rehabilitation

In a situation such as a disaster, competition over limited resources, the lack of know-how and the absence of institutional strategies to deal with chronic medical problems provide poor incentives for medical care workers to deal with chronic conditions. In addition, in developing countries where pre-disaster health services are limited, it will be unlikely to find relevant local staff with adequate knowledge of drug use and skills to support the management of chronic disease. The lack of appropriate human capital, supporting structures, history of multidisciplinary collaboration and government's policy that would be required to sustain services beyond the emergency will often hamper the management or development of relevant chronic disease strategies post-disaster. Furthermore, the absence of relevant field-friendly clinical diagnostic criteria, uncertainty in drug availability and the lack of rehabilitation facilities also pose additional challenges to provide chronic medical service in resource deficit settings. Fundamentally, many disaster medical interventions are acute in nature and targeted on short-term outcomes. Unless relief agencies or governments have strong underlying development ethos or policies that encourage community participation in the process, the concept of planning the long term strategies and sustainable exit planning are simply neglected.

Table 1 provides a summary of the identified factors that may impede the provision of care for chronic medical needs in the disaster affected populations

(III) What can we do?

In order to make chronic disease management part of the medical response in developing countries affected by conflict, it will be important to take steps in all phases of disaster planning and response. Disaster preparedness will need to incorporate plans to deal with chronic non-communicable diseases should disaster strike. Locally available data will assist in determining disease patterns and prevalence rates, which will be helpful in formulating a response including the stockpiling of appropriate drugs and supplies. Similarly, international relief agencies will need to incorporate expected needs regarding chronic diseases in their contingency planning and be prepared to deal with these diseases, which may include awareness and technical training of their staff. Awareness of the needs of often older, chronically ill people will be a key element during the initial relief phase and will include identification of patients and maintenance of their treatment, possibly through active case finding. Once more extensive needs assessments can take place to modify the initial relief programmes and to prepare for longer term rehabilitation and reconstruction, chronic medical needs will have to be taken into consideration as well. As a guide, various possible, low-cost activities are listed in Table 2 using Leavell's[23] distinction in primary, secondary and tertiary prevention

Table 1. Factors that may hinder the provision of medical care for chronic conditions during the post disaster medical interventions

(1) Pre-disaster
No services available (resource deficit setting)
No human and technical resources
Chronic medical needs not included into disaster preparedness and planning.
Not government policy priority
(2) Impact
Acute needs take priority
Relief workers unawareness (iatrogenic problems)
(1) (3) Needs assessment
Risk-based rather than need-based
Acute need focus
Assessment issues (mobile population, difficult access, lack of appropriate indicators)
Multidimensional outcomes which require multi-sector collaboration
Lack of sensitivity of relief workers towards chronic care needs
(4) Rehabilitation
Opportunity cost of investing limited resources in chronic medical service
Lack of technical know how of relief workers
Absence of institutional strategy to deal with longer term strategies
The absence of relevant field-friendly clinical diagnostic criteria, uncertainty in drug availability and lack of rehabilitation facilities

Table 2. Potential low cost activities and programmes that might prevent as well as support chronic medical needs of population in developing countries

Primary Prevention
Educate the affected population about chronic disease prevention and awareness (e g. dietary /habit, exercise, smoking cessation, alcohol use, injury prevention)
Secondary Prevention
Identify and assess health risk (cardiovascular risk) during opportunistic consultation
Opportunistic screening of chronic medical condition (hypertension, diabetes)
Establish patient management plans for chronic medical problems based on local resources availability
Support establishment of chronic medical service through training and coordination
Tertiary Prevention
Educate health care workers to prevent and detect chronic disease complications through training and coordination.
Act as a liaison to support the development of multidisciplinary service among different sectors in to promote communication and partnership.
Establish disease target monitoring according to local service availability
Support development of disease surveillance programmes at local setting

In pursuing these activities, agencies should ensure that these activities can be incorporated and sustained in the (re-)emerging health system following reconstruction The temporary additional resources, in terms of funds and technical capacity, often seen in post-disaster, may be put to use to give a boost to previously neglected care for chronic diseases, but should remain within the longer term realities of the health system at hand. Community partnership and collaboration that promote local ownership and technical transfer of chronic disease management skills will be essential for the sustainability of services beyond the disaster relief period.

Conclusion

The current scarcity of data in the literature points to the necessity for more research on the extent of needs of people with chronic, non-communicable diseases, in particular of older people who may suffer from multiple chronic conditions. Such research may lead the way to improved needs assessment tools and intervention models during disaster responses. This may not only save lives and reduce unnecessary suffering, but may also have longer term effects. As pointed out by Stephenson and Dufrane[37,38], disaster relief has long term implications on the affected area. From a public health perspective, it will thus be important to seize the opportunity during disaster relief to decrease the global burden of chronic disease. Fundamentally, expanding the concept of medical disaster intervention to include chronic medical needs in different stages of disaster planning, response and rehabilitation may benefit local populations in a sustainable way

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their needs can be effectively addressed. We would argue that the 'tyranny of numbers' often violates the human rights of those from smaller groups. Coupled with their minority status, the socio-cultural stigma that Aravanis carry with them makes this population extremely vulnerable in both developmental and disaster contexts. Gender-just disaster management would see that Aravanis, the victims of gender discrimination, are helped in an equitable manner, in all phases of disaster response. Sex- and gender-disaggregated data should take them into account, and their differing needs, capacities and aspirations should be recognised.

> **'when we pray we always say: "Let us be the last Aravanis on earth"' – Padma and Uma, Nagai and Cuddlalore, Tamil Nadu**

The needs of Aravanis for safe housing, access to citizenship documents, secure livelihoods, including access to credit and training for alternative livelihoods, their inclusion in the job market and recognition of their capacities and of the Jamat as a legitimate body are some of the areas interventions can seek to address. Such gender-sensitive needs assessment will require a process of reflection and a conscious effort to tackle entrenched biases and gender blindness, constant interaction with Aravanis themselves and a deliberate effort to counter the negative perceptions of Aravanis within mainstream institutions. Participatory capacity-building workshops focusing on ways to integrate their differing needs into ongoing programmes could be made an integral part of the disaster preparedness agenda.

To mainstream the gender concerns of Aravanis, strong advocacy and lobbying with policy-makers is needed to facilitate access to their entitlements, encompassing both their practical and strategic gender needs. In this context, a government order from 2006 safeguarding the interests of Aravanis needs to be properly analysed and widely disseminated, both to stakeholders and to Aravanis themselves. Giving the order practical effect remains a challenging task for all actors concerned. Finally, there is a need for donor agencies to channel funds for the empowerment of Aravanis through specific programmes, ensuring them a life of dignity and an existence free of violence, discrimination and stigma.

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Including chronic disease care in emergency responses

Emily Y. Y. Chan and Egbert Sondorp

Although acute physical injuries are the leading cause of human mortality and morbidity in natural disasters, a significant proportion of deaths are a result of poor hygiene and sanitation, inadequate nutrition as well as insufficient health care services due to the destruction of healthcare structures and resources to cope with the diseases prevalent in the affected area. Whilst the provision of basic care following disasters usually focuses on the treatment of acute conditions like injuries, diarrhoea and respiratory infections, as well as more recently on psychosocial and mental health services, the provision of care for chronic diseases is rarely seen as a priority. For the twenty-first century, the aging of most populations around the world, in combination with an increase of non-communicable, often chronic, diseases, calls for a rethink.[1]

1 E. Y. Y. Chan and E. Sondorp, 'Medical Interventions Following Natural Disasters: Missing Out on Chronic Medical Needs', *Asia Pacific Journal of Public Health*, vol. 19, Special Issue 2007.

The burden of chronic disease

Table 1 (page 44) highlights the burden of chronic disease in selected countries frequently affected by natural disasters. The absence or disruption of treatment for chronic diseases (like diabetes, high blood pressure, mental illness and HIV/AIDS) is not only life-threatening for vulnerable groups, but may also give rise to complications (e.g. diabetes retinopathy, stroke) resulting in a reduction in quality of life and potentially impaired livelihoods, due to the costs of complication treatments and avoidable deaths.

To act or not to act

Typically, a natural disaster emergency health response would include treatment for injuries, basic care for common diseases, surveillance and emergency preparedness for disease outbreaks. Management of non-communicable chronic disease is usually left out. There are a number of questions that need to be considered when deciding to

Table 1: Burden of chronic disease and natural disasters in selected countries (2000–2008)

Country	Total number of natural disasters 2000–2008	% deaths by chronic disease caused in the country					% chronic disease deaths (among total reported deaths)
		Cardiovascular disease	Cancer	Chronic respiratory disease	Other chronic diseases	Diabetes	
China *	235	33	20	17	8	1	79
India *	160	28	8	7	8	2	53
Indonesia*	133	28	12	7	11	3	61
Pakistan**	61	22	6	5	8	1	42

Sources: WHO, *Preventing Chronic Disease: A Vital Investment, World Health Organization Global Report*, 2005, http://www.who.int/chp/chronic_disease_report/en/; Centre of Research on Epidemiology of Disaster (EMDAT), http://www.unisdr.org/disaster-statistics/pdf/isdr-disaster-statistics-50top-countries.pdf. and http://www.emdat.be/Database/Trends/trends.html.
* As projected in 2005 ** As projected in 2002

Table 2: Issues to consider

To act	Not to act
Affected population	
Population need	Local population resistance due to different cultural understanding of the problem
Demand from recipient population	Competition (local physicians' financial incentive is being threatened)
Pre-existing structure/availability of resources and capacity	Prioritisation of other medical conditions for treatment
Invitation of the local authorities	Political pressure from the authorities not to tackle the issue
Capacity of relief agencies versus local capacity	
Resources (medication, human resources, equipment)	Competing medical priorities
Operational mandate	Lack of operational mandate for health-related issues
Humanitarian imperative (emergency/lifesaving for patients)	Lack of technical capacity/competency
Technical challenges	
Technical capacity and experience	Lack of guidelines/standards
Sustainability/continuity because of available local partnership	Unwillingness or lack of cooperation from stakeholders
Willingness to accept technical transfer (of knowledge and know-how)	Concern for management continuity and sustainability

provide medical services for chronic diseases in developing countries during medical relief after natural disasters. Table 2 outlines some of these issues.

Gaps in responses

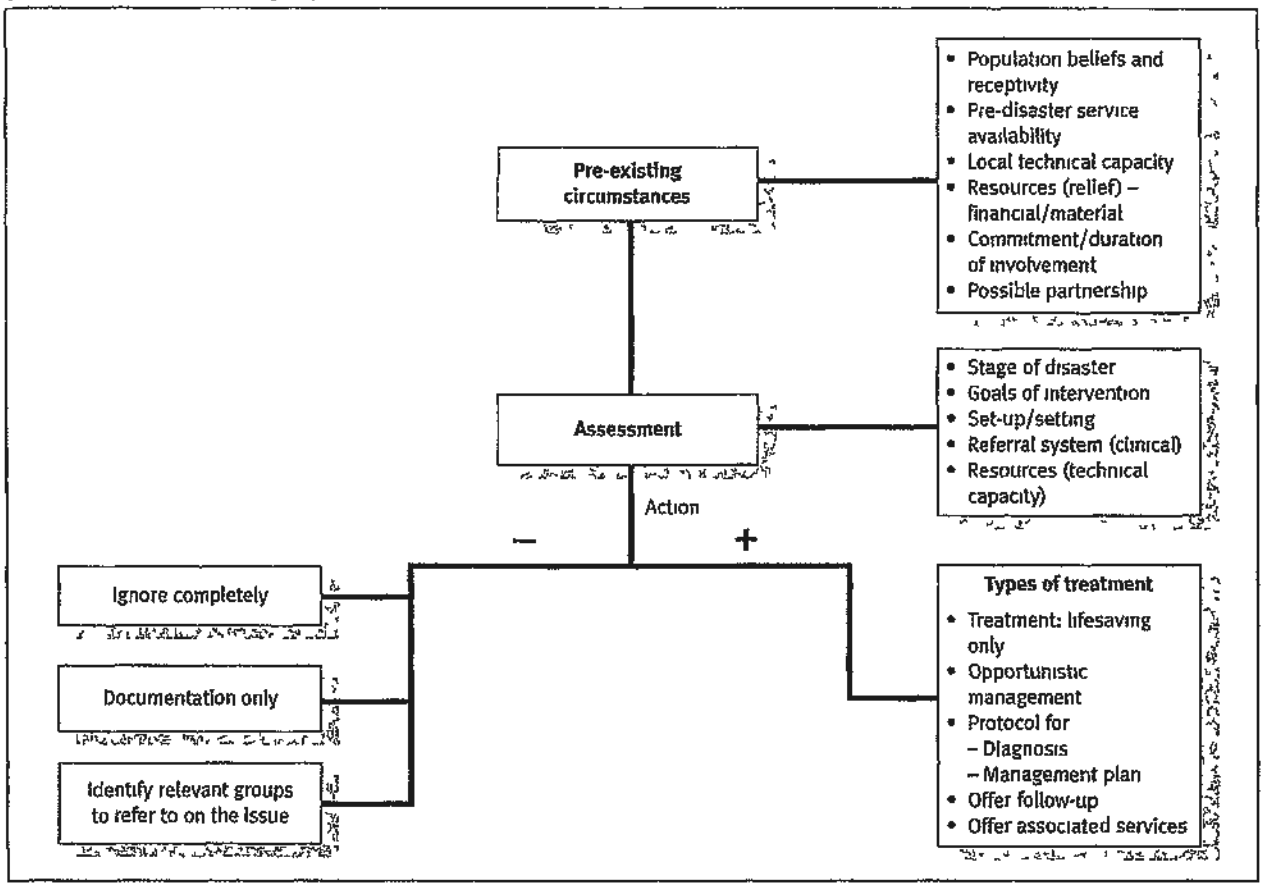
There are virtually no guidelines regarding the management of chronic medical conditions after natural disasters. The Sphere Minimum Standards highlight the issue of chronic medical condition management, but guidelines in terms of deciding which conditions to manage, indicators for monitoring or guidelines on treatments to adopt in emergency settings are absent. The key gap at the field level seems to be the lack of mandate and awareness among relief agencies and health workers of the need to manage chronic diseases during emergency relief operations. After the Sichuan earthquake in May 2008, frontline medical teams found that up to 38% of survivors needed clinical management of their pre-existing chronic medical conditions before further surgical interventions could be performed for their physical trauma.[2] Only a handful of relief groups had identified chronic disease management as a priority during emergency medical relief work. Even when surgeons and appropriate drug supplies were available, many older patients with orthopaedic trauma were not surgically treated because of their poor clinical condition (for instance unstable glucose control for diabetes). In addition, immediately after the initial acute phase, the patient profile changes as there will be an increasing number of patients seeking care for non-disaster health needs, such as unstable hypertension and minor stroke as a result of a lack of medication.

in the decades to come, chronic medical conditions will become too significant a burden to ignore during emergency medical field operations

The major field debate regarding chronic disease management post-disasters concerns whether medical care should be provided for chronically ill people living in areas where pre-disaster health services do not exist. To

2 E. Y. Y. Chan, 'The Untold Stories of the Sichuan Earthquake', *The Lancet*, vol. 372, 359–362, no. 9636, 2 August 2008, http://www.thelancet.com/journals/lancet/article/PIIS0140673608611411/fulltext.

Figure 1: Proposed conceptual model for decision-making on whether or not to provide chronic medical services post-disaster in developing countries



help decision-making on whether or not to include care for chronic diseases after a natural disaster, we present a conceptual model in Figure 1.

It is important to understand the pre-existing circumstances in the disaster-affected location before making decisions. Population beliefs and receptivity, pre-disaster service availability, local technical capacity, resource availability in terms of finances and materials, the commitment and duration of involvement of the intervening agency and possible partnerships should all be considered. During the assessment, the timing of the intervention (in terms of the stage of the disaster), its goals, where operations are set up, the availability of a referral system and the technical capacity of relief agencies all have to be examined.

Regardless of the decision, it is important to highlight that management of chronic conditions involves a spectrum of services ranging from disease prevention/protection to health promotion, diagnosis, treatment, rehabilitation ('tertiary prevention') and palliative care. Some of these services, such as health advice, would incur no cost but have, potentially, long-term implications for disease prevention. For instance, not only can smoking cessation advice prevent potential adverse clinical outcomes such as heart diseases, stroke and cancer, but health advice may also reduce spending on cigarette consumption. Even if it is decided not to provide chronic disease treatment, there are still ways to provide support. For example, agencies could try to identify referral options, where relevant services and clinical management support are provided, and facilitate referral. At the very least, they might consider documenting the key chronic disease burdens among the disaster-affected population so as to highlight health gaps that need to be addressed.

In the decades to come, non-communicable chronic medical conditions will become too significant a burden to ignore during emergency medical field operations. It is important that emergency medical missions do not substitute for local systems, and issues of sustainability of treatment should be carefully assessed. Nevertheless, refusing to manage chronic medical conditions during emergency operations may result in the very mortality and morbidity which the relief operation intends to minimise.

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