Teaming Up for Patient Safety: A Case Study of Social Interactions Among Surgical Team Members

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The author wishes to acknowledge the team members and leaders of the Department of Orthopedic Surgery for making this research project possible. Their experiences of teamwork will serve to inform future research into the nature of achieving and sustaining high performance amidst ever increasing complexity and instability within the healthcare environment in general, and in the operating room in particular.

Abstract of Dissertation

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Despite increased awareness of the link between teamwork and medical errors, and increased development of interventions aimed at improving team performance, the incidence of preventable errors in hospitals, and in the surgical environment particularly, remains high. Absent from interdisciplinary team development efforts is empirical evidence informed by the voices of surgical team members specific to their day- to- day experiences of teamwork. For this reason, a case study of interdisciplinary teamwork among Orthopedic Surgery team members was conducted from June to December 2013 to: (a) discover how teamwork behaviors are enacted in the surgical environment to affect the incidence of preventable surgical errors; and (b) understand the experience of teamwork from the perspective of surgical team members.

The case study data included 37 one-on-one interviews with Orthopedic Surgery team members (including two supervisors), and observations by the researcher guided by the Observational Teamwork Assessment for Surgery (OTAS) instrument. This study finds that while mindfulness is a prerequisite to safety behaviors that are found in the surgical setting, there is a dynamic interplay between processes of collective mindfulness and traditional teamwork behaviors wherein one continuously informs, shapes, and reinforces the other. Noting contributions of the this study to practice, the opportunity exists to expand the present inquiry beyond Orthopedic Surgery to include other surgical specialties as well as non-surgical practices within the hospital and clinic environments.

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CHAPTER 1: INTRODUCTION

A discussion is presented on the landmark report from the Institute of Medicine which made public for the first time the alarming number of patients that die each year in U.S. hospitals from preventable medical errors. A review is presented of efforts over the past 16 years to reduce the number of deaths from preventable medical errors including the creation of national patient safety goals and mandatory error reporting requirements for hospitals. Moreover, the link between teamwork and medical errors is explored with emphasis on the opportunity to develop a more informed perspective of teamwork behaviors and teamwork. It is within this context that the purpose of the present research study is outlined and attendant research questions posited. An expansion of existing literature as well as creation of new knowledge is outlined detailing the significance of the research study. Lastly, Weick and Roberts' (1993) conceptualization of collective mind is presented as the primary theoretical underpinning of the study.

Problem Statement

Nearly two decades ago the Institute of Medicine (IOM) released a highly publicized and alarming report entitled *To Err is Human: Building a Safer Health System* (Kohn, Corrigan, & Donaldson, 1999). The IOM report estimated that between 44,000 and 98,000 lives are lost in American hospitals each year as a result of medical errors. For the first time, the assumed quality and safety of U.S. hospitals was called into question. While healthcare providers and scholars debate the methodology used to estimate the number of deaths due to medical errors, the fact remains that each year thousands of patients suffer needless harm in U.S. hospitals due to preventable medical

errors. To further heighten awareness in this regard and encourage the development of improvement strategies, in 2002 the Joint Commission on the Accreditation of Healthcare Organizations (JCAHO) created and released for the first time standards specific to achieving patient safety in healthcare known as the National Patient Safety Goals. At the same time, the National Quality Forum (NQF), composed of healthcare policy experts and thought leaders, reached consensus in the development of a list of events that should never ever happen to patients in hospitals and other healthcare domains (National Quality Forum, 2002). One year later in 2003, Minnesota became the first State in the nation to require hospitals to publicly report never events or adverse events as defined and published by the NQF's *27 Serious Reportable Events in Healthcare*. Yet, in spite of these and similar efforts, 85% of hospitalized patients will experience an error or errors during their hospital stay (Leape, 2003). Further, the number of patients that experience preventable harm during their hospital stay may be much higher than originally estimated as James (2013) finds that annually between 210,000 and 440,000 hospitalized patients experience some type of preventable harm that contributes to their death.

While numerous factors contribute to medical errors including poorly designed and organized systems supporting care delivery (Kohn, Corrigan, & Donaldson, 1999), the lack of interdisciplinary teamwork among hospital team members is often cited as a relevant factor in the incidence of medical error (Amalberti, Auroy, Berwick, & Barach, 2005; Healey, Undre, & Vincent, 2004; Etchells, O'Neill, & Bernstein, 2003; Jones as cited in Rosenthal & Sutcliffe, 2002; Gaba, Fish, & Howard, 1994; Reason, 1995). Moreover, the National Quality Forum's 2009 update presents thirty-four (34) practices

with significant potential to reduce the incidence of adverse health events, including…establishing " a proactive, systematic organizational-wide approach to developing team-based care through teamwork training, skill building, and team-led performance improvement interventions that reduce preventable harm to patients" (p. vi). Further, the State of Minnesota's first public report of adverse health events in hospitals, points to the surgical practice as a significant and frequent domain of adverse and preventable medical errors (Minnesota Department of Health, 2005). Moreover, five years after Minnesota's initial public report, the surgical practice remains a domain of significant and frequent error (Minnesota Department of Health, 2010).

While the literature as well as actual events point to the operating room (OR) as a site of frequent errors, Healey, Undre, and Vincent (2004) assert that "research and development of interdisciplinary teamwork in surgery is comparatively scarce" (p. i33). In the absence of empirical research to guide improvement activities aimed at preventing adverse events in healthcare in general and in the OR specifically, large-scale and systematic efforts to eliminate patient harm have focused on the use of techniques from aviation including checklists (Shojania, Duncan, McDonald, & Wachter, 2002) and the development and implementation of regulatory standards, for example, the Joint Commission's Universal Protocol incorporating pre-procedure verification, site marking, and time-out processes (JCAHO Perspectives, 2002). While useful, critics warn of the unintended consequences that can arise from the broad application of standards and practices in the absence of thoughtful and rigorous empirical study. With this in mind, this study is designed to observe, pinpoint, and describe teamwork behaviors among

surgical teams members that when enacted produce nearly flawless teamwork, and hence reduce the incidence of preventable medical errors in the OR.

Purpose of the Study and Research Questions

The purpose of this study is to develop a more informed perspective of teamwork behaviors and teamwork with an eye towards the development and implementation of more effective teamwork improvement strategies and interventions. The primary research inquiry is to discover how teamwork behaviors are enacted in the OR to affect the incidence of preventable medical errors. In addition, four secondary research questions are examined:

1. What are the behavioral dimensions of surgical teams that contribute to overall patient safety and the detection, correction, and prevention of errors?

2. What are the patterns of teamwork among hospital surgical team members that result in more collective team capacity to detect, correct, and prevent errors?

3. What are the discernable patterns of teamwork among hospital surgical team members that correspond to patterns of teamwork in other highly complex, interdependent, and dynamic organizational environments?

4. To what extent can "blanket" teamwork behavioral dimensions be applied to the study of teamwork in highly complex, dynamic, and risky environments like the OR?

Significance of the Study

This study adds to existing theory and research in four important ways. First, teamwork is explored in those operational units within the hospital environment known to have a high incidence of preventable medical errors, and where there is little empirical research on interdisciplinary team development; namely, the OR (Rosenthal & Sutcliffe,

2002; Healey, Undre, & Vincent, 2004). Second, this study tests the theory of heedful interrelating and the attendant teamwork behaviors exhibited among interdisciplinary team members in the surgical setting. Third, while previous studies aimed at reducing medical errors have focused within a single discipline, this study is focused across disciplines. Finally, this study not only adds to existing literature, but also has the potential to illuminate important aspects of interdisciplinary teamwork in such a way as to affect the design and deployment of interventions aimed at improving team dynamics, effectiveness, and overall teamwork performance. Such improvements portend important implications for reducing medical errors and increasing overall patient safety and system reliability.

Theoretical Framework

Two theoretical constructs underpin this study. First, the work of Rousseau, Aube, and Savoie (2006) highlights the criticality of behaviors distinct from inputs, processes, and outcomes as factors likely to increase the performance of work teams. The authors note that behaviors are distinct from other individual and team attributes in that they can be observed and measured and importantly, "can affect the social and physical environment" (p. 541). Further, a distinction is made between task work behaviors and team behaviors in that the latter "facilitate the achievement of collective tasks and consequently increase team performance" (p. 542). In addition, Rousseau, Aube, and Savoie (2006) point out that behavior is difficult to conceptualize and for this reason there is significant disagreement as to the dimensions of teamwork behaviors. With this in mind, the authors posit an integrative framework of teamwork behaviors encompassing two overarching categories of teamwork behaviors described as regulation

of team performance and management of team performance. The former is based on action regulation theory (Frese & Zapf, 1994) and encompasses four specific teamwork behaviors: (a) preparation of work accomplishment; (b) work assessment behaviors; (c) task-related collaborative behaviors; and (d) team adjustment behaviors. The latter, or management of team performance, recognizes the need to attend to personal and interpersonal issues that can and often do arise throughout a team's time together. Team behaviors specific to team maintenance include psychological support and integrative conflict management.

The second theoretical underpinning of this study is mindful/heedful interrelating in high reliability organizations (Rochlin, LaPorte, & Roberts, 1987; Roberts & Rousseau, 1980; Sandelands & Stablein, 1987; Weick & Roberts, 1993; Weick, 1987; Wegner, Erber, & Raymond, 1991; Weick & Sutcliffe, 2001; Ryle, 1949; Hutchins, 1990, 1991). Drawing upon the work of Weick & Roberts (1993) teamwork in this study is characterized as collective mind or mindful/heedful interrelating and refers to how or the way behaviors are enacted. That is, certain behaviors when enacted heedfully reduce or eliminate the incidence of preventable medical errors in the OR. Heedful interpersonal interactions are characterized as attentive or mindful, purposeful, conscientious, and considerate (Weick & Roberts, 1993); ostensibly, the more heedful interrelating among surgical team members, the less the incidence of preventable medical error. Moreover, mindfulness and its five constituent processes (sensitivity to operations, reluctance to simplify interpretations, commitment to resilience, under specification of structure, and preoccupation with failures) provide the theoretical structures underpinning the relationship between behavioral dimensions of teamwork

and medical errors, and ultimately, overall quality in the OR. As such, this study seeks to operationalize the concept of mindful/heedful interrelating in the context of the identification and enactment of behaviors among surgical teams and team members which foster the reduction and elimination of preventable medical errors, and in so doing present the opportunity for more focused and effective team interventions aimed at medical error prevention.

Figure1-1 below presents the aforementioned conceptual framework wherein the relationship between teamwork behavioral dimensions, mindful/heedful interrelating, OR quality, and advanced safety culture is depicted.

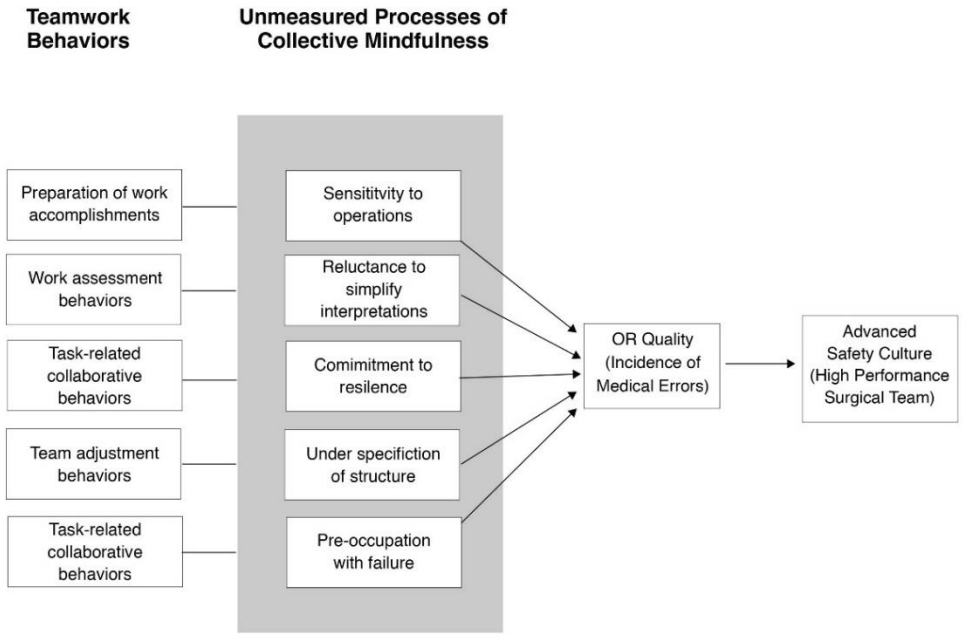

Figure 1.1. Conceptual Framework

Overview of Methods

The purpose of this study is to observe, understand, and describe interactions and patterns of interrelating between surgical team members. More specifically, the lived-experience of team members acting singularly or as a group to construct their reality is the focus of this study. That is, this study is grounded from an epistemolical perspective in the idea that individuals and groups construct their reality as posited by Burger and Luckman (1966). A case study research methodology in conjunction with an observational teamwork assessment instrument is proposed to observe, describe, and understand how specific patterns of interrelating among surgical team members contribute to the detection, reduction, and prevention of medical errors. The subject population includes surgical team members in Orthopedic Surgery. The inclusion of Orthopedic Surgery in this study is based on a review of four data points: (a) thirty-day post-operative complication rates; (b) reported surgical incidents; (c) staff satisfaction survey scores specific to teamwork; and (d) patient satisfaction survey scores specific to teamwork. The aforementioned review highlights Orthopedic Surgery as an exemplar with respect to clinical outcomes and overall surgical team performance, and presents the opportunity to further inform the phenomenon of teamwork in high risk, dynamic, and complex environments like the OR and through the voices and actions of high performance team members. Orthopedic Surgery team members participating in the study include: (a) six surgeons; (b) five physician assistants; (c) a first assistant; (d) four RN circulators; (e) five surgical technicians; (f) two surgical assistants; (g) five anesthesiologists; (h) four certified registered nurse anesthetists or CRNAs; (i) an

orthopedic resident; and (j) two anesthesia residents. In addition, two supervisors round out the study population.

Data analysis methods proceed in the tradition of phenomenological technique. Political considerations were addressed prior to the start of the study. Finally, the significance of the study rests with its potential to not only expand existing theory and research, but also to better inform interventions aimed at improving team performance and hence, reducing preventable surgical errors and improving overall patient safety.

Limitations and Assumptions

Limitations and assumptions of this study are outlined below. First, a comparison team is not included in the study and as such, the study is informed by the experiences of only one surgical specialty, Orthopedic Surgery—an already highly evolved and high-performance team.

Second, as the surgical environment is fast-paced, high-volume, and oftentimes resource constrained, the opportunity to be apprised of staffing changes in advance of planned observations is limited. For this reason, non-core team members or float staff are not included in the study.

Third, while observations of hand-off communications between OR staff and recovery room staff are planned for this study, recovery room nurses are not included in the study as research participants.

Fourth, all observations are planned to occur during regular working hours or from 7:00 a.m. to 7 p.m. excluding holidays, nights and weekends. This excludes the opportunity to explore any differences in team performance based on time.

A final limitation of the study is the researcher's relationship to the research site and as such, to research participants. The researcher has been employed at the site for nearly eight years and the environment is very well known to her. For this reason the researcher was careful to exercise due diligence at all times, incorporating self-reflection, journaling, and peer debriefings.

In addition to the above, several assumptions underpin this study. Teamwork in this study is defined as mindful/heedful interrelating among team members. This definition narrows the much broader conceptualization of teamwork from a focus on inputs, processes, and outputs towards a more behavioral teamwork construct and situated among team members in environments characterized as highly dynamic, complex, and interdependent. The level of analysis for this study is the small group or the four to five-member surgical team. The aim of this study is not to predict team performance. Rather, this study is concerned with identifying and understanding teamwork behaviors associated with error prevention in the OR, and achieving ever-increasing levels of patient safety and system reliability.

Definition of Key Terms

This study relies upon standardized and generally accepted definitions of key terms associated with healthcare safety as originally presented in the IOM (1999) report *To Err is Human: Building a Safer Health System*. A sub-set of terms particularly germane to the present inquiry are highlighted below:

- *Safety*: Freedom from accidental injury.
- *Error*: The failure of a planned action to be completed as intended, or the use of a wrong plan to achieve an aim. Errors can include problems in practice, products, procedures, and systems.
- *Adverse event*: An injury resulting from a medical intervention (i.e., not due to the underlying medical condition of the patient).
- *Preventable adverse event*: An adverse event that was attributable to a medical error. Negligent adverse events represent a subset of preventable adverse events that satisfy legal criteria used in determining negligence: whether the care provided failed to meet the standard of care reasonably expected of an average physician qualified to take care of the patient in question.
- *Types of failure*: Errors of execution, in which the correct action does not proceed as intended, or errors of planning, in which the original intended action is not correct.
- *System*: A set of interdependent elements working to achieve a common aim. The elements may be both human and nonhuman (e.g., equipment, technologies).

Summary

Despite efforts aimed at reducing the incidence of preventable medical errors in US hospitals, the number of avoidable errors remains high especially in the OR. The purpose of this study is to explore teamwork and team behaviors from the perspective of high performance surgical team members in an effort to discover and describe the patterns of interrelating among surgical team members that contribute to the detection,

correction, and prevention of medical errors. This study presents the opportunity to: (a) conduct empirical research on interdisciplinary team development in the surgical setting; (b) validate exemplar team behaviors; (c) extend the application of the Observational Teamwork Assessment for Surgery (OTAS) instrument to include Orthopedic Surgery; and (d) affect the design and deployment of interventions aimed at reducing medical errors and increasing overall patient safety and system reliability. This study draws upon two theoretical constructs: integrative teamwork behavior (Rousseau, Aube, & Savoie, 2006); and collective mind (Weick & Roberts, 1993). Observations of surgical teams in the OR and one-on-one interviews with surgical team members were deployed to illuminate not only the phenomenon of teamwork and team behaviors that reduce the likelihood of preventable medical errors, but also to pinpoint structures that enable highly reliable team performance.

CHAPTER 2: LITERATURE REVIEW

As we are concerned with the opportunity to reduce the incidence of preventable medical errors through more effective surgical teamwork, a review of the literature follows and includes reviews specific to medical errors, teamwork, high reliability organizations (HROs), collective mind, and mindfulness.

Medical Errors

A review of the literature specific to medical errors highlights the magnitude of the phenomenon as well as the challenges associated with quantifying the incidence of medical errors. In addition, factors that contribute to medical errors are presented along with how and where medical errors occur.

Rosenthal and Sutcliffe (2002) highlight two sources of data on medical errors. The first source stems from a study conducted at Harvard Medical School in 1990 that analyzed adverse events among hospitalized patients in the state of New York. The Harvard study was conducted over a period of one year and determined from the total sample of adverse events which ones were due to negligence. The adverse event rate was 3.7%. The Harvard study was based on the 1978 Medical Insurance Feasibility Study (MIFS) which measured hospitalized patients in California. The MIFS found a 4.6% adverse event rate. The second major source of data on medical errors replicated the Harvard study in California and Utah and was conducted in 1992. The adverse event rate was 2.9%. Studdert, Brennan and Thomas (as cited in Rosenthal and Sutcliffe, 2002) found that across each of the aforementioned studies OR events were a major cause of adverse events.

The Joint Commission on the Accreditation of Health Care Organizations (2005) reported that since the establishment of its sentinel event database nearly 16 years ago, 2,840 sentinel events have been reported. A total of 2,955 patients were affected by these events, with 2,186 or 74% of these events resulting in patient deaths. Wrong site surgery, intra-operative, and post-operative complications were among the 10 most frequently reported sentinel events.

Noting the above, Rosenthal and Sutcliffe (2002) posit that medical errors are "the product of individual factors and organizational and systems factors" (p. 259). Temporary distractions and impairments are examples of individual factors resulting in medical errors, while conflict, task ambiguity, and cognitive biases exemplify organizational and systems factors resulting in medical errors (Rosenthal & Sutcliffe, 2002). Barriers to error reduction include the reluctance of staff to report medical errors due to fear of consequences (Jones as cited in Rosenthal & Sutcliffe, 2002).

Teamwork

First, a distinction is drawn between group and work group in that the latter have specific defining features or attributes. Alderfer (1977) defines a group as a collection of individuals: (a) who have significantly interdependent interrelations; (b) think of themselves as a group and can reliably distinguish members from non-members; (c) whose group identity is recognized by non-members; (d) who acting singularly or as a group have significantly interdependent relations with other groups; and (e) whose roles in the group are informed by expectations that group members have of themselves as well as expectations that non-group members have of the group.

Drawing on Alderfer's definition of a group, Hackman (1990), notes that work groups are intact social systems wherein members: (a) depend on each other to achieve shared goals/purposes; (b) have specialized roles and expertise; (c) produce outcomes that are identifiable; and (d) perform within an organizational context. Sundstrom, DeMuse, and Futrell (1990) also find that work teams are small groups of individuals working interdependently to achieve organizational outcomes. Salas, Dickinson, Converse, and Tannenbaum (1992) elaborate, defining teamwork as "a distinguishable set of two or more people who interact, dynamically, interpedently, and adaptively toward a common and valued goal/objective/mission, who have each been assigned specific roles or functions to perform, and who have a limited life-span of membership" (p. 4).

As work groups or organizational groups (Adler, 1977) have defining properties or attributes that distinguish them from non-work groups, Sundstrom, DeMuse, and Futrell, (1990) observe specific categories of production work groups or teams. First, *advice and involvement teams* feature frontline employees engaged in decision-making traditionally reserved for management. *Production and service teams* use technology to create products and services while *projects and development teams* collaborate to achieve innovative solutions and or outcomes. Finally, the authors point to *action and negotiation teams* made up of highly skilled individuals who cooperate in "brief performance events that require improvisation in unpredictable circumstances" (p. 121). Such teams include surgery teams characterized by: (a) high differentiation (expert in their field with specialized training and facilities, and at times, extended time together as a team); (b) high integration (performance events closely synchronized with team

members and support staff in other parts of the organization); and (c) brief performance events often repeated under new conditions requiring extensive training/preparation (Sundstrom, DeMuse, & Futrell, 1990).

With increasing interest in teams and team performance efforts have included not only conceptually defining teams, but also pinpointing specific components of teamwork particularly with respect to team behaviors. For example, Dickinson and McIntyre (1997) point to the behavioral aspects of work groups to define teamwork noting that behaviors of team members that engender sharing of information and a coordination of activities are collectively called teamwork. In addition to communication and coordination, other salient components of teamwork have been identified and validated to include: team orientation; team leadership; monitoring; feedback; backup; cooperation; and adaptability (Dickinson & McIntyre, 1997; Hackman & Walton, 1986; McIntyre & Salas, 1995; Salas, Sims, & Burke, 2005; Sevdalis, Lyons, Healey, Undre, Darzi, & Vincent, 2009; Rousseau, Aube, & Savoie, 2006). Dickinson and McIntyre's (1997) teamwork model is drawn from a review and synthesis of the teamwork literature and highlights communication as a key mechanism that links the other components of teamwork. Communication in the model is defined as the active exchange of information between at least two members of the team and team members providing information to others as needed. Team orientation refers to the attitudes that team members have toward each other, their work, and their team leaders. Another key component of the model is team leadership which refers to the direction and structure provided by formal leaders and others. In this way, planning and organizing activities enable other teamwork components and their attendant behaviors presented in the model. Monitoring, another

component of the model, is defined as the extent to which team members observe and have an awareness of activities and the performance of fellow team members. This component of teamwork speaks to team member competency and their depth of knowledge of not only their specific tasks, but also the roles, responsibilities, and tasks of other team members. Feedback, backup, and coordination are the final components of the Dickinson and McIntyre (1997) teamwork model. High performance teams are rich in feedback as they adapt and learn from their experiences. Feedback entails giving, seeking, and receiving feedback among and between team members. Backup refers to team members freely and willingly helping each other and seeking assistance. It implies some degree of interchangeability of tasks among team members. Coordination is the final component of the model and highlights that team members execute their tasks as a function of the behavior of others. Dickinson and McIntyre (1997) assert that, "Successful coordination implies the effective operation of other components of teamwork…In this way, the actions of individual members are merged to produce synchronized team performance" (p. 22).

Teamwork theories and models have evolved to encompass not only observable behaviors as previously detailed, but also to include and integrate less observable shared mental models encompassing three components: (a) organized knowledge and interpretations that team members share about their tasks, each other, their goals and purposes; (b) attributes; and (c) cognitive skills (Cannon-Bowers & Salas, 1990). Gibson's (2001) conceptualization of cognition entails: accumulation and interpretation of information and knowledge; interaction wherein the recall of information is a function of group structure, communication patterns, and transactive memory; examination

wherein interpretations and impressions are discussed; and accommodation wherein points of view are reconciled and decisions and/or actions are finalized. With respect to team cognition, researchers are interested in the forming of shared cognition and how cognitive processes affect team performance.

Sensemaking refers to the process that individuals and organizations use to establish a plausible degree of certainty in ever-increasing complex, uncertain, and unstable environments (Weick, 1969). Group sensemaking refers to the process that individuals undertake to filter and synthesize information in order to create shared mental models (Nosek & McNeese, 1997).

Kozlowski and Chao (2013) posit that knowledge acquisition and its emergence are influenced by team member networks and team regulation (2013). In addition, they assert that knowledge is the outcome of the process of learning. For example, in studying how cardiac surgical teams in 16 hospitals implemented a complex and new surgical procedure, Edmondson, Bohmer, and Pisano (2001) found that teams learn more quickly and successfully when leaders are adept at creating learning environments. As such, how teams learn and under what conditions holds significant implications for team performance (Edmondson, Bohmer, & Pisano, 2001).

High Reliability Organizations (HROs)

Despite increased awareness and interventions aimed at team development and improvement, medical errors in the OR persist, leading some researchers including Schulman (as cited in Rosenthal & Sutcliffe, 2002), Weick and Sutcliffe (2003) and Weick (as cited in Rosenthal & Sutcliffe, 2002) to investigate the experiences of other organizations similarly concerned with error reduction and safety, particularly HROs.

A team of researchers from the University of California at Berkeley conducted the initial empirical research leading to the conceptualization and theoretical perspective on HROs (Gaba, 2000; Ruchlin, Dubbs, Callahan, & Fosina, 2004; Weick & Sutcliffe, 2003). HROs are those organizations that perform complex tasks under demanding conditions and do so with very low error rates and almost no failures. Examples include air-traffic control centers, nuclear power plants, and aircraft carrier operations. HROs are characterized as complex, risky, safe, and reliable (Rochlin, LaPorte, & Roberts, 1987) and are known to share a "devotion" to achieving zero defects. More specifically,

Rochlin, LaPorte, and Roberts (1987) have identified five factors that contribute to nearly failure-free performance in HROs: (a) ongoing training: (b) flat hierarchical structure; (c) collaboration; (d) operational redundancy; and (e) equivalent actor or cross familiarity of jobs among team members. Similarly, Weick and Sutcliffe (2001) illuminate the construct of collective mindfulness as theorized by Weick and Roberts (1993) in specifying five cognitive processes in HROs that contribute to a standard of failure-free performance: (a) sensitivity to operations; (b) reluctance to simplify interpretations; (c) commitment to resilience; (d) under specification of structure; and (e) preoccupation with failures. Sensitivity to operations means being present to unfolding events and in-coming information, and responding accordingly (Weick, Sutcliffe, & Obstfeld, 1999). Reluctance to simplify interpretations points to the value and importance ascribed to seeking diverse points of view, adding complexity, and guarding against assumptions and complacency (Weick & Sutcliffe, 2001). Commitment to resilience points to the capacity of organizations to detect, contain, and bounce back from surprises and/or errors (Weick & Sutcliffe, 2001). Under specification of structures

or deference to expertise means that decisions migrate to those with the expertise needed in the moment (Roberts, Stout, & Halpern, 1994). Preoccupation with failures refers to the intensity with which organizations treat any failure or near miss as such events hold important implications for system reliability (Weick et al., 1999; Weick & Sutcliffe, 2001). In addition, Weick and Sutcliffe (2001) have noted a number of values and norms operating within HRO's to include respectful interactions, communication, trust, first-hand knowledge of technology, attentiveness, and familiarity with one another's roles and experience. Furthermore, Weick and Sutcliffe (2001) draw on Weick and Roberts' (1993) earlier work to suggest that HROs possess: (a) an underlying style of mental functioning focused on interpretation of context and processes of attention; and (b) complicated mental models of how events unfold. Such cognitive capabilities facilitate interpretation and comprehension of unfolding events in such a way as to reduce the incidence of errors.

Collective Mind

Weick and Roberts' (1993) conceptualization of collective mind as a pattern of heedful interrelations of actions in a social system inform this inquiry into the nature and characteristics of teams and teamwork contributing to the detection, correction, and prevention of medical errors. Weick and Roberts' (1993) conceptualization in this regard encompasses four defining properties of group performance. First, individuals create the social forces of group life when they act as if they are such forces. Second, when individuals act as if they are social forces, they construct their actions (contribute) while envisioning a social system of joint actions (represent), and interrelate that constructed action with the system that is envisioned (subordinate). Third, contributing, representing,

and subordinating create a joint situation of interrelations among activities, namely, a social system. Finally, the effects produced by a pattern of interrelated activities vary as a function of the style (e.g., heedful-heedless) as well as the strength (e.g., loose- or tight-coupling) with which the activities are tied together. Weick and Roberts (1993) suggest that "… heed, interrelating, contributing, representing, subordinating, intelligent action, comprehension, recapitulation, and resocialization come together in the concept of collective mind as heedful interrelating" (p. 10). Weick and Roberts' (1993) conceptual framework expands upon three prior efforts addressing group mind (Hutchins, 1990, 1991; Sandelands & Stableins, 1987; Wegner, Erber, & Raymond, 1991; Wegner, Giuliano, & Hertel, 1993) and extends the concept of individual mind as a disposition to act with heed as formulated by Ryle (1949) as well as Asch's (1952) work on mutually shared fields.

Weick and Roberts' (1993) and Weick and Sutcliffe's (2001) aforementioned analysis of the development, representation, and use of collective mind in high reliability organizations exemplifies how knowledge structures (Walsh, 1995) or collective cognition (Langfield-Smith, 1992) shape and inform patterns of behavior among organizational members. That is, Walsh (1995) defines a knowledge structure "as a mental template consisting of organized knowledge about an information environment that enables interpretation and action in that environment" (p. 286). Walsh (1995) points out that Durkheim (1895), Fleck (1983) and Halbwachs (1950) were "the first to consider that groups of individuals may hold knowledge about issues in a way that transcends the cognitive facilities of any one of them" (p. 286). Further, in discussing

group level representation, Walsh introduces the construct of collective knowledge as noted below:

> When a group of individuals is brought together, each with their own knowledge structure about a particular information environment, some kind of emergent collective knowledge structure is likely to exist. This group-level representation of an information environment would act just like an individual's knowledge structure…the study of cognition at this level of analysis truly becomes a study of social cognition. (p. 291)

Walsh's (1995) "hypothesized group-level knowledge structure" is also known as collective cognition (Langfield-Smith, 1992). Langfield-Smith's (1992) initial hypothesis was that "groups of individuals who work closely together share a set of common beliefs which enable them to function successfully as a group" (p. 349). Following experimentation among firefighters, Langfield-Smith (1992) noted that "it was not necessary for members of a group to have a complete set of shared beliefs in order to function as a decision making group" (p. 349). Rather, "collective cognitions are described as transitory phenomena, changing in response to circumstances…the reforming of such phenomena over time results in the formation of shared belief systems" (p. 349). Langfield-Smith's (1992) work focuses on the interaction of cognition and social processes at the group level of analysis.

Conclusions and Implications for Research

Preventable medical errors continue to occur despite increased awareness on the part of healthcare providers and consumers and in the face of regulatory mandates for

hospitals to publicly report the incidence of adverse events. Moreover, interventions aimed at improving interdisciplinary teamwork and hence, reducing preventable medical errors, have evolved in the absence of empirical evidence to support the efficacy of such efforts. Noting the characterization of high reliability organizations and their environments as highly complex, dynamic, risky, and safe, the opportunity exits to apply the HRO framework in the OR, a similarly complex, dynamic, and risky environment, although lacking the safety record found in HROs. More specifically, the literature suggests an opportunity to operationalize the theory of collective mind as heedful interrelating among surgical team members towards an understanding of teamwork behaviors enacted in such a way as to prevent the incidence of error.

Theoretical Underpinnings

Two theoretical constructs underpin this study. First, the work of Rousseau, Aube, and Savoie (2006) highlight the criticality of behaviors distinct from inputs, processes and outcomes as factors likely to increase the performance of work teams. The authors note that behaviors are distinct from other individual and team attributes in that they can be observed and measured and importantly, "can affect the social and physical environment" (p. 541). Further, a distinction is made between task work behaviors and team behaviors in that the latter "facilitate the achievement of collective tasks and consequently increase team performance" (p. 542). In addition, Rousseau, Aube, and Savoie (2006) point out that teamwork behavior is difficult to conceptualize and for this reason there is significant disagreement as to the dimensions of teamwork behaviors. With this in mind, the authors posit an integrative framework of teamwork behaviors encompassing two overarching categories of teamwork behaviors described as regulation

of team performance and management of team performance. The former is based on action regulation theory (Frese & Zapf, 1994) and encompasses four specific teamwork behaviors: (a) preparation of work accomplishment; (b) work assessment behaviors; (c) task-related collaborative behaviors; and (d) team adjustment behaviors. The latter, or management of team performance, recognizes the need to attend to personal and interpersonal issues that can and often do arise throughout a team's time together. Team behaviors specific to team maintenance include psychological support and integrative conflict management.

The second theoretical underpinning of this study is mindful/heedful interrelating in high reliability organizations (Rochlin, LaPorte, & Roberts, 1987; Roberts & Rousseau, 1980); Sandelands & Stablein, 1987: Weick & Roberts, 1993; Weick, 1987; Wegner, Erber, & Raymond, 1991; Weick & Sutcliffe, 2001; Ryle, 1949; Hutchins, 1990, 1991). Drawing upon the work of Weick & Roberts' (1993) teamwork in this study is characterized as mindful/heedful interrelating and refers to how or the way behaviors are enacted. That is, are there specific behaviors that when enacted heedfully reduce or eliminate the incidence of preventable medical errors in the OR? Heedful interpersonal interactions are characterized as attentive or mindful, purposeful, conscientious, and considerate (Weick & Roberts, 1993); ostensibly, the more heedful interrelating among surgical team members, the less the incidence of preventable medical errors. Moreover, mindfulness and its five constituent processes provide the theoretical structures underpinning the relationship between behavioral dimensions of teamwork and medical errors, and ultimately, overall quality in the OR. For these reasons, this study seeks to operationalize the concept of mindful/heedful interrelating in

the context of the identification and enactment of behaviors among surgical teams and team members which foster the reduction and elimination of preventable medical errors, and in so doing present the opportunity for more focused and effective team interventions aimed at medical error prevention. Figure 2-1 below presents the aforementioned conceptual framework wherein the relationship between teamwork behavioral dimensions, mindful/heedful interrelating, OR quality, and advanced safety culture is highlighted.

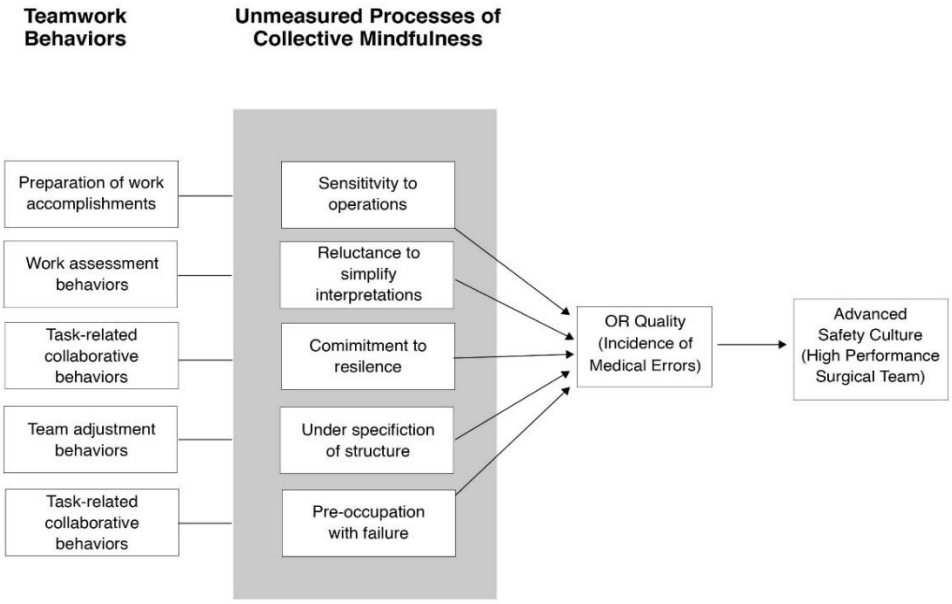

Figure 1.2. Conceptual Framework

Summary

This study characterizes teamwork as heedful interrelating and presents the proposition that the more heedful interrelating among and between team members, the more collective mind and team capacity to detect, correct, and prevent medical errors.

As such, the aim of this inquiry is to explore patterns of interrelating from the perspective of surgical team members with an eye towards understanding team behaviors that contribute to the detection, correction, and prevention of medical errors. Such an understanding presents the opportunity to develop and deploy more effective interventions aimed at improving team performance specific to the detection, correction, and prevention of medical errors.

CHAPTER 3: METHODOLOGY

This study was undertaken to achieve a deeper understanding of teamwork in highly complex, interdependent, and dynamic environments from the perspective of team members. More specifically, the purpose of this study was to discover teamwork behaviors and patterns of heedful interrelating among surgical team members that contribute to the detection, correction, prevention, and reduction of medical errors. A qualitative research design in conjunction with a quantitative component is presented considering the nature and focus of the research questions, the purpose of the study, and the researcher's worldview. The primary research question as well as four secondary questions is delineated. Selection criterion for research study participants is discussed along with data collection methods, data analysis methods, and political considerations. The significance of the study is reviewed noting especially the opportunity to discover more effective and new interventions aimed at preventing medical errors and improving patient safety.

Worldview for this Study

A qualitative research methodology supports this inquiry into the nature and characteristics of heedful interrelating among team members. Moreover, the researcher's worldview is consistent with the philosophical assumptions underpinning qualitative research as noted by Creswell (1998). That is, the study of teamwork in the OR assumes that teamwork is a socially constructed phenomenon (Burger & Luckman, 1966) wherein individuals acting singularly or as a group construct their reality. Burger and Luckman (1966) note that society is a "human product" (p. 51) and that humans construct reality based on socio-cultural norms and their own experiences. Moreover, reality is viewed as

subjective and interpretative (Burrell & Morgan, 1979). The researcher's role is to identify and describe team members' realities. In addition, the epistemological assumption underpinning the researcher's worldview is that truth and knowledge emerge from the subjective lived experience of team members. As such, and in keeping with the qualitative tradition, the researcher observed participants in their natural setting, the OR. With respect to the relationship between team members and their environment, this inquiry assumed a voluntaristic view. That is, members of the team acting singularly or as a group create their environment. Finally, the use of language such as *"describe"* and *"understand" is* consistent with the rhetorical assumption underpinning qualitative research and reflects the use of inductive logic to develop the qualitative narrative. This approach…"shows that the process is one of an emergent design" (Creswell, 1998, p. 78).

Case Study Methodology

While this inquiry is designed as a case study, phenomenological data analysis techniques are used to understand the experiences of teamwork among surgical team members. With respect to the focus of phenomenological data analysis, the emphasis is on understanding the essence or meaning of the phenomenon from the perspective of the research subjects. More specifically, phenomenological data analysis is concerned with the "essential, invariant structure" of the experience and "emphasizes the intentionality of consciousness" (Creswell, 1998, p. 52). Epoche or the requirement for the researcher to suspend or set aside all preconceived ideas or bias is particularly important in phenomenological data analysis. The narrative form specific to phenomenological data analysis is a detailed description of the "essence" or meaning of the experience or phenomenon. In addition, the phenomenological data analysis methodology stresses the

importance of context and hence, the requirement to study the phenomenon in its natural setting.

Noting the above, the phenomenological data analysis methodology deployed in this case study presented the opportunity…"to understand the meaning of experiences of individuals" (Creswell, 1998, p. 38) who are members of surgical teams as a prerequisite to the development and implementation of interventions aimed at detecting, correcting, and preventing medical errors. Further, a detailed description of the essence of teamwork in highly complex and dynamic environments illuminated behavioral dimensions of surgical teamwork and the patterns of interrelating among and between team members that contribute to overall error reduction and hence, enhanced patient safety.

Research Questions

The primary inquiry of this study was to discover how teamwork behaviors are enacted in the OR to affect the incidence of preventable medical errors. In addition, four secondary research questions are posited as noted below:

1. What are the behavioral dimensions of surgical teams that contribute to overall patient safety and the detection, correction and prevention of errors?

2. What are the patterns of teamwork among surgical team members that result in more collective team capacity to detect, correct and prevent errors?

3. What are the discernable patterns of teamwork among surgical team members that correspond to patterns of teamwork in other highly complex, interdependent, and dynamic organizational environments?

4. To what extent can "blanket" teamwork behavioral dimensions be applied to the study of teamwork in highly complex, dynamic and risky environments like the OR?

Research Site and Research Participants

Surgical teams were the focus of inquiry considering not only the highly complex and dynamic nature of the environment in which such teams perform, but also the assumption of high reliability in spite of evidence that a significant proportion of medical errors occur in the OR (Schulman as cited in Rosenthal & Sutcliffe, 2002). The researcher's ability to gain access to the research site also guided and supported site and participant selection. With respect to the selection of research participants, purposeful sampling criteria were employed and are delineated below.

The subject population included surgical team members in Orthopedic Surgery at a multispecialty hospital and clinic group practice. The inclusion of Orthopedic Surgery in this study was based on a review of four data points: (a) thirty-day post-operative surgical complication rates; (b) reported surgical incidents; (c) staff satisfaction survey scores specific to teamwork; and (d) patient satisfaction survey scores specific to teamwork. Finally, participant willingness and capacity to share their experiences further informed participant selection and inclusion. Details specific to the above-mentioned selection criteria are presented below.

First, post-operative complications comparing expected versus actual thirty - day mortality across nearly 100 academic medical centers and as reported by the University Health System Consortium were reviewed. Second, self-reported surgical incidents across all surgical specialties within the research site and categorized as adverse events, sentinel events, and near misses were reviewed. An analysis of self-reported surgical incidents served to not only guide the selection of participants, but also to further inform descriptions of patterns of heedful and heedless interrelating among team members.

Considering the confidentiality of sentinel event and adverse evident data, gatekeepers of the data were engaged during the "gaining access and making rapport" (Creswell, 1998, p. 110) stages of the study.

Third, while staff satisfaction survey questions specific to teamwork do not use the language of heedful interrelating, questions and scores specific to teamwork served as an approximate indicator of teamwork for the purposes of participant selection. Similarly, questions specific to patients' perceptions of teamwork among surgical team members guided participant selection.

Finally, participant selection criteria included the degree to which potential study participants were willing and able to share their "conscious experiences" (Creswell, 1998, p. 111) as members of the Orthopedic Surgery team, and as evidenced by a signed *Research Participant Consent and Privacy Authorization Form* (Appendix A). The *Research Participant Consent and Privacy Authorization Form* addressed several important considerations including participants' right to withdraw from the study, the purpose of the study, and measures undertaken to ensure the confidentiality of research participants (Creswell, 1998). The section below presents data collection procedures deployed in this study.

Review of the foregoing data revealed Orthopedic Surgery at the selected site as an exemplar surgical team with respect to clinical outcomes and overall surgical team performance and hence, presented the opportunity to further inform the phenomenon of teamwork through the voices and experiences of high performance team members. Materials developed for participant recruitment included e-mails from the researcher to prospective participants and presentations by the researcher at staff meetings. The

recruitment e-mail is presented in Appendix B. Orthopedic Surgery team members recruited to participate in the study included: (a) six surgeons; (b) five physician assistants; (c) four registered nurses/ circulating nurses; (d) five surgical technicians; (e) two surgical assistants; (f) five anesthesiologists/medical doctors; (g) four certified registered nurse anesthetist or CRNAs; (h) an orthopedic resident; (i) three anesthesia residents; and (j) a first assistant. In addition, two staff supervisors rounded out the study population.

Data Collection Methods

Qualitative Component

A case study research design was used for this study incorporating two data collection techniques: observations and interviews. With respect to observations, the literature supports both medical experts and lay persons as observers. More specifically, Carthey (2003) notes that while clinicians are better at assessing content specific attributes, non-clinicians as observers are better at assessing interpersonal factors. Field notes were gathered "by conducting observations as an observer (Creswell, 1998, p. 121).

One-on-one interviews were conducted with six orthopedic surgeons participating in the study and their respective team members: (a) five physician assistants; (b) one first assistant; (c) four circulating RNs ; (d) five surgical technicians; (e) two surgical assistants; (f) five anesthesiologists; (g) four certified registered nurse anesthetists or CRNAs; (h) three residents; and (i) two supervisors. Interviews were conducted face-to-face in a meeting room on the campus of the research site. Up to 60 minutes were allocated for each one-on-one interview. Interviews concluded upon

saturation of information from participants. Interviews were audio-tapped and transcribed verbatim by the principle investigator or designee. In addition, the principle investigator compiled hand written notes during the interview (in the event of audio equipment failure or that research participants elected not to have their one-on-one interview audiotaped). The research protocol, including interview questions, is presented in Appendix C.

Quantitative Component

The Observational Teamwork Assessment for Surgery (OTAS) instrument was used to record and assess overall surgical teamwork performance as well as sub-team (anesthesia, surgical, and nursing) behaviors in three phases of the surgical process: pre-operatively, intra-operatively, and post-operatively. The OTAS instrument highlights five behavioral dimensions of surgical teamwork (cooperation, coordination, communication, situational awareness, and leadership) as well as corresponding exemplar behaviors. Initial development of the OTAS instrument relied upon General Surgery procedures. The instrument was subsequently refined and applied to Urology and Vascular Surgery procedures, and simulation-based, non-technical skills training.

While, Rousseau, Aube, & Savoie (2006) note the lack of agreement among scholars regarding behavioral dimensions of teamwork and hence, posit an integrative framework of teamwork behaviors, OTAS pinpoints not only behavioral dimensions of surgical teamwork as opposed to blanket behavioral teamwork dimensions, but also corresponding and representative exemplars. As such, OTAS provided a level of specificity particularly helpful and germane to the present inquiry. Moreover, there is evidence of increasing agreement among researchers and scholars with respect to the

behavioral dimensions of teamwork as the integrative model incorporates three of five OTAS dimensions of surgical teamwork behaviors: coordination; cooperation; and communication.

For this study, OTAS exemplar behaviors served to guide the researcher through the observation process. More specifically, upon observation of surgical team members working together throughout each phase of the surgical process, exemplar behaviors provided evidence in the form of non-technical behaviors exhibited by surgical team members that when heedfully enacted reduce the likelihood of preventable errors and contribute to the overall safety of the surgical environment for patients and the team. Further, the researcher learned how to apply the instrument over a period of five days observing and assessing surgical teams with OTAS developers at the Imperial College of London.

A total of 12 observations were conducted for this study using the OTAS tool described above. Two observations were conducted for each of the six surgeons and their respective team members participating in this study. Prior to each observation the researcher reviewed staffing assignments for each case. Assignments were compared to the researcher's list of signed consents to ensure that all surgical team members staffing the case had consented to participate in the study. If all team members had not consented, the planned observation(s) did not occur. Rather, the researcher repeated the process until a total of 12 observations were identified wherein all surgical team members consented to participate in the study. Further, no subject identifiers were collected during the observational phase of this study. The mean behavioral scores for

each team is presented in Appendix E. Appendix F displays the average means across all teams.

Data Analysis Methods

Qualitative Component

Analysis of each of the 37 transcribed one-on-one interviews proceeded in accordance with Moustakas' (1994) "modifications of the Van Kaam method of analysis..." (p. 120). Each step of the analysis is delineated below.

First, each transcribed interview was read and each statement in the transcribed interview that was "relevant to the experience" (Moustakas, 1994, p. 120) of teamwork was listed on sheets of paper specific to each transcribed interview. As Moustakas (1994) notes, "Horizonalization illustrates the importance of being receptive to every statement…granting each comment equal value" (p. 122).

Next, the aforementioned list of relevant statements were reduced to invariant horizons or meaning units. According to Moustakas (1994) invariant or core horizons "point to the unique qualities of the experience" (p. 128) and portray a "moment of the experience that is a necessary and sufficient constituent for understanding it" (p. 121). Moustakas notes further that "if it is possible to abstract and label the statement or expression, it is a core horizon" (p. 121).

Following identification of core horizons, Moustakas (1994) recommends clustering the invariant constituents into themes. "Phenomenological reflection and imaginative variation…will facilitate the process of constructing…thematic portrayals of the experience" (p. 131). Invariant constituents and themes were checked against the original transcribed interviews to discern explicit representation of core horizons and

themes in the transcribed interviews prior to initiating the next step in the data analysis process. Upon validation of core horizons and themes, individual textual and individual structural descriptions of teamwork were constructed followed by the compilation of composite textual and composite structural descriptions of the experience of teamwork (Moustakas, 1994).

The aforementioned textual and structural descriptions were used to complete the analysis in conjunction with OTAS scores. That is, the final step of phenomenological data analysis "requires the integration of the composite textual and composite structural descriptions, providing a synthesis of the meanings and essences of the experience" (Moustakas, 1994, p. 144).

In sum, this synthesis of meanings and essences describes (from the perspective of team members) the patterns of interrelating among surgical team members that contribute to the detection, prevention, and reduction of surgical errors; and provided further validation of the behavioral dimensions of surgical teamwork as defined by OTAS. Steps deployed to ensure the trustworthiness of the study are discussed below.

Trustworthiness Activities. Lincoln and Guba (1985) have suggested four criteria for establishing the trustworthiness of naturalistic inquiry: credibility; transferability; dependability; and conformability. Techniques specific to each of these criteria were deployed in this study to ensure trustworthiness and are presented below.

Credibility. As previously noted, three data collection methods were used for this study: observations; interviews; and document reviews. Triangulating the data in this fashion increased the credibility of findings and interpretations. In addition to triangulation, peer debriefings, negative case analysis, and member checks were used to

increase the credibility of the study. For example, research participants reviewed and approved each audiotaped and transcribed interview.

Transferability. With respect to transferability, Lincoln and Guba (1985) differentiate between "precise statements about external validity" (p. 316) and thick description which facilitates decision making with respect to the feasibility of a transfer. The latter technique was deployed in this study to support "transferability judgments" (p. 316).

Dependability and Conformabilty. Dependability criteria were also deployed to establish trustworthiness of the study. The technique specific to dependability is the inquiry audit (Lincoln & Guba, 1985). This technique was used to determine conformability. As such, an inquiry auditor was called upon to determine dependability and conformability of research processes by examining the data, findings, interpretations, and recommendations and attesting that the study is supported by data and is internally coherent. Finally, throughout this study the research maintained a reflective journal to record methodological decisions, schedules and logistics of the study, and personal reflections.

Quantitative Component

Two observations were conducted for each of the six teams participating in the study to ensure reliability. Descriptive statistics, nonparametric ANOVAs, and post hoc tests were used to analyze OTAS results. Team profile plots as well as mean scores for each observation and a non-parametric, two-way ANOVA were used to assess consistency between each team observation. Tukey post hoc tests were performed to identify differences between the teams. Upon completion of the aforementioned

analysis, additional comparisons were drawn. For example, the post hoc test from the initial ANOVA served to identify teams with the highest OTAS scores. The highest scoring teams were subsequently analyzed in an effort to identify any differences that might exist between the highest scoring teams.

Validity. OTAS has achieved content (Hull et al., 2011) and construct (Sevdalis et al., 2009) validity. More recently, assessors' learning curves have also been demonstrated (Russ et al., 2012).

Ethical Considerations

Several ethical considerations surfaced during the data collection, data analysis, and data reporting phases of the qualitative research process. First, the anonymity of research informants was ensured as outlined in the research participant consent form. Second, the purpose of the study was shared with each research informant. In this way, participants were fully aware of the nature of the study and any questions regarding deceptive research practices and/or disclosures were avoided. Third, throughout the research process the researcher used bracketing procedures as previously noted. That is, the researcher did not share personal experiences of teamwork with participants during the data collection phase of the process. Finally, although the researcher is employed at the research site and has access to the site for research purposes, the researcher did not and does not have direct administrative responsibilities for the Department of Orthopedic Surgery. Therefore, the potential for conflict of interest in this context was avoided.

Political Considerations

In addition to the above, two political considerations were addressed at the start of the research process. First, the research site, like most organizations, is very protective

of data or information, especially data or information about the organization intended for publication. As such, questions about who owns the data once collected, and how the data will be used and disseminated were addressed in advance of the study.

Another political consideration that is closely aligned with the issue of data dissemination concerns how to handle findings that may cast the organization in a negative light or put the organization at a disadvantage in some way. While it is difficult to identify all possibilities or potentialities in this regard, as Miles and Huberman (1994) recommend, agreements in this regard were addressed proactively and throughout the study period.

Significance of the Study

More collaborative interdisciplinary teamwork among health care providers is needed to reduce medical errors (Jones as cited in Rosenthal & Sutcliffe, 2002). Yet, what collaborative teamwork in health care means and how it is achieved and sustained has remained unclear. Further, while a great deal of research has been conducted on teamwork and group performance, prior to this study collaborative, interdisciplinary teamwork from the perspective of team members had not been explored in detail nor in the context of patient safety and system reliability. As such this study presents a deeper and richer understanding of surgical teamwork conditions and structures that contribute to the detection, correction, and prevention of medical errors. These conditions and structures hold important implications for the identification and deployment of more effective interventions aimed at improving patient safety and reducing medical errors, and for the recruitment and retention of health care professionals.

CHAPTER 4: PRESENTATION of DATA and SUMMARY of THEMES

Despite increased awareness of the link between teamwork and medical errors, and increased development and implementation of interventions aimed at improving team performance, the incidence of preventable error in hospitals, and in the surgical environment particularly, remains high. Absent from teamwork improvement efforts is empirical evidence specific to the kind of teamwork that results in nearly flawless team performance in the OR environment. Further, prior to this study, teamwork from the perspective of individual surgical team members had not been explored in the context of patient safety and reliability in the surgical setting.

This study of interdisciplinary teamwork in the OR and among Orthopedic Surgery team members was conducted in an effort to develop a more informed and nuanced perspective of teamwork and teamwork behaviors with an eye towards the development and implementation of more effective teamwork improvement strategies and interventions. The primary research inquiry was to discover how teamwork behaviors are enacted in the OR to affect the incidence of preventable medical errors. Further, the study was conducted to understand the experience of teamwork in the OR from the perspective of high-performance surgical team members.

As presented in Chapter 3, the case study data includes interviews with research participants and observations by the researcher guided by the OTAS instrument. The flow of analysis and relationship of the data to the synthesized themes is portrayed in Figure 4.1.

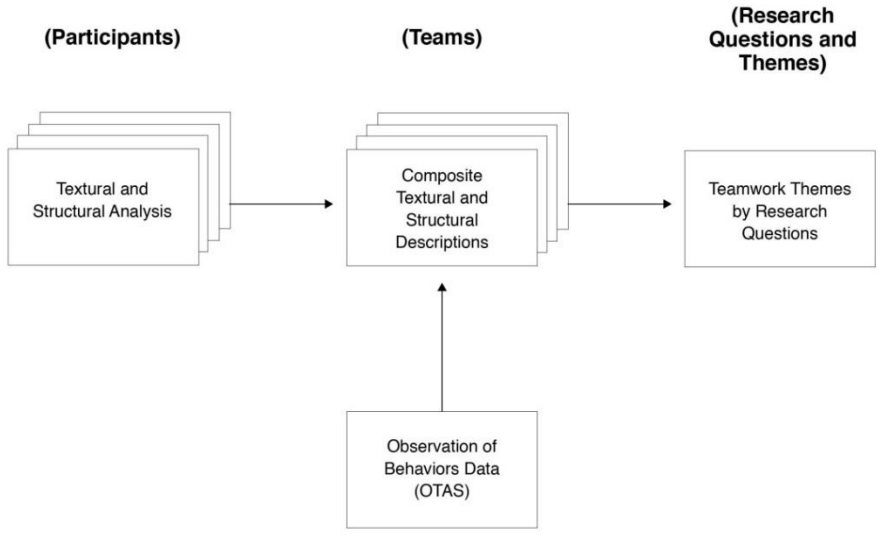

Figure 4.1. The Flow of Analysis, Relationship of the Data to Themes

To aid the reader, this chapter only includes each team's textual and structural composite descriptions, while individual team member textural and structural descriptions (available upon request) were used to excavate themes that answer the research question. In addition, the analysis of OTAS behaviors is presented to provide a more dynamic view of team members' perceptions of behaviors as conveyed in participant interviews.

Qualitative Component

One-on-one interviews were conducted with 35 surgical team members and two supervisors. Interviews were transcribed and are presented in composite textural descriptions followed by composite structural descriptions for each of six teams. A delineation of themes linked to research questions precedes the composite descriptions. Individual team members' textural and structural descriptions are available to other researchers upon request.

Emergent Themes Linked to Research Questions

Fourteen themes emerged from the analysis and synthesis of team composite textural and structural descriptions, and observations of 12 orthopedic surgical procedures. Emergent themes are presented below in relationship to the research questions explored in this study.

Research Question 1: What are the discernable behaviors exhibited by high performance surgical team members that result in nearly flawless teamwork performance and few if any preventable surgical errors?

Theme 1: *Team members exhibit discernable safety behaviors that reduce the likelihood of preventable errors*. They speak up and share their opinions, suggestions and concerns. Participant S- 2 asserts, "No matter what it is you speak up." Participant AR- 2 adds, "They think and believe that good communication leads to good patient outcomes."

Team members constantly and consistently pay attention to and keep track of what is happening around them. They attend to details; they stay focused on the task at hand and guard against distractions. Participant CN- 1 says, "Everyone on the team has attention to detail." CRNA-2 also notes, "They pay attention…If I need an extra set of hands, they're always there, ready and willing." Team members have a panoramic awareness of their environment at all times. Participant ST- 3 says, "We have to scrutinize all aspects of the process…Exercising due diligence at all times is very important." Participant CN- 2 adds, "Being totally aware of your surroundings makes a big difference…It's proven itself over time." Participant SA- 1 asserts further, "Staying

focused on the task at hand and guarding against distractions, keeps the team out of trouble."

Team members exercise due diligence in doing the right things correctly and step by step. For example, Participant AR- 2 says, "Ortho is observed to be a good example of patient safety and what they do should be spread or echo across the system…They take patient safety seriously…The team's focus on doing what is right and safe for the patient is something I have not seen at other places…Ortho goes above and beyond; they make sure all the I's are dotted and T's crossed."

They are prepared and well-informed. For example, Participant ST- 2 says, "We just acquired a new nurse who left her service and came into Orthopedics, so she was already a nurse that had already worked in the OR, but we still trained her for three months."

Team members are adept at responding to unfolding events and they are resilient. Participant S- 1 underscores this point upon self-reflection and says, "I can do it differently; I can treat that; I can back-up, regroup and start at is again; I can keep going." Participant CN-4 notes further, "…I can anticipate what will be needed as the case unfolds and have it available and ready without being asked."

They identify and address problems or potential problems collaboratively and proactively. For example, Participant S- 2 says, "Problems are handled collaboratively just like good cases are handled collaboratively." Moreover, as Participant S- 6 asserts, "Each member of the team is expected to identify problems." Participant SA- 1 elaborates, "Once a problem surfaces the team looks for the best, fastest, and safest solution to the problem."

Team members defer to other members and non-members who have the knowledge and expertise needed in the moment. For example, while the surgeon is the primary decision maker, Participant S- 5 says, "Everybody knows their role and we have to defer to each person because they do know their role."

Team members exhibit advanced coordination, prioritization, and adjustment skills. For example, Participant CN- 2 asserts, "It is good to be able to prioritize, multi-task, and give and take orders well. Participant S- 1 adds, "As things come up during the case and you have to make a decision, you can adjust." Participant ST- 3 notes further, "With a few minutes of conversation and clarity, the team can switch to plan B effortlessly and expeditiously."

They maintain a professional demeanor at all times and they welcome and treat new team members like part of the group. Participant AR- 2 asserts, "Professionalism here is above and beyond anything I have ever seen anywhere; they take it seriously."

Theme 2: *Team leaders (surgeons) exhibit discernable safety behaviors that reduce the likelihood of preventable errors.* They invite, value, and respect the opinions, suggestions, and contributions of team members. For example, Participant CRNA- 4 says, "Leaders emphasize the importance of each team member."

Team leaders listen and take input from team members to heart. Participant PA-3 says, "The surgeon always listens to suggestions and is agreeable to take advice." Participant ST-3's experience underscores this point. Participant ST- 3 asserts, "Our leader's emphasis on safety is priceless…We are a safer and smarter team."

Team leaders are accessible and approachable. Participant CRNA- 2 says, “I get to actually interact with the surgeons in a more collegial way.” Participant S- 3 elaborates, “It’s a privilege to lead the team and to take care of patients; team members trust me and I trust them; my approach is to treat team members with respect and to try and make the environment enjoyable.”

Team leaders expect team members to speak up. For example, Participant ST- 4 notes, “Through our boards (CTS) we discuss solutions and leadership follows up; things are resolved in a timely fashion.” Participant CRNA- 2 concurs, “Under the leadership of Dr. X, I think she set up the situation where any member feels if there’s something they need to say they can say it without reprisal or punishment, or whatever.” And as Participant S- 2 explains, “ I want everybody to be eyes on deck…If they see something or something doesn’t sound right, then they need to speak up…I want people to be proactive, open, and collaborative…”

Team leaders ensure that team members are well-informed and prepared. For example, Participant CRNA- 2 recalls his experience in the surgeon-led team brief and says, “The briefing makes the day go smoother as everyone knows what to expect; it keeps you from missing things.” Participant SA- 1 offers a further example noting, “Because we have briefings we now are well informed…The surgeons go above and beyond in helping their team be prepared.” Participant CRNA- 1 adds, “The huddle is wonderful because compared to other surgical teams, the surgeon and all members of the team clearly delineate their expectations of the day.” Participant S- 5 notes further, “...anything that is unusual, out of the ordinary or different than what we expected, we converse about that and make a plan.”

Team leaders maintain their composure under duress. Participant S- 3's experience exemplifies this point. Participant S- 3 says, "It is important not to be abusive but to lead by example…The leader has to remain cool even when things don't seem to be going smoothly and as anticipated…This helps team members feel more secure; they do their jobs better and they don't make mistakes."

Team leaders reinforce organizational values. As Participant ST- 4 says, "Surgeons here really, truly feel that it's all about the patient." Similarly, supervisors model teamwork as an organizational value. For example, ST- 2 says upon reflection about his supervisor, "There is nothing that he would ask of you that he is not willing to do himself."

Research Question 2: How are non-technical teamwork behaviors enacted among and between surgical team members to affect few if any preventable surgical errors?

Theme 3**:** *Team members behave heedfully by noticing, paying attention, taking care, attending to, concentrating, and thinking about what they are doing and what comes next*. For example, participant SA- 2 asserts, "Mistakes happen not because the tasks are routine, but because you stop thinking." Participant ST- 4 adds, "As a scrub tech when I walk into a room, I'm thinking, is my room ready for surgery." Participant ST- 4 notes further, "Even in a case that I'm familiar with you take and throw a kink in it then my little OCD brain goes crazy; I have to really concentrate, make sure everything still flows the way it's supposed to." Participant FA- 1 says, "Doing the same type of surgeries over and over can become a little boring to where you don't pay attention to detail and you have to work hard to prevent that." Participant SA- 1 elaborates, "Team

members have the astute capability to constantly pay attention throughout the case in order to spot problems or the potential for problems; attention to detail is something that we have to have in surgery." Participate MD- 4 concurs, "As part of your process you have to guard against team members becoming too comfortable, making assumptions, and paying less attention to detail."

Research Question 3: What are the discernable patterns of interactions among and between high performance surgical team members that result in few if any preventable surgical errors?

Theme 4**:** *Patterns of interactions among and between team members are coordinated, interrelated, sequential, and timed.* Patterns of interactions are specific to communication, coordination, and cooperation among and between team members. For example, the team places a premium on communication throughout each phase of the surgical process. Pre-operatively, team members, first the surgeon and anesthesiologist, followed by the circulating nurse and the CRNA, meet with patients to discuss various aspects of the procedure and to address any concerns that patients may have about what is going to happen. This initial meeting and discussion presents the opportunity for team members to individually confirm key information specific to each patient. For example, type of procedure, surgical site, patient demographics, and patient medical history data. Team members also hold team huddles and briefings prior to each case with the surgeon taking the lead to convey important information about the case that team members need to know to perform optimally. The team brief also affords team members the opportunity to raise questions, make suggestions, and to share key information with the rest of the team. Participant PA- 6 says, "We gather in the morning to discuss the cases that we

have and what we are going to need to do…For each case the team is setting up the room and getting ready." Participant MD- 1 adds, "The surgeon leads the team briefing at the beginning of the day; most decisions are made and shared at that time."

Once the patient arrives in the OR, the CRNA and the circulating nurse complete a procedural pause wherein the patient is engaged in the communication to once again confirm right patient, right procedure, right surgical site, and right OR, as well as any known allergies, and patient blood type. This information is also displayed on white boards in each OR. In addition, just prior to the start of each case, the surgeon conducts a timeout with the entire team present and engaged. Once again patient specific information is confirmed and importantly, each team member states their name and voices agreement about what is about to occur.

Intra-operatively, team members collaborate to identify and resolve problems and to come to mutual understanding. Participant ST- 6 explains, "During the case we brainstorm to come up with the best solution." Post-operatively, Participant ST- 6 says, "…we discuss what happened, what we did to fix it, and what might work better next time."

Participant ST-3 underscores the importance of communication and coordination among team members noting, "Every day, every patient, every situation, and every scenario is different…This means a lot of coordination with a lot of team members."

Theme 5: *Intact teams reduce the likelihood of preventable errors and patient harm, and contribute to team efficiency and effectiveness, and overall teamwork performance.* Regular team members know each other's routines and nuances. Participant ST- 2 explains, "When you work with someone over and over again you

learn their routine; everything kind of flows naturally and easily; I know what's coming next so that I' m not guessing what's coming next; you kind of anticipate what your nurse is doing and they know what you're doing and you just kind of work together; it's almost like a dance…Knowing everyone's routines and nuances makes a big difference." Participant ST- 4 notes further, "Because I know my surgeon's techniques and routines better than anyone else, the case runs more smoothly and this in turn allows for a quicker case and that means less chance of problems, infections, or errors." Participant S- 1 adds, "When I first started here my hip replacements were taking around two hours or so…I did one the other day on a really sick patient that we had to move a little faster on and we did it in 28 minutes; I have seen our efficiency grow with time and our teamwork grow as people know what you like and what you don't like."

Regular team members know the cases, their roles, and they know what is expected of them. They know what is needed and when without prompting. Participant S- 2 explains, "By having people that I am used to working with and know my way of doing things and have done surgeries with me before makes things go very well rather than having someone new every time for every case." Participant ST- 3 underscores this point and says, "…At any given time there's over 100 years of surgical experience in the room; we know what we are doing; we know what is expected of us; we know our roles and the roles of everyone else on the team."

Intact teams composed of regular team members are comfortable and familiar with each other and unafraid to speak up. Participant S- 2 recalls how the practice has evolved in this regard, "I was trained where the surgeon is top of the food chain and everybody does what I say and people are afraid to speak up…I think the culture has

changed." Participate PA- 3 concurs, "We are welcome to speak up and I feel like everybody feels like they are and they don't get shot down for it." Participant PA- 6 adds, "I feel that the atmosphere and the climate in the OR are such that everyone really feels comfortable talking if there is an issue."

Participant MD- 4's experience amplifies the difference between intact teams composed of regular team members and teams made up of new or float team members. Participant MD- 4 says, "New team members are problematic and can compromise the effectiveness of the team and patient outcomes as small errors mean a lot to the patient…New team members lack experience and are afraid to ask questions and to ask for help…They do not know what to expect or what is expected of them in their role." MD- 2 adds, "It's frustrating as you can tell when you go in that it's a difficult case and someone new is scrubbed in that is unfamiliar with the procedure or who doesn't know the equipment; that's a disaster; it just slows the case down and there is tension…" Participant MD- 3's experience is that familiarity among team members facilitates problem solving and helps the team work through difficult situations wherein the patient takes an unexpected turn for the worse. He says, "Just because we have the right team, we've worked together before, and everybody knew each other's capabilities, we were in a really secure environment."

Theme 6: *Social time together outside of work enhances relationships and teamwork.* As Participant S- 1 says, "We even go out to have dinner and hang out together socially which I think enhances the relationship." Participant ST- 4 elaborates, "What makes this team easier to be a part of is that we for the most part are a family; we work well together but we also socialize outside the operating room; we share family

functions together, we go together as a group to make a stand for a cause (heart walks, cancer mud runs, etc.); we are not just a group of individuals that show up and work; we extend that relationship…We are family and friends." Participant PA- 3 adds, "It is fun for us as friends too; we do play together outside of work and I think when the team plays together they stay together."

Team members feel that getting to know each other outside of work promotes understanding and supporting behavior on the job especially when problems arise. Participant PA- 3 explains, "…When somebody has a bad day it can be disruptive; if you get to know somebody on the outside and you get to know their life and their struggles…Instead of being adversarial with them about it, it is better to be understanding and support them through the bad part of their day."

Theme 7: *Protocols, standard operating procedures, checks and double checks, as well as redundant processes and structured hand-off communication tools help keep patients and the team safe.* Participant MD-1 says, "With protocols and standards there are fewer mistakes and people get good at what they do." Participant MD- 4 explains, "Humans make mistakes and the more checks and balances you have the less mistakes you make." Participant CRNA- 2 notes further, "It seems like overkill, but we follow all the steps without skipping any."

Theme 8**:** *Team briefs, debriefs, and meetings at the Commitment to Safety (CTS) learning board are manifestations of the learning system and the learning environment wherein the focus is on improvement and engagement and the leader is the guardian of the learning system.* Participant S- 1 says, "As a surgeon, I think the brief and debrief have improved the teamwork and communication." Participant ST- 3 adds, "The team

brief minimizes mistakes and distractions and offers the opportunity for the team to get it right the first time." Participant S- 4 asserts, "Post-operatively, debriefs and meetings at the CTS learning board present the best opportunities for problem-solving and learning." Participant ST- 4 elaborates, "Through our boards we go through all the little things…That's how we solve problems….We discuss solutions and leadership follows up…We have identified and solved a lot of problems in our CTS meetings." Participant MD- 2 underscores the significance of meetings at the CTS learning board noting, "Meetings at the CTS learning board are helpful because team members are asked to share their opinions and everyone is considered an important part of the team…Sharing your opinions and making decisions together makes you feel like what you think matters." With respect to the debrief, Participant OR- 4 notes further, "It is important for everybody to have the opportunity to say what went well and what we can do better." Participant S- 4 points to the role of the leader with respect to the learning system and notes, "Leaders are guardians of the learning system…That means you have to guard it, support it, and ensure it; you have to protect it; you have to nurture it…That is what a guardian does and that's the leader's role.

Theme 9: *Team members possess characteristics and attributes that are particularly well-suited to the fast-paced, high-energy, high risks, high stakes, demanding, and stressful Orthopedic Surgery environment*. As MD- 4 says, "Risks are greater, the stakes are higher, and tolerance for error is lower within the Orthopedics practice…It is a tightly controlled and high quality environment in which team members make extra effort to communicate and to do the right thing…The high quality of the environment that has to be maintained makes you a better team player." Participant CN-

4 asserts, “It’s got to be more than a job; you have to have initiative and some motivation; those that don’t aren’t here anymore.” Moreover, the environment is high volume and dynamic as anything can happen at a moment’s notice to changing the plan. As Participant S- 5 says, “Anything can happen at the drop of the hat and we have to be ready for it.” Participant MD- 1 adds, “its go, go, go all the time.” It is within this context and against this backdrop that team members ascribe attributes and characteristics to themselves and their fellow team members that draw them to Orthopedic Surgery here and compel them to remain on the team. More specifically, team members say that they derive a great deal of satisfaction from doing their jobs to the best of their abilities and knowing that their fellow team members are doing their jobs to the best of their abilities as well. Participant ST- 3 says, “We are 100% dependable, 100% of the time.” They characterize each other as not only reliable, but also trustworthy and humble. They are overachievers, relish a challenge, and take it personally when things do not work out as planned for patients. Participant SA- 1 says, “We do the out of the ordinary or maybe a little tougher cases; no matter what comes in, the team gets the job done.” Participant SA- 1 elaborates, “Everyone in the room on our team likes to do their best and bring their best every single day; I like that it takes a little more for someone to accomplish the goal that we’re all here for; I like being a part of that team and seeing great outcomes.” Their experience on this team in comparison to other teams is that members of the Orthopedic Surgery team are to a person meticulous and attentive to detail. Participant ST- 4 says, “It’s like nothing that I have ever seen before.” Team members too express pride in being a member of the team and in the work that they do. They love what they do and as Participant S- 5 says, “I am grateful to

do what I love for a living." Participant CN- 2 notes, "It is good to… not get frustrated and just focus on one thing at a time."

Theme 10: *Team members prefer working with others and value and derive satisfaction from the team experience.* Team members recognize, value, and appreciate the unique contributions of each team member and believe that no one on the team is any more or less important than anyone else; everyone makes a difference. They understand that their roles are interdependent and hence they know their roles and those of fellow team members. Participant S- 4 says, "Each individual brings a very special talent to the team; a uniqueness that makes us a great team." Participant PA-3 notes further, "It's satisfying knowing my role and doing it to the best of my ability and knowing the people on the team are doing their role to the best of their ability too; it's satisfying to handle complex cases with facility."

Team members believe that they accomplish more together and in a safe and efficient manner than they could on their own. Participant CN- 1 explains, "Being on a team, you have to humble yourself…you are not going to do everything yourself… you have to rely on other people." Participant CN- 1 recalls a quote from the founding fathers of the organization…*No one is big enough to be independent of others*…and says, "I think that is a big and important thing."

Team members are committed to team and share responsibilities for patient outcomes. For example, Participant MD- 2 asserts, "If one part breaks down, nothing works…" Participant CN- 2 notes, "We all work together to ensure that everything is ready and that we have anticipated every possible scenario that will be required for that procedure; we are all trying to work cohesively and function as a well-oiled machine."

Participant CRNA- 1 finds too that, “Everybody helps and pitches in even though it’s not really their job.” Participant PA- 1 adds, “Being a member of a team means making sure the patient is taken care of and getting everything done even if it is not your role.” Participant MD- 1 notes as well that, “The team has a very good flow to get the patient safely and quickly through the OR…I am very happy to be with them every day.”

Team members support and help each other, and watch out for each other. As Participant S- 4 says, “Somebody will watch out for you and you will watch out for them.” Participant CN- 1 adds, “You can pretty much trust everybody that is in your room.” Team members make personal sacrifices for each other and the team. Participant ST- 3 notes, “Everybody is kind of pulling together, recognizing what hasn’t been done and stepping in.” Participant PA- 3 elaborates, “No one on the Orthopedic Surgery team is ever too busy to help; there is no job that we are not willing to do for each other.”

Theme 11*: Being a member of the team fulfills team members’ basic need to belong.* Team members feel like they belong. They feel that they are part of something that is more than just a job, and that they are contributing to something that is bigger than they are. As Participant CN-1 says, “You’re not just on the outside looking in; you’re right in the middle.”

Team members are colleagues, friends and family. Participant AR- says, “The camaraderie among team members makes it easy to do the work.” Participant AR- 3 agrees, “Camaraderie among and between team members makes it easy to work with everyone and to be a part of the team; I feel like I am on a team.” Participant S- 1 adds, “We even go out to have dinner and hang out together socially which I think enhances the relationship.”

Team members think being a member of this team is where they belong and they would not want to be a part of any other team. Team members feel honored and privileged to be a part of the team. For example, Participant ST- 6 says, I am proud to do Orthopedic Surgery and to say that I am on the Orthopedic Surgery team; I wouldn't want to be on any other team. Participant ST- 6 adds, "It is probably the best job that I have ever had."

Team members are close. Participant ST- 4 asserts, "The camaraderie that exits is like nothing I have ever seen before." Participant OR- 4 notes further, "The environment here is more collegial; everyone is involved and they know each other on a first name basis; teams are tight; team members look out for each other; it is a good experience for a resident in training."

Team members feel that they are an integral part of the team. They feel respected and that their opinions are valued. Participant S- 2 says, "It's a team that is committed to team…Everybody's in on the mission and feels that what they do is important…We all make a difference." Participant PA- 6 notes further, "I feel I am an integral part of this team…My surgeon makes me feel valued, other people that I work with make me feel valued."

Theme 12: *Team members share a common purpose, mind-set, and overarching goal— the needs of the patient come first.* As Participant CN- 4 says, "There is a shared mind-set about the work among team members; no matter who we're working with we are all on the same page." Participant CN- 2 elaborates, "If anybody ever gets off track you can always think back to the needs of the patient."

Team members believe that the only interest to be considered is the interest of the patient. Participant ST- 4 explains, "We are here for one reason and one reason only, to make sure that the patient's outcome is the best it can possibly be; the solution is what is best for the patient; not for me, not for my nurse, not for anybody else." Participant S-1 notes further, "I think number one is the goal to take the best care of the patient; I think an effective team does that." Participant S- 2 adds, "When we know that the patient is going to get a great result, I don't know anything else that is as fulfilling other than seeing my children grow up well." Participant AR- 3 underscores this point, "Working with this team has reinforced my belief in the organization's core value…the needs of the patient come first."

Theme 13: *The collaborative environment makes it easy to be a member of the team and enables team performance*. Team members describe interactions among and between team members as respectful, collegial, and collaborative. Their experiences in this regard are representative of each team member's commitment to team and teamwork; the team leader's due diligence in reinforcing organizational values; and the culture of collaboration that includes the hospital and clinic settings. More specifically, team members understand that each member of the team contributes to the whole and they value each other's expertise and unique contributions. They believe that no one on the team is any more or any less important than anyone else. Further, team members' accounts of their experiences suggest that hierarchy is flattened and egos are set aside in favor of team members working together in a collegial, respectful, and collaborative manner to achieve the best possible outcomes for patients. Participant PA-3 says, "You can accomplish more as a team…None of us could do what we get done together in an

efficient or safe and effective way on our own." Participant MD- 4 elaborates, "Once everyone understands the objective of the team in that we can't do the work individually…this is when you have efficiency and patient safety." Participant S-6 notes further, "It's really quite amazing that there is a collaborative culture that enables us to get the work done when it is so complicated; there is synergy in multiple people working together."

Theme 14: *Challenges make the work and the work environment difficult and distract from the team's capacity to optimize team and individual performance and to keep patients and the team safe.* For example, staffing, time constraints, production pressures, and ever-changing external regulations and internal mandates add to job complexity and make the work and work environment more difficult and stressful. With respect to staffing, team members are oftentimes reassigned to non-Orthopedic Surgery cases that they are less familiar with and replaced by staff from other surgical specialties that are similarly unprepared or less familiar with Orthopedic Surgery procedures, routines, and expectations of team members. Participant S- 2 says, "With new or non-core people joining the team I feel like I have to keep one eye on the patient and the other on the new team member to guard against mistakes."

Orthopedic Surgery Team 1 Descriptions

Table 4.1. *Surgical Team #1: Years of Experience*

Participant	Position	Years in Position	Years with Hospital/Clinic	Years on Team
CN- 3	Circulating Nurse	1.3	1.3	1.3
CN- 4	Circulating Nurse	30+	23	23
SA- 2	Surgical Assistant	33	19	19
ST- 1	Surgical Technician	4	3	3
ST- 2	Surgical Technician	4	3	3
ST- 4	Surgical Technician	14	1	1
ST- 6	Surgical Technician	14	1.6	1.6
PA- 1	Physician Assistant	1	1	1
CRNA- 4	Certified Registered Nurse Anesthetist	20	15	15
MD- 1	Anesthesiologist	2	2	1
MD- 5	Anesthesiologist	1.2	1.2	1.2
S - 1	Orthopedic Surgeon	6	1	1
Totals	**N/A**	**130.5+**	**71.1**	**71.1**
Average	**N/A**	**~10.9**	**5.9**	**5.9**

Textural Composite Description

"When you work with someone over and over again you learn their routine…Everything kind of flows naturally and easily…I know what's coming next…I'm not guessing what's coming next…You kind of anticipate what your nurse is doing and they know what you're doing and you just kind of work together…It's almost like a dance…We know what move comes next." **Participant ST- 2**

Team members' voice that they love taking care of patients and being members of the Orthopedic Surgery team. They find the work enjoyable and that the organization is a great place to work. As Participant CN- 1 says, "It is fun to come to work; I love working here and I tell everybody that."

The work presents the opportunity for team members to continuously learn and grow as the cases are interesting and oftentimes more complex than those they have experienced elsewhere. The environment is fast-paced and high-energy. Team members' find the work rewarding and fulfilling especially when patients express gratitude for how they feel after surgery. Team members find the experience humbling and feel honored to be a part of the process and the team. As Participant SA- 2 says, "I feel good every day; it's gratifying and uplifting knowing that you helped somebody."

Team members' express a sense of pride and accomplishment in the work as they see the final result, a new hip or knee for example, and they work alongside world renowned surgeons. As Participant CN- 2 says, "I am proud to do Orthopedic Surgery and to say that I am on the Orthopedic Surgery team; I wouldn't want to be on any other team." Participant ST- 4 explains further below:

> Team members enjoy the nuts and bolts of orthopedics. The hands on of using power tools and instruments such as osteotomies, pliers, wire cutters, nails and bolts, etc. We get to see the finished product, such as removing a hip and then seeing a new one put in its place, the mechanics of it all. There is a sense of pride within when you see this being accomplished.

Team members' are committed to the work, their patients, and to each other. The work is more than just a job to them. They care and take it personally when patients are

not happy or are dissatisfied with their outcome. As participant SA- 2 says, “It’s what I do; it’s my life; it’s everything and it’s in my blood.” Team members work hard as the environment is very busy and demanding. They show up every day not so much because they have to; rather, they want to and they are internally motivated to do so.

Team members share their lives outside work and think of themselves not only as a team, but also as friends and family. Participant S- 1 finds that extending their relationships beyond the workday is beneficial. She says, “We even go out to have dinner and hang out together socially which I think enhances the relationship. Thus, team members’ collective experience is that the people they work with make the difference. Everyone is friendly, easy to get along with, professional, and meticulous. Team members like each other and enjoy each other’s company and importantly, they trust each other and take care of each other. As Participant S- 4 says, “Somebody will watch out for you and you will watch out for them.” It’s a close knit group and the camaraderie among and between team members is palpable as they fit well together and feel that they belong, and are part of something big.

Like family, team members are willing to give and take and make personal sacrifices to be a member of the team. They accept the good and the bad and are able to work with a variety of people and with different personalities. Participant SA- 2 says, “We have a good team right now...We have a good mix of older, younger, experienced…men, women…different ideas and cultures…The teamwork is good.”

Team members can depend on each other as their experience is that everybody pitches in to get the work done and they work well together. As Participant MD- 1 says, “The team does good work; its fast, high quality, and efficacious; it’s a well-oiled

machine." Participant ST- 6 feels good about what the team does and says, "It's probably the best job I have ever had."

Team members compare the Orthopedic Surgery team to other teams they have known and find that what sets this team apart is that everyone's mindset or mentality is *the needs of the patient come first*. It's the organization's and the team's primary value and as Participant CN- 2 says, "If anybody ever gets off track, you can always think back to the needs of the patient." Collectively, team members voice that it's all about the patient as detailed below:

> Each patient is an individual…I have a lot of respect for my patients. I love how our team always puts the patient first. I love to give the patient 100% and so does the team. I think number one is the goal to take the best care of the patient. I think an effective team does that. So what it means to me to be on the team is to take good care of the patient. If someone asks me for something or to do something I do it because in the long run it's for the person lying on the table. We are here for one reason and one reason only, to make sure that the patient's outcome is the best it can possibly be. The solution is what is best for the patient. Not for me. Not for my nurse. Not for anybody else. My biggest role is just being a patient advocate and making sure everything runs smoothly for the patient.

Team members know their roles and those of their fellow team members. They recognize the importance of each team member's role and their contributions to the whole. Participant S- 4 says, "Each individual brings a very special talent to the team; a uniqueness that makes us a great team." Team members are accountable to each other,

share responsibility for the work, and rely heavily on each other. Participant S- 1 explains below as she recalls the role of the physician assistant that she partners with most often:

> She makes things run. She does the schedules. She decides what time the patients show up to surgery. She goes through all their pre- operative paperwork. She sees them post- operatively and does all their paperwork and their prescriptions. There are a lot of prescriptions. Each patient is an individual so she makes sure they're not allergic to something when doing the orders. She checks with me at the end of the day and makes sure there is nothing else she needs to do or I need to do. She does a lot.

In the operating room the certified registered nurse anesthetist (CRNA) assists with administering anesthesia medication and monitors the patient's vital signs throughout the procedure. They ensure a steady state of anesthesia as the surgeon performs the procedure. Participant ST- 1 recalls the role of the CRNA below:

> We have CRNA teammates that we can count on. They help us get the patient on the table and make sure everything is safe for the patient. They watch the whole time and help do either the spinal or the general anesthetic. They help us get the patient off the table. They're part of our interaction in the OR. They're just as much a part of the team as the people that are scrubbed in.

The circulating nurse serves as the patient's advocate and ensures that things run smoothly for the patient and the team. The circulating nurse visits with each patient pre-operatively in the holding room to make sure consents are signed and that the patient is ready to proceed to the OR. Participant MD- 1 says, "The team has a very good flow to

get the patient safely and quickly through the OR…This is largely dependent on the circulating nurse and the scrub nurse who are fantastic…I am very happy to be with them every day."

Familiarity counts. Participant ST- 2 explains below:

> When you work with someone over and over again you learn their routine. Everything kind of flows naturally and you don't have to think about it. That being with a certain person over and over again and knowing what they're going to do next, it makes it kind of flow easily. You get used to that one person you work with all the time and then when you're having to seek out somebody new in the room and they're not following the same steps you are and then things get out of whack and it makes anxiety just goes up. Just learning the new routines and getting new people in just can mess up things a little bit. It's vital to have someone in there that is on the team…there is so much to it…knowing everyone's routines and nuances makes a big difference.

Team members' find that oftentimes they don't even have to speak or they only need to say a word or two as they know what each other is thinking; there is very little guess work because they know what comes next. Participant CN- 2 says, "They don't have to ask me because I'll know if they don't' have something…After doing it for so long I'll go get it without them asking and they'll look up and I've got it in my hand." Participant S- 1's experience is similar in that familiarity among and between team members increases efficiency and teamwork. She explains below:

> When I first started here my hip replacements were taking around two hours or so. I did one the other day on a really sick patient that we had to move a little

> faster on and we did it in 28 minutes. I have seen our efficiency grow with time and our teamwork grow as people know what you like and what you don't like. I don't think I could have done that at the beginning of the year. I think it was our surgical tech learning the order in which I do things.

Participant SA- 2's experience is that the work is so familiar that it is routine, automatic even. He says, "I don't even have to think about it." While he can perform routine tasks without thinking he knows very well the dangers in doing so. He says, "That's when mistakes happen and we can't have that; mistakes happen not because the tasks are routine, but because you stop thinking." It is his experience and those of fellow team members that focus and attention to detail mitigates the attendant risks of doing repetitive tasks in the same way day- in and day-out. Participant CN- 1 says, "Everyone on the team has attention to detail." And, it is Participant MD- 1's experience that team members pay attention and they are meticulous. Participant ST- 4 recalls a personal example below:

> Even in a case that I'm familiar with you take and throw a kink in it then my little OCD brain goes crazy. I have to really concentrate, make sure everything still flows the way it's supposed to.

Team members feel well-prepared and informed as communication among and between team members is good. Team member's detail their collective experience below:

> We have opened up as a team and can talk. I think it's easy to communicate with everybody here because they've been on teams before. Everybody is open to discussion back and forth. I feel like we can go to someone and speak our mind,

and it can stay private and confidential if we want it to. We communicate a lot better than most of the other services. It's easy to be a member of the team because communication is good and everybody is on the same page. There is great communication within the team, especially in briefings and debriefings. We brief 15 minutes before the patient is due in the room and then we do the case based on what we discussed, then we debrief at the end of each case. We are all in the room: circulating nurse; surgeon; surgical assistant; surgical tech or scrub tech; CRNA, physician assistant; and sometimes the vendor rep. We go over the cases for the day and what we will need for the entire day. We are asked to share our ideas, suggestions, and questions. We listen because it's what you're really going to need on this case especially if the case is different. The anesthesia MD does not attend the brief because we are doing blocks at that time. The CRNA or resident attends the brief and shares information with us. The best way to communicate is in our briefings and then making sure you're passing information on. As a surgeon I think the brief and debrief have improved the teamwork and communication. There is a lot of communication; I saw increased communication over the year of my fellowship.

While decision making and problem solving among and between team members is collaborative, the surgeon is the primary decision maker in the OR. Participant ST- 1 explains below:

In the OR, the surgeon makes the decisions. I think we all pretty much default to the surgeon. They are the highest tier and they get to make the call. So if the surgeon makes a call for something, I trust that what they are calling for is

probably the best. I wouldn't make a decision on anything that the patient needs. That's just not my role. If we have a major concern or if we think something is not right, we are encouraged to speak up. We get to stop the train

The anesthesiologist decides what anesthesia is safest for the patient based on their airway and medical history, and the surgeon provides input depending on the patient's situation or as needed. Participant MD- 1 finds that communication between the surgical sub-team and the anesthesia sub- team is very important. He explains below:

> The surgeon leads the team briefing at the beginning of the day. Most decisions are made and shared at that time. I am usually covering two rooms so I am going back and forth between rooms. I know if something happens that is unplanned the CRNA will call me as the CRNA is always in the room for each patient. Some decisions are the surgeon's call and others are on anesthesia. Everyone on the team is very receptive to any kind of suggestions.

Participant S- 1 says, "As things come up during the case and you have to make a decision, you can adjust." Her experience is that team members' input is very helpful. She recalls an experience below:

> One of our surgical techs is involved with derers and they're kind of hard for them to hold. So he took them home and actually bent them in a different way then brought them in and got them sterilized and they are working much better and everybody is happier. So, he gave that input of, 'hey let's try this' and I said sure. So, absolutely team members can make adjustments.

For non-surgical decisions the team follows the chain of command much like in the military. Participant ST- 4 explains below:

> Well primarily we do our chain of command. Of course our supervisor makes the decision. If it's something that needs to be made right away, it's by talking, interacting. Asking each other what they think; what they suggest; what can I do. Get your opinion and then I can give you my opinion. Then we can come to resolution. It's got to be a team thing.

Team members find that in the OR as soon as anyone identifies a problem they speak up. Problems are discussed and the team develops a plan to address the issue. Participant ST- 6 explains below:

> Hopefully before surgery we find a solution to a problem before something happens. During the case we brainstorm to come up with the best solution. During the debrief we discuss what happened, what we did to fix it, and what might work better next time.

Similarly, Participant S- 2 says, "No matter what it is you speak up." He details the team's experience below:

> When we do the spinal, some of the anesthesiologists like to hang the patient's legs off the side and turn them. It's kind of dangerous. We don't like that. We like to keep them on the bed in line and drop the foot, it's safer.

Anesthesia sub-team members and surgical sub-team members collaborate to identify and resolve problems and to come to mutual understanding. Participant CRNA-4 recalls his experience below.

> Usually towards the end of the case, I'm also looking around, seeing how much blood loss we've had; calculating blood loss, urine output, fluids that went in and out of the patient. I usually discuss it with one of the physician assistants, saying, 'What are your thoughts on what the blood loss is? We usually come to a mutual agreement.

Team members find meetings around the commitment to safety (CTS) learning board provide a forum for identifying and resolving problems. Participant ST- 4 details the experience below:

> Through our boards that we do once a quarter outside of OR 15 we go through all the little things. That's how we resolve problems. We start at that board and we get to each give our opinion. What is wrong? What can we fix? How can we fix it? Where do we see error? How can we make that error better? We discuss solutions and leadership follows up. We have identified and resolved a lot of problems in our CTS meetings. Things are resolved in a very timely fashion.

Team members work together throughout the case and thereafter as well to prepare the room for the next patient. Their collective experience is that they have each other's back as detailed below:

> As a scrub tech when I walk into a room, I'm thinking, is my room ready for surgery…not is my room ready for me. Anything I can do to make the nurse's job easier and still maintain my job is my goal. I may miss something on my part of the table and I don't worry about that…I know that nurse is going to cover my back. They're going to come in and ask me, 'Is there anything else I can do for you?' 'What do you need?' What can I help you with?' All through my case I

know that I've got that nurse covering my back. You kind of anticipate what your nurse is doing and they know what you're doing and you just kind of work together to make sure she gets her things done…and that I get my things done. If I finish my room, I'm not going to sit around and do nothing. I'm going to find another room and help tear down. I don't see that in other practices. The orthopedic team, yes across the board everybody's going to walk in and help the other team out. I've never seen anybody just walk away and leave a team working there without offering their help first. They pay attention...If I need an extra set of hands, they're always there, ready and willing. I know that if I need anything they are right there. We all work together as a fine-knit team.

Team members plan ahead. As Participant S- 1 says, "Before you get there as a surgeon you kind of plan in your head 'ok, that's how I am going to do that surgery.'" Similarly, Participant MD- 1 says, "I come in between 6:00 a.m. and 6:30 a.m. and I have reviewed the day's cases and we have a plan…I have emailed the surgeon the day before about the cases." Participant PA- 1 also plans ahead. She says, "I put in the orders ahead of time so everything is in the computer and ready the day of surgery."

The Orthopedic Surgical practice is protocol driven as 90% of cases have the same protocol. Participant MD- 1 says, with protocols and standards there are fewer mistakes and people get good at what they do." Team members find too that established protocols and pathways, while administratively difficult to set-up, make the flow of operations easy and smooth for them.

Protocols and standards as well as checks and double checks help keep the patient and the team safe. For example, in the holding room or pre-op area the CRNA

and the anesthesiologist interview the patient and cover much of the same information. Similarly, the surgeon, physician assistant, as well as the circulating nurse visit the patient pre-operatively and while each covers aspects of the patient's surgery specific to their respective roles and responsibilities, there is some overlap of information and built in redundancies as the circulating nurse refers to a check sheet that includes all tasks that must be completed prior to the patients arrival in the OR.

Once in the OR, the CRNA and the circulating nurse repeat the process known as the procedural pause. The CRNA explains below:

> I say the patient's name, medical record number, and date of birth. I also ask the patient to tell us what type of procedure they are having. The patient's verbal confirmation lets us know that everyone's on the same page.

Participant SA- 2 recalls his experience double checking the surgeon's site marking. He details what happens below:

> In the pre-op area the surgeon marks the site and we will check too before we begin. Because if I don't see it: stop, stop the train. Stop! What are we doing? She hasn't marked the leg yet; well maybe it's the other leg…we look at that.

Just before the surgeon makes the incision, the team conducts another procedural pause or time out. The circulating nurse holds up the patient's consent for surgery form and the surgeon reads out loud the patient's name, medical record number, surgical site, known allergies, antibiotics given, implants, and sterile instruments, and asks if everyone agrees.

The team's focus on doing things right and according to protocol is reflected in the way new members of the team are trained and oriented to the practice. Participant ST- 2 explains below:

> We just acquired a new nurse who left her service and came into orthopedics; so she was already a nurse that had already worked in the OR, but we still trained her for three months. Throughout that time she is learning how we do things, how it works, following the leader because they know what to do.

While adherence to protocols and standing operating procedures reduce the risks of preventable errors and mistakes, practices not within the team's control raise concerns and from the perspective of team members, increase the opportunity for error. Participant ST- 4 explains below:

> The only thing I find difficult is the fact that I don't finish stuff. If I start a case I want to be there for the final product. Because of time constraints or whatever, you may get pulled out of it. It's frustrating to me. I'm trained old school, and when we were trained there was not all this swapping when you're in the room. When you're doing a total joint, you're in the room from start to finish. We're taking a chance on infections in my book. When someone comes in to offer me a break they're going to go back out the door they came in. It's a swinging door and just like with a screen door, you open it and close it and sooner or later flies are going to come in- figuratively speaking. Because I know my surgeon's techniques and routines better than anyone else, the case runs more smoothly and this in turn allows for a quicker case and that means less chance of problems, infections, or errors.

Participant ST- 2 finds too that the atmosphere in the OR changes as staff changes. She says, “When you have to seek out somebody new in the room and they’re not following the same steps you are then things get out of whack and anxiety just goes up.”

MD- 5’s experience is that time constraints and the volume of work can be challenging as well. He says, “The volume of work and time pressures to complete sometimes difficult blocks quickly is challenging.” He explains below:

> My role on the team is to control the patient’s pain; administer nerve blocks; and provide oversight of residents and CRNAs. Residents take more time because they are not as experienced as CRNAs. The difficult parts are the production pressures. Surgeons don’t always have sympathy or don’t’ appreciate that other factors cause delays. They could be more understanding about delays. We all have production pressures. Surgeons have them from administration.

On the other hand, Participant ST- 2 says, “A seasoned CRNA can complete a block in five minutes compared to a trainee that can take as long as 30 minutes and we don’t’ factor that time in our day.”

Whether learning to do things differently or responding to unfolding events or regrouping from a bad day, team members share the capacity to adjust. Collectively they say, “Okay, I can do it differently; I can treat that; I can back-up, regroup and start at it again; I can keep going.”

Team members find that leaders here, on this team, are different than leaders of other teams they have known. The supervisor or coordinator of the nurses and technicians is more accessible and visible, and as Participant ST- 4 says, “There is

nothing that he would ask of you that he is not willing to do himself." Team members also find that the surgeons here are different. They are more approachable and they respect and value each team member's opinions and contributions. Surgeons here are also unafraid to let their personal feelings about patients show. Team members say with a collective voice, "Surgeons here really, truly feel that it's all about the patient."

Structural Composite Description

The work and the work environment appeal to members of the Orthopedic Surgery team. The work is rewarding, gratifying, and uplifting as team members get to see the finished product as patients are restored to full form and function. The environment is fast-paced, high energy, and demanding; and offers continuous learning and development as the cases are often times more complex and therefore more interesting. Team members are invested in the work and at the end of the day have a sense of accomplishment because they have helped someone. Team members find the work and the environment fun and enjoyable and they are proud to be a part of it all and humbled too.

Team members are committed to the work, their patients, and each other. They take it personally when things do not work out as planned and patients are unhappy or dissatisfied with their results. They care and are internally motivated as the work is more than just a job to them.

Team members think of themselves as a team and as friends and family. They enjoy each other's company and spending time together on and off the job. Social time together outside of work enhances the work time together, and strengthens relationships among and between team members. While the work itself and the environment make it

easy to be a member of the team, it is the people that make the biggest difference. Team members are easy to get along with, friendly, professional, and meticulous. They trust each other and look out for each other. The camaraderie among and between team members is palpable. It's a close knit team. Team members fit well together and feel that they belong and are part of something big.

Like family, team members support each other, depend and rely on each other, and make personal sacrifices for the good of the team and patients. The team is diverse in terms of gender, age, experience, culture, and perspectives. Yet, team members share the same mindset or mentality when it comes to caring for patients and that is, *the needs of the patient come first.* It is the team's and the organization's primary value and each member of the team is personally and professionally committed to living it because for this team, it's all about the patient.

Team members know their roles and those of their fellow team members. Everyone on the team is important and team members recognize each other for their unique contributions to the whole. Team members work together throughout each phase of the surgical process (pre-operative, intra-operative, and post-operative) to move patients safely and quickly through their procedure.

The circulating nurse serves as the patient's advocate throughout the process and ensures complete documentation of the surgery and expectations for post-op care in the recovery room. The surgical technician is responsible for setting up instrument trays and passing instruments to the surgical team once the surgery is underway.

The surgical assistant and the physician assistant are at the table with the surgeon as the procedure is being performed. Working together they position, retract, and hold

limbs throughout the case. Oftentimes too the physician assistant is called upon to close or suture the wound once the surgeon completes the procedure. Additionally, the physician assistant's role and responsibilities extend beyond the OR to include partnering with the surgeon to see patients in the clinic and hospital.

The anesthesiologist and the CRNA partner to oversee patients' anesthesia care throughout the procedure. While the anesthesiologist and the CRNA are responsible for patients medically, the surgeon's responsibilities include planning the surgery and sharing the plan with the team; performing the procedure; and ensuring the best possible outcome for each patient.

Familiarity counts. Working with intact teams is important as team members become familiar with each other's routines, techniques, and nuances to such an extent that verbal communication is often unnecessary. Team members know what they are doing and they know what comes next. They are comfortable with each other, the procedure and the environment. This means quicker cases, less chance of surgical infections and errors, and happier team members.

Team members find that mistakes happen not because the tasks are routine. Rather, mistakes happen when team members stop thinking. Team member's capacity to focus, to concentrate, and to pay attention to detail mitigates the attendant risks of routine and repetitive tasks. Team members find too that maintaining a professional demeanor and posture at all times reduces the opportunity for mistakes as inappropriate emotional reactions and interactions are curtailed.

Team members feel well-prepared and informed as communication among and between team members is good. Leaders invite and welcome feedback and input, and

everyone feels comfortable speaking up to share their opinions, ideas, suggestions, and concerns. Team members feel that leaders take their ideas and suggestions to heart.

Team briefs at the beginning of each day ensure that team members know what the plan is for each patient and have the opportunity to raise questions and/or concerns. The brief ensures that everyone is on the same page with respect to what is about to happen in the OR. The surgeon leads the brief and team members are expected to pass along key information from the brief to absent colleagues. Team members find that oftentimes problems are identified and resolved during the brief and importantly, prior to the start of the procedure.

At the end of each case the team debriefs to discuss any issues or problems that occurred during the case, how the issue was addressed, and what might work better going forward. Team members find that the brief and debrief have improved communication and teamwork.

The surgeon is the primary decision maker in the OR for any surgical concerns and the anesthesiologist or CRNA (under the supervision of the anesthesiologist) makes the call for any medical issues or concerns specific to anesthesia care. Non-surgical decisions follow the chain of command as team members reach out to their immediate supervisor. If a decision is needed right away, team members confer with each other and decide.

Problem solving is a collaborative process in that each member of the team is responsible for identifying problems and working together to resolve them. Everyone on the team is open to feedback and suggestions from team members. Briefs and debriefs as

well as team meetings at the CTS learning board provide key venues for identifying and resolving problems.

Team members plan ahead and rely on protocols and standard operating practices to keep patients and the team safe. While administratively difficult to set-up, protocols ensure an efficient flow of operations to move patients safely and efficiently through the OR.

Checks and double checks provide an additional measure of safety and include the procedural pause or timeout; counting and reconciling supplies opened and used during the case; site markings; checklists; and briefing sheets. Extensive training for new staff adds yet another measure of safety.

While team members find it satisfying and rewarding to be a part of the team, there are challenges. Team members find it frustrating when they are unable to finish a case and when they are reassigned to cover cases where there is less familiarity and comfort with the procedure and with the team. Time constraints and the volume of work are similarly challenging and especially so when more time is needed to train residents and to administer difficult anesthesia blocks. Team members' capacity to adjust makes it easier to move forward in the presence of such challenges.

Leaders on this team are different. They are accessible and visible, and consider themselves as leaders and team members. Surgeons are more approachable and they respect and value the opinions and contributions of everyone on the team. They care, about their patients and team members.

Orthopedic Surgery Team 2 Descriptions

Table 4.2. *Surgical Team #2: Years of Experience*

Participant	Position	Years in Position	Years with Hospital/Clinic	Years on Team
FA- 1	First Assistant	9	20	9
CN- 1	Circulating Nurse	3	3	3
CN- 4	Circulating Nurse	30+	23	23
ST- 2	Surgical Technician	4	3	3
CRNA- 2	Certified Registered Nurse Anesthetist	19	19	8
MD- 5	Anesthesiologist	1.2	1.2	1.2
S- 2	Orthopedic Surgeon	24	24	24
Totals	**N/A**	**90.2+**	**93.2**	**71.2**
Average	**N/A**	**12.9**	**13.3**	**10.2**

Textural Composite Description

"It's like making music...having a real team that has worked together and where we are all signing off the same sheet of music and the music is very familiar to all of us."

Participant S- 2

Participant FA- 1 has been working in the surgical setting for 20 years and recognizes a good team. "This is a good team," she says. Ages vary among team members. Team members support and respect each other; listen to each other; work hard; and have a high regard for patients and each other. They are willing to try each other's ideas and they take their responsibilities seriously. They trust each other. As Participant CN- 1 says, "You can pretty much trust everybody that is in your room."

Team members are open, receptive, and professional; they work well with colleagues inside and outside of the OR. They like their jobs and they like each other. It's more than just a job. Team members feel that they are an integral part of a bigger picture. As Participant CN- 1 says, "You're not just on the outside looking in; you're right in the middle." And, as Participant CRNA-2 recalls, "I get to actually interact with the surgeons in more of a collegial way." For Participant S- 2 being in the OR is happy time. He says, "It's where my joy is."

Team members are inspired and guided by the organization's primary value…*the needs of the patient come first.* It's the team's mentality. Everybody is honed in on doing the things they set out to do for the patient; they're all moving in the same direction. Participant S- 2 says, "When we know that the patient is going to get a great result, I don't know anything else that is as fulfilling other than seeing my children grow up well." Participant CN- 1 says, "If anyone ever gets off track, you can always think back to the needs of the patient."

The circulating nurse and the surgical technician start the day in the team huddle with their immediate supervisor. Team members review the cases for the day as well as equipment and supplies that will be needed for each case. Then the team attends the team briefing with the surgeon. At the briefing the surgeon tries to give team members an idea of what they will be dealing with for each patient. While the CRNA attends the briefing and passes along information to the anesthesiologist, the surgeon will also talk to the anesthesiologist separately about the type of blocks and anesthesia for each case. Planning at the beginning of the day helps the team address any unplanned events once the case begins as team members have already identified alternative or back-up plans.

Participant CRNA- 2 says, “The briefing makes the day go smoother as everyone knows what to expect and it keeps you from missing things.” While decisions are made during the team brief, the debrief at the end of the case is the team’s main forum for identifying issues and making changes. Team members find that the best way to communicate is during team briefs and debriefs and meetings at the CTS learning board.

Team members help each other. They rely on each other and work hard to move patients through each phase of the surgical process. As Participant CN- 1 says, “Being on a team, you have to humble yourself…you are not going to do everything yourself…you have to rely on other people.” It’s a fluid team as team members nearly know what each other is thinking. Each team member knows their role and the roles of their fellow team members. They know what comes next as their roles are interdependent. And, team members recognize that everybody’s role is important. Participant CN- 1 refers back to a quote from the founding fathers of the organization…*No one is big enough to be independent of others*...and says, “I think that is a big and important thing.”

While the surgeon is the ultimate decision maker, the anesthesiologist makes the decision regarding the patient’s anesthesia medication. During the procedure the CRNA is in charge more than anyone else in the OR as they ensure that the patient is medically under control. The anesthesiologist is only present during induction of anesthesia and emergence from anesthesia; however, they are immediately accessible to the CRNA by telephone. CRNA- 2 says, “It’s nice to have them available immediately if you need them.”

As the surgeon is the ultimate responsible party, the CRNA takes care to inform the surgeon of any changes in the patient's condition. Participant S- 2 says, "I want to be informed of any physiological event." It is important too for the CRNA to attend the team brief and inform the surgeon of any sensitivities or other key information about the patient. The CRNA and surgeon are the decision makers in the OR while other members of the team provide input.

The team relies on the circulating nurse to ensure that everything runs smoothly for the patient. As Participant CN- 1 says, "My biggest role is being a patient advocate." Similarly, Participant S- 2 says, "The circulating nurse is circulating her eyes and ears and making sure that those things we talked about at the beginning of the case are unfolding…I want someone really sharp in there as the role is very important."

The role of the first assistant is to ensure that everything needed for each case is in the room. The first assistant also orients new members of the team. S- 2 says, "She manages proactively and thinks of things that I don't think about." The first assistant is involved in each phase of the process: (a) seeing patients in the clinic and in the holding area pre-operatively; (b) assisting the surgeon intra-operatively including holding retractors, suturing, and dressing the wound; and (c) placing orders for post-op care and rounding on patients post-operatively in the hospital.

Team members' experience is that it is vital to have someone in the OR that knows what they are doing and who is familiar with the team. Team members recall their collective experience below:

> You just pass and don't even usually speak or you may say one little word and they already know. That's definitely vital to have someone in there that is on the team and that works with those people more often because there is so much to it. There's so much about knowing their nuances. Surgical technicians get more experienced the more times they work with me and it's like making music. Sometimes they will think of things that I might need before I thought I needed them. Team members know what the surgeon likes. Here we are on the same team and then that team member is pulled out…that is disruptive and I think brings in elements where it is not to the good of the patient. By having people that I am used to working with and know my way of doing things and have done surgeries with me before makes things go very well rather than to get someone new every time for every case. You feel like you have to keep one eye on the case and one eye on the person to make sure they are doing the right thing.

Participant FA- 1 says, "Doing the same type of surgeries over and over can become a little boring to where you don't pay attention to detail and you have to work hard to prevent that." Checks and double checks as well as team members speaking up guard against the mundane nature of the work and help keep patients and team members safe. For example, the circulating nurse visits with patients pre-operatively and goes over much of the same information as does the pre-operative or holding room nurse just to make sure that all is in order per the checklist for the patient to proceed to the OR. Similarly, the CRNA adheres to standard operating procedures to transition the patient from the pre-operative area or holding room to the OR. CRNA- 2 says, "It seems like overkill, but we follow all the steps without skipping any." A second timeout just prior

to the start of each case provides an additional measure of safety as key patient information is once again confirmed prior to the incision. Post- operatively, hand- off communications between the circulating nurse, the CRNA, and the recovery room team include structured communications in the form of the report sheet as well as information documented in the patient's electronic medical record (EMR).

Participant S- 2 says, "I was trained where the surgeon is top of the food chain and everybody does what I say and people are afraid to speak up…I think the culture has changed." Team members' experience is that leaders have created an atmosphere wherein it is ok to speak up without fear of reprisal or punishment. Whether problems with patients, instruments, or interactions between individuals, it is okay to speak up as speaking up is expected and valued. Team members know they will be heard. As Participant S- 2 says, "I want everybody to be eyes on deck…If they see something or something doesn't sound right, then they need to speak up…I want people to be proactive, open, and collaborative…Problems are handled collaboratively just like good cases are handled collaboratively."

Structural Composite Description

Team members support and respect each other. They listen to each other and have a high regard for patients and their fellow team members. Team members are diverse and they work hard. They are willing to try each other's ideas and they take their responsibilities seriously. They trust each other. Team members are open, receptive, and professional; and they work well with colleagues inside and outside of the OR. They like their jobs and they like each other. They spend time together on and off the job. The work is more than just a job to them as team members feel that they are part of

something big…a bigger force or imperative…a bigger picture. Interactions among and between team members are collegial and respectful. Team members are inspired and guided by the organization's primary value…*the needs of the patient come first*. The team's mentality or mindset is the interest of the patient is the only interest to be considered. Everyone is honed in on doing the things they set out to do for the patient; they are all moving in the same direction. Team members help and rely on each other. They understand that their roles are intertwined and interdependent. Team members are humbled by the experience of teamwork and restoring patients to full form and function.

Team members are prepared and informed. The surgeon defines the work of the team and ensures collective understanding about what is to be accomplished. While team huddles and briefings ensure that team members know what to expect for each case, the team debrief surfaces any problems, steps undertaken to resolve them, and what might work better going forward. Briefings, debriefings, and meetings at the CTS learning board are the best venues for communication among and between team members. Team members pass along key information shared at these meetings to absent colleagues.

The surgeon is the ultimate decision maker while the anesthesiologist makes the decision regarding the patient's anesthesia medication. The CRNA is in charge more than anyone else in the OR as they ensure that the patient is under control medically. The CRNA takes care to inform the surgeon of any changes in the patient's condition and steps taken to address the change. The CRNA and the surgeon are the decision makers in the OR while other members of the team provide input. Problems like good cases are handled collaboratively with all team members speaking up and taking personal responsibility for doing so without fear of reprisal or punishment.

Time together in the OR counts as team members come to know each other's routines, nuances, likes, and dislikes; and team members learn to anticipate what will be needed when without prompting. While familiarity among and between team members facilitates each phase of the surgical process, having someone new every time for every case is disruptive and not good for patients.

Team members work hard to prevent the mindlessness that can result from doing the same type of surgeries over and over. Speaking up, checks and double checks as well as structured hand-off communications help to keep patients and team members safe.

Orthopedic Surgery Team 3 Descriptions

Table 4.3. *Surgical Team #3: Years of Experience*

Participant	Position	Years in Position	Years with Hospital/Clinic	Years on Team
CN- 4	Circulating Nurse	30+	23	23
ST- 1	Surgical Technician	4	3	3
ST- 2	Surgical Technician	4	3	3
ST- 4	Surgical Technician	14	1	1
PA- 3	Physician Assistant	7	7	7
CRNA- 2	Certified Nurse Anesthetist	19	19	8
AR- 2	Anesthesia Resident	2.6	.4	.4
MD- 4	Anesthesiologist	24	9	1.4
S- 3	Orthopedic Surgeon	28	7	7
Totals	**N/A**	**132.6+**	**72.4**	**53.8**
Average	**N/A**	**14.7**	**8.0**	**6.0**

Textural Composite Description

"Once everyone understands the objective of the team in that we can't do the work individually rather each team member is responsible for a small piece and we all know each other's roles, this is when you have efficiency and patient safety."

Participant MD- 4

Team members find the experience of teamwork on the Orthopedic Surgery team awesome and rewarding. They take pride in the work and being on the team, and are dedicated to their jobs and to each other. They are friends and colleagues. Participant

AR- 2 says, “The camaraderie among team members makes it easy to do the work. Participant MD- 4 adds, “The high quality of the environment that has to be maintained makes you a better team player, so we work together a lot better.” Participant PA- 3 says, “It’s satisfying knowing my role and doing it to the best of my ability and knowing the people on the team are doing their role to the best of their ability too.” Participant AR- 2 notes further, “It’s satisfying to handle complex cases with facility.”

Team members value teamwork and recognize each team member’s contribution to the whole. Participant PA- 3 explains below:

> You can accomplish more as a team. None of us could do what we get done together in an efficient or safe and effective way on our own. No one on the Orthopedic Surgery team is ever too busy to help; there is no job that we are not willing to do for each other.

Similarly, it is Participant MD-4’s experience that teamwork matters. He says, “Once everyone understands the objective of the team in that we can’t do the work individually, rather each team member is responsible for a small piece and we all know each other’s roles, this is when you have efficiency and patient safety.

The role of the surgeon is multifaceted as it encompasses taking care of patients and the team. Participant PA- 3 says, “The surgeon is the ultimate responsible person in the room for what the course of action is going to be…it is good if the surgeon is well rested, feeling good for the day, and they feel like we are supporting them to the best of our ability. Participant S- 3 shares his experience as a surgeon and leader of the team below:

> My job is to make sure the patient goes through their surgery as safely as possible and that their outcome is as they expect. It's a privilege to lead the team and to take care of patients. Team members trust me and I trust them. My approach is to treat team members with respect and to try to make the work environment enjoyable.

Orthopedic Surgery differs from other surgical specialties in that additional measures are needed to ensure patient and team safety. Participant MD- 4 explains below:

> Orthopedic Surgery is a much tighter controlled environment and tolerance for error is much lower than in other specialties. There are requirements for barrier protection, infection control, and temperature management. Small breaks in sterile precautions can be devastating.

Participant AR- 2 says, "Ortho goes above and beyond; they make sure that all the "I's" are dotted and T's crossed." He details his experience further below:

> Ortho is observed to be a good example of patient safety and what they do should spread or echo across the system. Professionalism here is above and beyond anything I have ever seen anywhere. They take it seriously; they take patient safety seriously. The team's focus on doing what is right and safe for the patient is something I have not seen at other places. Ortho colleagues really strive to do the best they can for each patient. Team members make extra effort to communicate and do the right things as the stakes and risks are higher. They think and believe that good communication leads to good patient outcomes.

The team's experience is that during the team brief the surgeon will discuss all the patients for the day including what to expect and what not to expect, and address concerns. Similarly, during the team debrief members discuss what went well, what could have gone better, and what to do next time. Meetings at the CTS learning board facilitate communication and problem-solving, and ensure that everyone is on the same page.

With respect to decision making, Participant PA- 3 says, "Decision-making in the OR is situation specific. Some decisions are based on historical evidence while surgical decisions are made by the surgeon. Participant MD- 4 adds, "Decision-making varies depending on the type of decision and level of decision making." He explains below:

> Medical decisions specific to anesthesia are made by the anesthesia resident and the anesthesiologist. Other non-medical decisions are made by anyone with the knowledge or expertise needed with consultation from team members.

Problems are identified and resolved by someone seeing something or noticing something and calling for assistance. Participant PA- 3 recounts the team's experience below:

> We are welcome to speak up and I feel like everybody feels like they are and they don't get shot down for it. In a good room anybody is comfortable saying we need to stop. The surgeon always listens to suggestions and is agreeable to take advice. If somebody says we should do something that is erring on caution or could cause potential harm or a complication, we will do that regardless of who it came from. Everyone in the room has the patient's interest at heart and

doesn't mind being derailed for a moment to make sure there isn't a problem and to visit the issue.

While familiarity among and between team members counts, Participant MD- 4 says, "Humans make mistakes and the more checks and balances you have the less mistakes you make…As part of your process you have to guard against team members becoming too comfortable, making assumptions, and paying less attention to detail." As such, protocols, standards, checks, double checks, timeouts, and structured hand-off communications are built in mechanisms that ensure patient and team safety. For example, the circulating nurse sees patients in the pre-op or holding area and signs off on the red, stop sign, check-sheet attached to the front of the patient's chart. This signals the anesthesia team that the patient is ready to go to the OR. Once the patient enters the OR, the team completes the pre-procedure pause or timeout to confirm right patient, room, procedure, and side or surgical site. The team transfers the patient to the OR table, completes positioning, and the resident alerts the team that they patient is sedated and ready for surgery. The process is known as the anesthesia release. After draping and prepping, the surgeon calls for a second timeout and upon completion, the case proceeds. In the recovery room, the circulating nurse and the anesthesia resident give structured verbal reports to the recovery room nurse.

PA- 3 asserts, "Working on the team is best when regular team members are at the table." Her experience mirrors that of fellow team members and their collective experience is recounted below:

They know what we need and what comes next and it makes us more efficient. They can be counted on and trusted to do a good job. When the people who are

in supporting roles have done their part, then we can do our part efficiently and the physician can do their part efficiently. It is easy to work in Orthopedic Surgery because team members care about what they do, everything is done, you don't' have to double check, and you don't have to fight to get someone to do their job. You develop relationships and understand each other's needs and how we each operate. We have common goals and everyone knows what everyone else is doing. Regular circulators are well trained and familiar with the equipment needed for each case. They anticipate what is needed and when and are always cheerful and helpful. It just flows smoothly when we have our usual circulators. Regular surgical technicians are comfortable and familiar with the procedures. They have what you need before you ask for it and they have excellent sterile technique and are un- afraid to speak up. They can do a whole surgery without even talking as we can just hold our hand up and they will know what we need and put it in our hand.

The team's experience is that working with new or float team members is problematic and adds to an already stressful environment. Participant MD- 4 explains below:

New team members lack experience and are afraid to ask questions and to ask for help. They do not know what to expect or what is expected of them in their role. They are problematic and can compromise the effectiveness of the team and patient outcomes as small errors mean a lot to the patient.

Yet, Participant S- 3 says, “When new people join in who are not familiar with the case and the team’s routines we have to remember that they too are trying to do a good job for the patient.” He explains further below:

> It is important not to be abusive, but to lead by example and to handle issues or problems appropriately. The leader has to remain cool even when things don’t seem to be going smoothly and as anticipated. This helps team members feel more secure; they do their jobs better and they don’t make mistakes.

While team members enjoy the work, there are aspects of the work that present difficulties and challenges. For example, Participant PA- 3 says, “When somebody has a bad day it can be disruptive. Similarly, Participant AR- 2 finds that production pressures present challenges. He explains below:

> Production pressures are challenging as patients are complex and regional anesthesia takes time to complete. It is sometimes difficult to carry out a well thought out anesthesia plan given production pressures.

In addition, Participant S- 3 finds aspects of his leadership role more challenging than others. He elaborates below:

> While it is difficult for me I have to balance the desire for a little levity in the OR and the need for everyone to stay focused, especially towards the end of the surgery. The case is not over until the dressing is on and the patient is transported to the recovery room.

Participant S- 3 finds too that after hours staffing presents difficulties and holds the potential to compromise patient and team safety. He details his experience below:

> The potential for patient harm occurs more after hours, weekends, and holidays as team members from other surgical specialties are called upon to staff Orthopedic Surgery cases instead of the on-call Orthopedic Surgery team. Team members are stressed because they do not know the cases, instruments, and routines. After hours staffing is something that I would like to see us do better.

Structural Composite Description

The experience of teamwork is rewarding, fun, and a privilege. Team members find that they can accomplish more as a team. Team members enjoy and derive satisfaction from knowing their roles and performing them to the best of their abilities and with facility. Team members support and help each other. There is no job that team members are unwilling to do for each other. They trust each other and count on each other. Professionalism and camaraderie among and between team members sets the Orthopedic Surgery team apart from others. Team members are excellent, high quality, and dedicated to their job. They care about patients and each other. Team members share a common goal and mindset and that is to do what is best for the patient.

The surgeon's job is to make sure the patient goes through their surgery as safely as possible and that the outcome is as the patient expects. He listens and treats team members with respect. He tries to make the work environment enjoyable; yet, as the leader of the team he must also balance the desire for a little levity in the OR with the need to keep the team focused. It is important for the surgeon to remain cool under duress as doing so helps team members feel more secure, do their jobs better, and avoid making mistakes.

The risks and stakes are higher in Orthopedic Surgery compared to other surgical specialties and the tolerance for error much lower. Team members go above and beyond to communicate and do the right thing. Extra effort elevates the performance of each team member and hence, the overall effectiveness and efficiency of the team. Team members think and believe that good communication leads to good patient outcomes. Team briefs and debriefs and meetings at the CTS learning board facilitate communication and problem-solving, and ensure that everyone is on the same page.

Decision-making in the OR is situation specific as the surgeon makes surgical decisions and the anesthesia sub-team makes medical decisions specific to anesthesia care. Still other types of decisions are made upon discussion and consensus among team member with the team deferring to any member of the team with the knowledge or expertise needed.

Problems are identified and resolved by team members speaking up. Surgeons are receptive, agreeable, and they listen. Team member feel comfortable speaking up and are unafraid to do so.

Checks and balances, hand-off communications, protocols, and standards are built in mechanisms to help guard against mistakes, complacency, and loss of attention to detail. Checks, double checks, and even triple checks help keep patients and the team safe.

When regular team members staff a case everything flows more smoothly and the team is more efficient and effective. Conversely, when new team members join in, their lack of experience and familiarity with Orthopedic Surgery and the routines and expectations of team members can compromise the effectiveness of the team and patient

outcomes. Moreover, the potential for patient harm occurs more after hours, weekends, and holidays as inexperienced team members from other specialties who are unfamiliar with orthopedic cases, team members, equipment, and instruments are called upon to staff Orthopedic Surgery cases.

Production pressures are similarly challenging. Patients are complex and regional anesthesia takes time to complete. It is difficult to carry out a well thought out anesthesia plan under such circumstances.

Orthopedic Surgery Team 4 Descriptions

Table 4.4. *Surgical Team #4: Years of Experience*

Participant	Position	Years in Position	Years with Hospital/Clinic	Years on Team
CN- 2	Circulating Nurse	22	7	7
ST- 3	Surgical Technician	14.6	4	4
SA- 1	Surgical Assistant- 1	4	15	15
PA- 4	Physician Assistant	19	19	19
CRNA- 2	Certified Nurse Anesthetist	19	19	19
CRNA- 4	Certified Nurse Anesthetist	20	15	15
OR- 4	Orthopedic Resident	4	.4	.4
MD- 2	Anesthesiologist	15	8	8
MD- 5	Anesthesiologist	1.2	1.2	1.2
S- 4	Orthopedic Surgeon	22	22	22
Totals	**N/A**	**140.8**	**110.6**	**110.6**
Average	**N/A**	**14.1**	**11.1**	**11.1**

Textural Composite Description

"Leaders are guardians of the learning system…that means you have to guard it, support it, and ensure it; you have to protect it; you have to nurture it. That is what a guardian does and that's the leader's role." **Participant S- 4**

The environment in Orthopedic Surgery is fast-paced and ever-changing and requires significant coordination of resources and prioritization of tasks. Participant ST-3 says, "There are no typical days in Orthopedic Surgery. Every day, every patient, every situation, and every scenario is different as some days the surgeon has two rooms and sometimes they go between three rooms…This means a lot of coordination with a lot of team members. Participant CN- 2 adds, "It's good to be able to prioritize, multi-task, give orders and take orders well; not get frustrated, and just focus on one thing at a time."

The team is oftentimes called upon to do the extraordinary. Participant ST- 3 says "There are many aspects to every case; it is rare to have easy, simple, straightforward cases." Participant SA- 1 notes his experience in this regard below:

> The cases are difficult and sometimes they are easy; variability makes the team strong. We do the out of the ordinary or maybe a little tougher cases. No matter what comes in, the team gets the job done.

Team members underscore the importance of situational awareness and paying attention. Participant ST-3 says, "We have to scrutinize all aspects of the process regardless of the type of procedure...Exercising due diligence at all times is very

important. Participant CN- 2 adds, “Being totally aware of your surroundings makes a big difference...It’s proven itself over time. Participant SA- 1 elaborates below:

> Team members have the astute capability to constantly pay attention throughout the case in order to spot problems or the potential for problems. Attention to detail is something that we have to have in surgery. Staying focused on the task at hand and guarding against distractions, keeps the team out of trouble.

The team is guided by the organization’s mission or primary value, *the needs of the patient come first*; and the organization’s service values: *mutual respect; teamwork; integrity; innovation; excellence; compassion; and stewardship.* Participant MD- 2 says, “It’s a team that’s committed to team...Everybody’s in on the mission and feels that what they do is important…we all make a difference...If one part breaks down, nothing works…We’re all here for one thing, to take care of patients.” Participant OR- 4 details his experience below:

> The environment here is more collegial. Everyone is involved and they know each other on a first name basis. Teams are tight. Team members look out for each other. It is a good experience for a resident in training.

Team members care, enjoy the work and each other, and want to make a difference. Participant MD- 2 says, “Everyone enjoys the work as we’re all trying to do the best for the patient; I think it exudes through the whole staff most of the time.” Participant SA- 1 adds, “We have fun; we come in with a good attitude and end on a good note; we work well together and we are good friends.”

Participant CN- 2 is honored to be a part of the team and takes pride in going above and beyond to attend to the needs of patients and team members. He says, “The

quality of team members makes the job more pleasant and enjoyable...I see a lot of over-achievers and people who are very good at what they do…We count on each other 100% of the time." Participant ST- 3 adds, "We give 100% effort 100% of the time and we are expected to and we will die trying." Participant SA- 1 explains further below:

> Everybody in the room on our team likes to do their best and bring their best every single day. I like that it takes a little more for someone to accomplish the goal that we're all there for. I like being a part of that team and seeing great outcomes.

Team members' work together to ensure that all aspects of the surgical process have been attended to in readiness for each patient. Participant CN- 2 says, "We all work together to ensure that everything is ready and that we have anticipated every possible scenario that will be required for that procedure; we're all trying to work cohesively and function as a well-oiled machine. Participant SA- 1 adds, "Everybody is kind of pulling together, recognizing what hasn't been done and stepping in." Participant ST- 3 says, "The circulating nurse and the surgical technician work together to complete multiple instrument and supply counts throughout the course of the case as the dressing is not started unless and until the count is correct." Participant SA- 1 recalls his experience in this regard further below:

> The circulating nurse works with the surgical assistant and the surgical technician to set up the sterile field; if any item is missing or needed it will be retrieved before the patient arrives in the operating room. The surgical assistant works with the CRNA to make sure that all equipment needed for the case is in the room and

in working order. The surgical assistant and surgical technician also work with the housekeeping team to quickly clean the room in preparation for the next case.

Team members find that time together counts. Participant CN- 3 says, "We've all worked together so long we can almost anticipate each other's needs; there are times where I can almost finish people's sentences." Participant ST- 3 reflects further below:

> We can communicate a lot on hand signals. These people that I'm working with, my nursing staff, collectively, and at any given time, there's over 100 years of surgical experience in the room. We know what we're doing. We know what is expected of us. We know our roles and the roles of everyone else on the team.

Participant MD- 2 finds too that familiarity among and between team members counts in terms of patient outcomes, efficiency, and safety. He details his experience below:

> We know and have a good relationship with the surgeons, nurses, and techs. They know me. Everybody feels pretty comfortable on the team. We are familiar with each other. We feel like we're a part of the team. The downside can be when someone new comes in and they don't understand what's going on in that environment. In orthopedics we have certain things that we do that's known to the team. When a newcomer or inconsistent people come in and out they're not used to that particular surgeon or that type of surgery, it can add a little stress to the team. With a core team in the room surgeries are more efficient, relaxed, and comfortable. Everyone knows what they are doing and they are good at what they do. Team members speak up because they know the surgeons and their personalities. Team members know if the surgeon is having a bad day and they

know how to manage the situation, so it makes it a lot easier. I don't think that you get the same quality or outcome if you have someone that doesn't do it all the time.

Participant MD- 2 notes as well that it is particularly frustrating when someone new is assigned to staff a difficult or complex case. He explains below:

> It's frustrating when there is a difficult case and someone new is scrubbed in who is unfamiliar with the procedure or who doesn't know the equipment; that's a disaster; it just slows the case down and there is tension and that's just not a good thing. The case can take twice as long and then the risk of infection increases along with patient morbidity and errors. Efficiency matters. Get in, get out, know what you're doing; everybody knows what they do in their role. It's like a dance. It's much more efficient to have the same people every time and for the surgeon to know that they will have one scrub for example who is going to take care of all their needs; who knows what equipment the surgeon uses; and what the surgeon does at every step.

With regard to planning and decision-making, Participant ST- 3 says, "The surgeon plans the work and the team works the plan." Participant OR- 4 recalls the team brief and says, "The team brief provides an opportunity for the surgeon to share the plan for each patient's case and for team members to bring up items that the surgeon may not be aware of or thinking about." Participant ST-3 adds, "The team brief minimizes mistakes and distractions and offers the opportunity for the team to get it right the first time. And, Participant SA- 1 says, "Because we have briefings we now are well informed...The surgeons go above and beyond in helping their team be prepared."

While most decisions in the OR are made by the surgeon, Participant MD- 2 says, “Medical decisions specific to anesthesia care are handled differently in that steps are taken by the anesthesia sub-team to do what is medically important for the patient based on best practice and medical data.” In addition, Participant OR- 4 underscores the importance of seeking input from others in the decision-making process. He says, “The surgeon is ultimately responsible for the patient during surgery and you must give people an opportunity to speak-up without retribution so that they will tell you things that you need to know to take care of the patient.”

Problem solving is a shared responsibility amongst team members as any member of the team can stop the line if there is a problem. Participant MD- 2 says, “Everyone feels comfortable with the surgeons so everyone speaks up.” Participant SA-1 adds, “Once a problem surfaces, the team looks for the best, fastest, and safest solution to the problem.” And Participant ST-3 notes, “With a few minutes of conversation and clarity, the team can switch to plan B effortlessly and expeditiously.”

While briefings ensure that team members are well-prepared for each case, Participant S- 4 says, “Post- operatively, debriefs and meetings at the CTS learning board present the best opportunities for problem-solving and learning.” Participant OR-4 recounts his experience in the debrief below:

> Each surgeon does the team debrief differently; some more formally than others. Sometimes you are searching for anything to say. It is important for everybody to have the opportunity to say what went well and what we can better. The team debrief also provides an opportunity for the circulating nurse to include any

changes that may have occurred intra-operatively in the final documentation for the case.

With respect to the CTS learning board, Participant MD- 2 says, "Meetings at the CTS learning board are helpful because team members are asked to share their opinions and everyone is considered an important part of the team…Sharing your opinions and making decisions together makes you feel like what you think matters." Participant SA-1 adds, "We are able to bring out points that may not have been talked about ever if we didn't have the CTS learning board."

Participant S- 4 says, "Leading cultural and behavioral change takes time and energy." Her experience is that much of the work falls to the department chair. She adds, "Behavioral change is hard as real change means that team members have internalized the change, they want to change, and they possess the self- motivation needed to change." Behavioral change processes include creating more psychological safety wherein team members feel free to speak up without fear of retribution or punishment; and creating more of a learning environment with emphasis on improvement and engagement, and wherein the leader is the guardian of the learning system. Regarding effective measures of the team's efforts to change the culture, Participant S- 4 elaborates below:

> Measuring the effectiveness of the change is hard because the team already has good outcomes in terms of infection rates, surgical complications, and adverse events. There is objective data that points to improvements in job satisfaction, the work climate, and how team members feel about their work. And, the team is more adept implementing change and doing so more quickly and effectively.

Participant ST-3 says, “Our leader’s emphasis on safety is priceless…We are a safer and smarter team.”

Structural Composite Description

It is a collegial environment as team members are close and familiar with each other, and everyone on the team in engaged and committed to the mission, *the needs of the patient come first.* The team is guided as well by the organization’s service values: *mutual respect; teamwork; integrity; innovation; excellence; compassion; and stewardship.* What sets the team apart from others is that everyone on the team is committed to the team as everyone on the team is important to the whole. No one is more or less important than anyone else on the team.

Team members are very good at what they do and strive to do their jobs to the best of their abilities. They are over-achievers and count on each other to make 100% effort 100% of the time. Team members focus on working together in a cohesive fashion to achieve what is best for the patient. Variability of cases makes the team strong; no matter what comes in, the team gets the job done. They have fun and look out for each other.

Team members know each other so well and have worked together for so long that they can anticipate each other’s needs and practically complete each other’s sentences. At times, team members even forego verbal communication in favor of the simple hand gesture. Collectively, team members have over 100 years of surgical experience among them at any one time in the OR. They know what they are doing and they know what to expect. Familiarity among team members makes it easy to be a part of the team and results in a more efficient and safe surgical practice.

Team members consistently and constantly pay attention. They scrutinize all aspects of the surgical process and are totally aware of their surroundings at all times. Their due diligence in continuously scanning the operating room, watching for the next step, anticipating needs, and expecting the unexpected has proven effective in terms of patient and team safety.

The work requires significant coordination and cooperation among and between team members. Team members come together when needed to complete a task and then return to their respective roles. Someone is always doing something. Everybody is pulling together, recognizing what hasn't been done, and stepping in to help out.

The team brief presents a chance for team members to discover any special needs of the patient and any idiosyncrasies of the surgeon. Team members share information or raise issues that the surgeon may not be thinking about but needs to know. The brief ensures that the team is prepared and helps team members anticipate, identify, and resolve problems.

In the OR team members feel free to speak-up when they notice something or see something that needs to be addressed. Once a problem surfaces, the team looks for the best, fastest, and safest solution.

While some debriefs are carried out more formally than others, the debrief presents the best opportunity for learning as team members discuss what aspects of the case went well and what the team could do better next time. Monthly team meetings at the CTS learning board with the department chair present the opportunity for collaborative problem-solving and decision-making as issues previously not discussed

are raised and addressed at the board. Sharing opinions and making decisions in this manner makes everyone feel important, and that what they think matters.

Bringing about and sustaining behavioral and culture change takes time, energy, perseverance, and due diligence on the part of the leader as the goal is to effect real change where team members have internalized the change, want to change, and have the self-motivation to change. The process includes creating an environment wherein team members feel safe to speak up and share their ideas and opinions; and creating a learning culture that emphasizes improvement and engagement. Briefs, debriefs, and the CTS learning board are structural components of the learning system and the leader is the guardian of the learning system.

Overall, the culture has changed and the team is safer and smarter. While it difficult to measure the impact of the team's cultural improvements given already great patient outcomes, there is objective data pointing to improvements in how team members feel about their work as well as gains in job satisfaction and work climate. And, the team is more adept implementing change, and doing so more quickly and effectively.

Orthopedic Surgery Team 5 Descriptions

Table 4.5. *Surgical Team #5: Years of Experien*ce

Participant	Position	Years in Position	Years with Hospital/Clinic	Years on Team
CN- 1	Circulating Nurse	3	3	3
CN- 2	Circulating Nurse	22	7	7
ST- 2	Surgical Technician	4	3	3
SA- 2	Surgical Assistant 2	33	19	19
PA- 1	Physician Assistant	1	1	1
PA- 6	Physician Assistant	22	22	22
CRNA- 1	Certified Nurse Anesthetist	5	5	.6
AR- 3	Anesthesia Resident	0.5	0.5	0.5
MD- 1	Anesthesiologist	2	2	1
MD- 5	Anesthesiologist	1.2	1.2	1.2
S- 5	Orthopedic Surgeon	34	26	26
Totals	**N/A**	**127.7**	**89.7**	**84.3**
Average	**N/A**	**11.6**	**8.2**	**7.7**

Textural Composite Description

"Working with this team has reinforced my belief in the organization's core value…the needs of the patient come first." **Participant AR- 3**

Team members express that the people make it easy to be a member of the Orthopedic Surgery team. Participant S- 5 says, "We have great people to work with; they try very hard to accomplish the goals with a successful surgery outcome for the

patient…Team members help out quite a lot." Team members value and appreciate each other. Participant PA- 6 asserts, "I feel I am an integral part of this team…My surgeon makes me feel valued, other people that I work with make me feel valued." Participant AR- 3 details his experience in this regard below:

> Team members appreciate my role as a care provider more so than members of other teams I have worked on. My opinion is valued. Working with the team has reinforced my belief in the organization's core value; *the needs of the patient come first.* Camaraderie among and between team members makes it easy to work with everyone and to be a part of the team. I feel like I am on a team.

Participant PA- 6 finds that the work easy and predictable. She says, "The job itself does not vary very much and my surgeon is pretty predictable and that makes the job easier too." She adds, "I know what his standard responses to standard questions are and therefore I can answer a lot of the patient's questions without his assistance."

The day begins with the team brief. Participant S- 5 details how the day unfolds below:

> We gather in the morning and discuss the cases that we have and what we are going to need to do such as special features of the operation for that case and that patient. For each case the team is setting up the room and getting ready. I rely on the physician assistant to make sure that patients have the appropriate plans before surgery; that the surgery is listed appropriately in terms of type of procedure; that parts and instruments needed for the case are available and working; and that any medical issues have been resolved. She is responsible for all of that under my guidance. She also assists during the procedure.

Participant PA- 6 takes on additional responsibilities in the surgeon's absence. She says, "When he leaves and goes and talks to the family and signs the next patient's surgical site, I am closing the wound, putting the dressing on, getting the patient off the table, doing the post-op note, and initiating those orders."

In addition to the physician assistant, Participant S- 5 says, "I rely on the scrub nurse or surgical technician to make sure all the instruments are available, the components are available, that it is all done sterilely, and all set up and ready to go." Participant PA- 6 adds, "They have to have significant knowledge of the case and know the steps…because optimally, the surgeon doesn't have to ask for everything he needs, it just comes." Regarding the role of the surgical assistant she says, "Our surgical assistants help with positioning because positioning takes muscle." Participant S- 5 notes as well the role of the circulating nurse. He says, "The circulating nurse looks out after the medical and safety issues surrounding the patient's care." Participant PA- 6 adds, "The circulating nurse is a patient advocate whose specific responsibilities include making sure that all of the patient's pressure points are sufficiently padded, and that the Foley catheter is in place and functioning." Specific to the role of anesthesia, Participant S- 5 says, "The anesthesiologist and the CRNA supervise the patient so there is no injury." Participant PA- 6 adds, "They ensure adequate upper body, neck, and shoulder padding for each patient; adequate anesthesia for each patient; and that the patient's medical condition is doing well."

Regarding the team brief and debrief, Participant AR- 3 says, "I am very involved in the team briefing and debrief...When a question is asked they look at you and wait for your reply." Participant PA- 6 comments further below:

> My surgeon does not ask that I be a part of the team brief just because I have a lot of other duties to do. Prior to his meeting with the patient to sign the surgical site, he and I review the patients for the day and talk about anything unusual, any special equipment, any patients that fit into the age range that they need additional things

Team members plan ahead and collaborate to effect the best decisions for patients and the team. Participant S- 5 says, "Decisions are basically made ahead of time and anything that is unusual, out of the ordinary or different than what we expected, we converse about that and make a plan." Participant PA- 6 finds that while the surgeon is the primary decision maker, the team relies on the expertise of each team member to effect the best decision for the situation at hand. She details her experience in this regard below:

> While the surgeon is basically the captain and makes the decisions, everybody knows their role and we have to defer to each person because they do know their role. For example, it is the circulating nurse's job to make sure that a timeout gets done, but Dr. X (name omitted) has to be the one to lead it. So we defer to each person as to what their role is and then they feel free to ask questions if they have any.

Speaking up is an expectation and the team norm. Participant PA- 6 explains below:

> I feel that the atmosphere and the climate in the OR are such that everyone really feels comfortable talking if there is an issue. We have multiple arenas where they are bringing up issues whether it is in writing, out in the open, or a post-it note on our commitment to safety board. Then we have the checkout or debrief where we address things that we don't want to happen again and we further discuss that in our commitment to safety meetings. I don't think anyone is afraid to bring up any issues and if they are we have a certain chain of command where if someone wants to be anonymous they can certainly be.

Team members share responsibility for finding and solving problems. Participant S- 5 explains below.

> There could be any number of ways that problems are identified; abnormal vital signs, we are missing a component or missing part. There are a thousand different ways that things can change the course of a procedure. It depends on what the item is; the person who notices it brings it to our attention; we discuss it and make a plan to correct it. I welcome their input.

Familiarity among and between team members and time working together on the same team promotes teamwork and benefit patients and team members. Participant PA-6 elaborates below:

> The team works very well together. I feel it is really necessary to have a team type of atmosphere in order to make things go smoothly. When you have somebody that is floating or not usually on the team, it is instantly apparent when

somebody doesn't understand the flow. So the team atmosphere is beneficial for the patient and for everyone on the team.

Team members find that there are challenges inherent in the work. For example, Participant PA- 6 says, "Changing availability of medications, changing policies at the hospital and clinic, and time constraints add a degree of difficulty to my job...Each new additional duty, check- off list requirement, guideline, and law adds to how many things you have to remember to do each time; I feel like the job increases in complexity with each year." Similarly, Participant S- 5 says, "The hard part is it is a stressful occupation; things can go wrong at the drop of the hat and you have to be prepared for all of that…I have to kind of keep track of everything that is happening around me at all times; that can be hard sometimes and stressful." Participant AR- 3 adds, " Because I am new to anesthesia in Orthopedic Surgery I don't yet know all aspects of practice and that it difficult for me; I review the literature specific to a diagnosis or procedure so that I am prepared for questions and familiar with what is going to happen or may happen."

Structural Composite Description

Team members feel valued and that they are an integral part of the team. They feel that their opinions count and that they are respected for their contributions. Camaraderie among and between team members makes it easy to be a part of the team as does the predictability of the work. Team members rely on each other and recognize the unique roles and contributions of each member of the team.

The team atmosphere wherein everyone on the team is familiar and comfortable with each other, the procedures, work flows, and expectations of team members is beneficial to patients and the team as every aspect of the process proceeds in a smooth

and effective manner. The team atmosphere also supports collaborative decision-making and problem solving.

While the surgeon is the leader of the team and as such the primary and ultimate decision maker, team members defer to the expertise of fellow team members as the situation warrants to ensure the best decision and outcome for the patient. To the extent possible, decisions are made in advance with the team collectively addressing any problems that arise.

Team members feel free to comment and their input is welcomed and appreciated. If problems arise during surgery, team members collaborate to formulate a plan. Similarly, outside of the operating room, team members feel comfortable and are unafraid to raise issues. Multiple structures, verbal and written, make it easy for team members to do so including, the team brief and debrief, meetings at the CTS board, and written notes posted to the board.

Challenges inherent in the work make it more difficult for team members to excel. Internal and external mandates add to job complexity and the necessity to be continuously aware of what is happening throughout each phase of the surgical process makes the job stressful as problems can and do arise and the team has to be prepared to deal with all contingencies. Similarly, being a new member of the team presents challenges and difficulties as new team members have yet to learn all aspects of the practice and the routines and expectations of team members.

Orthopedic Surgery Team 6 Descriptions

Table 4.6. *Surgical Team #6: Years of Experience*

Participant	Position	Years in Position	Years with Hospital/Clinic	Years on Team
CN- 4	Circulating Nurse	30	30	23
ST- 4	Surgical Technician	14	1	1
ST- 6	Surgical Technician	14	1.6	1.6
PA- 2	Physician Assistant	1	1	1
CRNA- 1	Certified Nurse Anesthetist	5	5	.6
CRNA- 3	Certified Nurse Anesthetist	29	14	14
CRNA- 4	Certified Nurse Anesthetist	20	15	15
MD- 3	Anesthesiologist	16	16	16
S- 6	Orthopedic Surgeon	15	15	15
Totals	**N/A**	**144**	**98.6**	**87.2**
Average	**N/A**	**16.0**	**11.0**	**9.7**

Textural Composite Description

"It's really quite amazing that there is a collaborative culture that enables us to get work done when it's so complicated." **Participant S- 6**

Participant S- 6 finds the surgical environment quite different from others in the clinical setting in terms of complexity and with respect to the number of and varying people engaged in every aspect of the surgical process. He details his experience and observations in this regard below:

> I think that overall it's really quite amazing the number of people that we interact with in surgery in particular as it's different in the other parts of medicine…there are the pre-anesthetic nurses, the post-anesthetic nurses; there are the board people that control the flow of the operating room; there are of course all the people in the operating room; there are people on the ward, in the clinic, and in pharmacy. You have to interact with all those people. Those people change from day to day. They're never the same people, except for my physician assistant… Every day is different as the people are never the same and the environment is dynamic, ever-changing, and interactive. There is synergy in multiple people working together.

While Participant S- 6 observes that it is the culture of collaboration that enables team performance, team members assert too that they share a common goal and an over-arching purpose, *the needs of the patient come first*, and that collective thinking in this regard makes it easy to be a member of the team. As participant CN- 4 says, "There is a shared mindset about the work among team members; no matter who we're working with, we all are on the same page."

Team members find as well that teamwork is a longstanding organizational value that is continuously reinforced by organizational leaders and among and between team members. No one on the team is any more or less important than anyone else. Participant CRNA- 4 says, "Leaders emphasize the importance of each team member" Further, team members appreciate each other and recognize each other's contributions to the whole.

Team members help and support each other; they back each other up. As CRNA- 1 says, "Everybody helps and pitches in even though it's not really their job." Similarly,

it is PA- 1's experience that "being a member of a team means making sure the patient is taken care of and getting everything done even if it's not your role."

It's a close knit team. Team members think they are a team. They take care of each other and watch out for each other. Participant ST- 4 says, "The camaraderie that exists is like nothing I have ever seen before." Team members socialize outside of work and they try to be a part of each other's lives. In this way, they are not only colleagues, but also family, friends. Participant ST- 4 says, "New team members are welcomed and treated like part of the group right from the start."

Team members seem to prefer being a part of a team versus working in isolation. While team members find the work gratifying, worthwhile, and rewarding, interacting with others makes the work fun and enjoyable for them. As Participant CN- 4 says, "It is a pleasure to come to work."

Team members are easy to get along with, hardworking, selfless, cooperative, meticulous, professional, and experts at what they do. Team members take initiative and they are good communicators. They pay attention to detail, anticipate problems and work together to resolve them. Team members not only get along well with each other, but also with members of other teams.

For members of the Orthopedic Surgery team, the work is more than just a job. Team members are proud to be a part of team and they take great pride in their work. They are grateful to have the opportunity to serve and are humbled by the experience. Team members feel that it is an honor to be a part of the team. Participant ST- 6 says, "It is probably the best job that I have ever had."

As a new member of the team Participant ST- 4 compares the Orthopedic Surgery team here in this organization with other teams that he has known and says, "Team members put forth their best effort at all times; they make extra effort to do no harm; and they take is above and beyond to make sure that the patient's outcome is the best it can possibly be." He also finds that team members make personal sacrifices, accept the good and the bad; and set aside their egos to do what is in the best interest of the patient.

The CRNA is usually the first to arrive in the operating room each morning. The CRNA makes sure the machines are safe and ready to go and that all the drugs needed for the case are on hand. In this way, the CRNA ensures that there are no surprises once the case is underway.

While the CRNA is setting up the OR, the anesthesiologist, Participant MD- 3, is rounding on patients scheduled for procedures and ensuring their understanding of what is about to happen to them, and administering nerve blocks as appropriate for the type of procedure to follow. Participant MD- 3 also talks to the surgeon either before or after visiting with the patient, and then meets with the CRNA to review the briefing cards for each case and to ensure shared understanding. Participant MD- 3 says, "...we both have a shared mental model of not only how the case is going to go, but also of the parameters for each case."

Members of the nursing sub-team and the surgical sub-team subsequently arrive in the OR and the surgeon initiates the team brief or huddle. Ideally, everyone involved in the care of the patient for the day attends the team brief. Team members find the team brief very helpful as the surgeon communicates expectations for each case including

equipment needed and patient positioning. Participant CRNA- 1 says, "The huddle is wonderful because compared to other surgical teams, the surgeon and all members of the team, clearly delineate their expectations of the day…The surgeon typically asks everybody if there are any questions, so a majority of the clarification happens before you even start your day." The brief presents an opportunity for anyone noticing anything to bring it to the attention of the team so everyone is informed. Participant CN- 4 finds that team briefings are less formal in outpatient surgery on the 1st floor.

After the team briefing, the CRNA visits with the patient in the holding room and goes through checking the patient to make sure the patient is correct and that there is agreement regarding the type of surgery being done. Upon completion, the CRNA calls the operating room to alert the team that the patient is all set and escorts the patient from the pre-op room to the operating room. Upon entering the room the CRNA initiates and completes the timeout or procedure pause with the nursing team and the patient. The procedural pause is a safety precaution and entails confirming the patient's name, medical record number, date of birth, and known allergies, as well as the type of procedure to be performed and the surgical site. The patient's verbal confirmation is required as it informs the team that everyone is in full agreement as to what is about to happen. Participant CRNA- 3 details the procedural pause below:

> We quiet the room. We don't say anything until the room is quiet. Then we have the patient say his or her name and the type of operation that they are having. We go through our medical record numbers and everything else to make sure everything is correct, then we'll proceed.

Pre-operatively, the surgical technician assembles instruments and supplies needed for the case, sets up the case cart, and creates the sterile field within which the surgical team will perform the procedure. The circulating nurse meets with each patient in the holding room. Like the CRNA, the circulating nurse completes the surgical checklist, including confirmation of right patient and right surgery, and ensures that all the consent forms have been signed. Overall, the circulating nurse assist in any way needed to prepare the patient for surgery including insertion of the patient's Foley catheter, assisting the CRNA during induction of anesthesia, and prepping or scrubbing the surgical site. The circulating nurse also assists the surgeon in completing the timeout procedure just prior to the start of each case. The timeout assures that the team is set to perform the right surgery for the right patient.

Intra-operatively, the surgeon is in charge of making the decisions and directing the case. The surgeon does the integral part of the surgery and relies upon the physician assistant to close the wound as they are familiar with the surgeries and the surgeon's techniques. The surgeon often has a resident scrubbed in for the case. If the surgeon has a second room up and running the resident could potentially close the procedure in the first room as the surgeon exists to prepare for the next case in the second room.

Surgical technicians are scrubbed- in and work the case by handing the surgeon and other members of the surgical team supplies and instruments as they are needed throughout the case. Surgical assistants are specialized surgical technicians as they perform some of the same tasks as the physician assistant.

The circulating nurse operates non-sterile machinery such as cautery, suction, and/or tourniquets. If instruments are needed that aren't open already, they're accountable for assuring that they're there, and that they're accounted for.

Intra-operatively, Participant MD- 3 says, "The CRNAs are my eyes and ears for 100% of the case…If something occurs that is out of what the boundaries are, they must call me as it's very bad to guess during a case even if it's something minor that you don't think is important." CRNAs also take responsibility for making sure the atmosphere in the room and during the case remains calm even under emergent conditions.

Post-operatively, the team debrief presents the opportunity for team members to talk about what went well during the case and what needs to be improved. Participant CRNA- 1 says, "It is an open forum, sometimes with the primary surgeon, sometimes not...It's an open forum for honesty, like an amnesty box." The team talks about what happened during the case, what the team did to address the issue, and what might work better going forward.

Post-operatively, the surgical technician and the circulating nurse ensure that all instruments used throughout the procedure are accounted for and that there is a proper count or reconciliation of instruments and trays opened and used during the procedure. The surgical technician also gathers and disposes of all used supplies and organizes all used instruments for processing or cleaning. At the same time, the CRNA confers with the physician assistant regarding the amount of fluid loss to be recorded in the patient's medical record while the circulating nurse calls the post-anesthesia care unit (PACU) or recovery room to secure a bay for the patient and to ensure that the recovery room nurse

is ready to receive the patient. Everyone collaborates to prepare the patient for transport to the recovery room.

After documenting final details of the case in the electronic medical record, the CRNA and the circulating nurse transport the patient to the recovery room and use structured communication tools to report details of the patient's procedure and condition to the recovery room nurse.

Back in the OR, the surgical technician and the surgical assistant help the housekeeping staff prepare the operating room for the next case. The orthopedic team completes the room turnover process in 15 to 20 minutes or in about half the time as other teams.

Team members find that while decision making relies on a single expert operator there are times when the decision maker, usually the surgeon, needs input. Participant S-6 says, "Major decisions, as it relates to the actual propagation of the surgery…are made by the surgeon; decisions that refer to the patient's overall stability and medical issues are made by the anesthesiologist ultimately in a hierarchal fashion…There's some independent decision making and most of the decision making is collaborative."

Most often, decisions are made by the surgeon facilitating discussion and gathering input from team members. Participant CRNA- 1's experience in this regard is detailed below:

> Should there be a collaboration of decisions, it's led by the surgical team, primarily the surgeon. Should we need to discuss anything for patient safety with anesthesia, the decision is made by my attending in collaboration with me and the surgeon. During the case, should anything need to be voiced as far as patient

safety, I directly tell the surgeon and/or my anesthesiologist. We make decisions second by second.

Problems are addressed in much the same way as team members act proactively and collaboratively to identify and resolve problems before surgery or before something happens. Everyone is expected to speak up and everyone feels comfortable in doing so. The CTS learning board facilitates the process as team members gather around the board and discuss potential solutions in terms of what is in the best interest of the patient. Participant S- 6 says, "Each member of the team is expected to identify problems…Low level problems, or a problem that doesn't need a lot of input from the other team members, can be resolved independently; if it's more of a major problem, then it oftentimes is dealt with as a team depending on the nature of the problem."

During surgery, the team brainstorms to identify the best solution to the problem. Participant PA- 2 says, "Everybody can speak up if they know something is going wrong or if something is different than what was discussed during the huddle…The team tries to take care of issues as they arise by just talking about them."

Participant MD- 3 finds that teams get stronger under duress and that this is the time when a true team distinguishes itself. He recalls his experience in this regard below:

> When you have problems, it may not be the most pleasant interaction among everybody, but the team gets tighter, more tightly woven. They consolidate and say, 'Things didn't go well; here's what didn't go well; here's a way to fix it; if any of us can help it, we're not having another day like today, no matter what.' That's when the team gets stronger and that's what builds a team.

Team members find too that familiarity among and between team members facilitates problem solving and helps the team work through difficult situations and issues. Participant MD- 3 recalls a particular situation during surgery where the patient took an unexpected turn for the worse. He says, "Just because we had the right team, we've worked together before, and everybody knew each other's capabilities, we were in a really secure environment." The team was able to complete the surgery and move the patient safely to recovery. Similarly, Participant CRNA- 3's experience is that once team members work together long enough they come to know each other's position on certain issues and they work through the discussion. He says, "It's that team intuition…we kind of meld together…Team intuition helps to mitigate some of the stress and strain that arises when trying to negotiate and navigate varying perspectives and/or competing priorities like room temperature, for example."

Familiarity among and between team members not only facilities problem solving, but also produces efficiencies. Participant CRNA- 1 explains below:

> It is easier to communicate protocols and any changes in the surgical plan to only a few designated CRNAs as opposed to the entire group of nearly forty (40) CRNAs that could be assigned to Orthopedic Surgery at any given point in time. You begin to know the surgeon's preferences and anticipate their needs for specific surgeries; and you begin to form good team work with the other members of the team…Team members begin to know what you like and help you.

Participant CN- 4 shares the sentiment as it her experience that familiarity makes a difference. She says, "Just doing it for as long as I have and observing what's going on

and hearing the conversation, I can anticipate what will be needed as the case unfolds and have it available and ready without being asked."

Familiarity counts; yet, Participant MD- 3 cautions, "It can be a double edged sword." That is, the relationship can get in the way of passing along information and may lead to inappropriate or incorrect assumptions. He says, "Structured communication helps in such instances and it is far more important to have good training and to know each other's capabilities and verified expectations than it is to be friends."

While team members find the work rewarding, gratifying, and worthwhile, and enjoy being members of the team, there are challenges and difficulties. Participant MD-3 says, "It is hard when things don't work out because we didn't perform optimally, either as a team or individually." Participant CRNA- 3 says, Keeping up to the surgeons' standards may be difficult." And, Participant S- 6 says, "It's not always easy to build unity." Still other members of the team find it frustrating when meetings overlap and they are unable to attend the team briefing. Participant CRNA- 1 says, "I'm a part of the team, but I don't always get to see and hear all the feedback that is shared."

Team members find that while the goal is to have the same team members together for the entire day in their assigned OR, the dynamics of the surgical environment are such that this is not always possible. Rather, team members are reassigned to other ORs and cases that they are less familiar with and that such changes produce dissatisfaction, inefficiencies, and increased risk of infection for patients. Team members observe that getting pulled from their regular assignment to work elsewhere is difficult even when being replaced by another member of the Orthopedic Surgery team as team members know their assigned surgeon and as such can do the case with more

ease and speed than anyone else. Participant ST- 6 says, " It is difficult getting pulled to another area or into something that I am not real familiar with…I am more familiar with the people in Orthopedic Surgery…We know what each other is thinking and there is very little guess work." While Participant S- 6 says, "Revolving staff produces a lot of interactions," Participant MD- 3 asserts, "This on-demand model we have now in the operating room is a disaster for the teams." He explains below:

> We used to, in anesthesia, have a little more sub-specialization among the CRNAs and anesthesiologists. Now, because we've increased the volume so much and not increased our staff to go along with it, we have sort of a just-in-time inventory system where they want all of us to be members of all the teams. So, we don't have solid teams anymore.

Participant MD- 3 also finds that the surgical practice lacks standard operating procedures that address behavioral issues, and that reliable delivery of care where patients get everything they need and nothing they don't need, every time, is 30 to 40% of target. Participant MD- 3 feels that challenges specific to staffing, standard operating procedures, and reliable delivery of care get in the way of teams truly exceling as high performance teams. His experience too is that briefings and debriefings are an investment in time and that not everyone is committed to the process because they have not been exposed to what is possible when a high performance team truly excels. He says, "At a brief, if you have a team behind you and there's something passed at the brief, you have to pass it down the line…Team members think there is some other meeting where the MD gets that information." He feels that many of the challenges that

get in the way of teams exceling can be overcome with a commitment to training. He says:

> I don't think you're going to get it just with briefing and debriefing…It's not going to work unless we provide an extra hour in the morning for training, representing an actual commitment to training and improving teamwork. It's such a key, important concept that we just don't see in medicine in general.

Participant CRNA- 3 observers that while computers are helpful in terms of having immediately accessible patient care information and documentation, the positioning of the computer relative to the patient presents a safety risk. He explains below:

> The patient in is in front of you and the computer is 180 degrees behind you. When you swing around to do work on the computer the patient is at your back. I think it's just poor design. It just goes against the grain where the patient is your focus. Now is the patient my focus 100% of the time? No. It's the computer. Documentation has to be done, wrapped-up, finished by the end of the case and that results in more pressure. So, attention is probably more off the patient…It's disturbing.

Leadership on boarding is an essential component of any change effort. Participant MD- 3 says, "If you don't have them squarely on board with what's at stake they will not spend the time."

Team members find that the orthopedic surgeons are different from other surgeons they have known in that they respect everyone on team and are not afraid to let their personal feelings show regarding patients. Team members also observe that their

direct supervisor is engaged and accessible and right there alongside them leading the team. Participant ST- 4 says, “There is nothing that he would ask of you that he is not willing to do himself.”

Structural Composite Description

A culture of collaboration enables team performance in an ever-changing complex, and highly interactive surgical environment. Certain aspects of the culture make it easy for team members to perform in the midst of such complexity. Most noteworthy, team members find that they share a common goal, an over-arching purpose; *the needs of the patient come first.*

Team members find too that teamwork is a longstanding organizational value that is reinforced by organizational leaders and among and between team members. Team members appreciate each other and recognize each other’s contributions to the whole. They help and support each other irrespective of roles. Team members back each other up to make sure the needs of the patient are addressed.

It’s a close knit team as team members think they are a team. They take care of each other and watch out for each other. Team members are not only colleagues, but also family and family. New team members are welcomed and treated like part of the group without hesitation.

Team members prefer being a part of a team. While the work is gratifying, worthwhile, and rewarding, interacting with others makes the work fun and enjoyable. Team members are easy to get along with, hardworking, selfless, cooperative, meticulous, professional, and experts at what they do. Team members take initiative and

they are good communicators. They pay attention to detail, anticipate problems and work together to resolve them. Team members not only get along well with each other, but also with members of other teams.

The work is more than just a job as team members are proud to be a part of team and they take great pride in their work. They are grateful to have the opportunity to serve and are humbled by the experience. Team members feel that it is an honor to be a part of the team.

Team members go above and beyond to ensure the best possible outcome for each patient. Team members make personal sacrifices, accept the good and the bad, and set aside their egos to do what is in the best interest of the patient.

The day starts early for members of the Orthopedic Surgery team as team members' individual and collective responsibilities extend to all phases of the surgical process. Doing the right things the right way every time is the norm as the goal throughout each phase of the surgical process is to keep the patient and the team safe. Team briefings, timeouts, instrument and supply reconciliation processes, hand-off communication tools, team debriefs, checklists, briefing cards and sheets, and structured communications support and facilitate the team's safety goals and efforts to achieve the best outcome possible for each patient. Similarly, paying attention, speaking up, conferring with fellow team members, and seeking mutual agreement and /or confirmation are ever present safety behaviors among and between team members.

Team members know their roles and the roles of their respective team members. They are familiar with each other's routines and thought processes. As such, there is very little guess work. Team members know what comes next and can anticipant what

will be needed and when without prompting. In this way, everything flows as team members go about their respective and sometimes overlapping or redundant tasks and responsibilities.

Tasks are at once sequentially and simultaneously executed as in the pre-operative phase of the surgical process. For example, while the CRNA is making sure machines and drugs are safe and ready to go for the procedure, the anesthesiologist is visiting with the patient and the surgeon to ensure mutual understanding about the anesthesia plan for the case. At the same time, the circulating nurse is attending to final details specific to each patient including surgical consents, as the surgeon visits the patient to mark the surgical site and the physician assistant completes post- operative orders. In the meantime, the surgical technician and the surgical assistant are in the operating room opening trays and supplies and setting up the sterile field. Thereafter the team assembles for the team briefing.

Decision making most often is the purview of the surgeon. There are times when the surgeon needs input from team members and when the surgeon defers to the expertise of others. Surgical decisions rest with the surgeon while medical decisions and those specific to patient stability rest with the anesthesiologist. While there is some independent decision making, overall, the process is one of collaboration among and between team members.

Team members anticipate problems and work together to resolve them. Team members are expected to speak-up if they see something that might be problematic or if they have information that the team needs to know. The environment is such that team members feel comfortable speaking-up. The CTS learning board facilitates the process

as team members gather around the board and discuss potential solutions in terms of what is in the best interest of the patient.

Team members' find that familiarity among and between team members facilitates problem solving and helps the team work through emergent conditions and difficult issues. Familiarity among and between team members also results in efficiencies as time together affords the opportunity for team members to learn each other routines, preferences, and expectations. As such, team members can anticipate what comes next and act accordingly without prompting.

Familiarity counts; yet, relationships among and between team members can impede optimal patient care when assumptions are made or information is withheld based on relationships among and between team members. Training may prove to be far more important than familiarity in terms of team performance.

While being a member of the Orthopedic Surgery team is satisfying, rewarding, and worthwhile, difficulties and challenges exist. More specifically, it is hard when things do not work out as planned due to sub-optimal team or individual performance. Further, not all staff are committed to the team brief and debrief, and the opportunity exists to enhance standard operating procedures that address behavior. Additionally, it can be difficult keeping up to surgeons' standards. Similarly, it is sometimes hard to build consensus.

Operational challenges include operating room layout and design specific to the placement of the computer relative to the patient and the CRNA; frequent calls to the anesthesiologist for non-emergent communications; and the lack of solid or intact surgical teams as team members are often times reassigned to other teams. Unintended

consequences of pulling team members to cover assignments that they are less familiar with include job dissatisfaction, inefficiencies in terms of longer procedure and room turnover times, as well as delayed case start times, and increased risk of surgical infections and surgical errors.

Team members find that orthopedic surgeons are different from other surgeons they have known in that they respect everyone on team and are not afraid to let their personal feelings show regarding patients. Team members also observe that their direct supervisor is engaged and accessible and that leadership buy-in is an essential component of any change effort.

Quantitative Component

Observational Teamwork Assessment for Surgery Results

The Observational Teamwork Assessment for Surgery (OTAS) instrument was used to observe and assess teamwork performance in this study and is presented in Appendix D. OTAS is a validated instrument and is used throughout the United Kingdom. OTAS scores for each of the six surgical teams participating in this study, as well as the overall teamwork score for the Department of Orthopedic Surgery are displayed in Appendices E and F respectively. Quantitative results including descriptive statistics are displayed below:

Descriptive Statistics

Table 4.7 and Figure 4.1 depict OTAS scores for each team's observation.

Table 4.7. *Score of Team Observations*

	Team 1	Team 2	Team 3	Team4	Team 5	Team 6
Obs 1	5.83	5.69	5.73	5.86	5.72	5.16
Obs 2	5.74	5.63	5.86	5.84	5.60	5.43

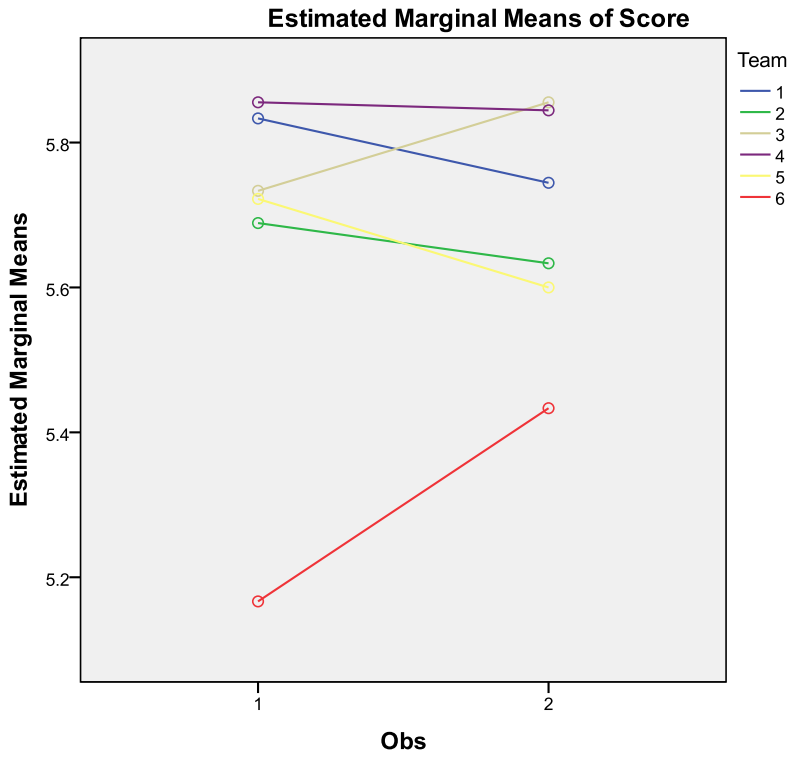

Figure 4.1. Profile Plot of Team Observations

The following descriptive statistics (Table 4.8) represent OTAS team performance scores for all six teams and sub-teams and during the pre-operative, intra-

operative, and post-operative phases of the surgical process, and specific to the five behavioral dimensions of surgical team performance.

Table 4.8. *Descriptive Statistics*

Descriptive Statistics Dependent Variable:Score					
OpStage	SubTeam	Behavior	Mean	SD	N
1Pre-op	Anesth	Comm	5.583	.5573	12
		Coop	5.875	.2261	12
		Coord	5.833	.3257	12
		Leaders	5.917	.1946	12
		Mont	5.917	.1946	12
		Total	5.825	.3423	60
	Nursing	Comm	5.417	.7017	12
		Coop	5.833	.3257	12
		Coord	5.625	.5276	12
		Leaders	5.542	.6557	12
		Mont	5.458	.7525	12
		Total	5.575	.6094	60
	Surgical	Comm	5.917	.1946	12
		Coop	5.583	.6339	12
		Coord	5.917	.1946	12
		Leaders	5.792	.4502	12
		Mont	5.917	.1946	12
		Total	5.825	.3887	60
	Total	Comm	5.639	.5556	36
		Coop	5.764	.4389	36
		Coord	5.792	.3850	36
		Leaders	5.750	.4855	36
		Mont	5.764	.4998	36
		Total	5.742	.4741	180

Continues

Descriptive Statistics Dependent Variable:Score					
OpStage	SubTeam	Behavior	Mean	SD	N
2Intra-op	Anesth	Comm	4.708	.4981	12
		Coop	5.875	.2261	12
		Coord	5.708	.4981	12
		Leaders	4.125	.3108	12
		Mont	5.917	.1946	12
	Nursing	Comm	5.792	.3965	12
		Coop	5.708	.4981	12
		Coord	5.708	.5823	12
		Leaders	5.292	.5418	12
		Mont	5.792	.4502	12
		Total	5.658	.5166	60
	Surgical	Comm	5.875	.3108	12
		Coop	5.917	.1946	12
		Coord	5.917	.1946	12
		Leaders	5.875	.2261	12
		Mont	5.792	.3965	12
		Total	5.875	.2704	60
	Total	Comm	5.458	.6695	36
		Coop	5.833	.3381	36
		Coord	5.778	.4543	36
		Leaders	5.097	.8265	36
		Mont	5.833	.3586	36
		Total	5.600	.6262	180

Continues

Descriptive Statistics Dependent Variable:Score					
OpStage	SubTeam	Behavior	Mean	SD	N
3Post-op	Anesth	Comm	5.875	.2261	12
		Coop	5.792	.3343	12
		Coord	5.792	.3343	12
		Leaders	5.792	.3343	12
		Mont	5.875	.2261	12
		Total	5.825	.2886	60
	Nursing	Comm	6.000	.0000	12
		Coop	5.833	.3257	12
		Coord	5.917	.1946	12
		Leaders	5.000	.0000	12
		Mont	5.875	.3108	12
		Total	5.725	.4261	60
	Surgical	Comm	5.375	.4827	12
		Coop	5.917	.1946	12
		Coord	5.750	.3989	12
		Leaders	5.417	.5149	12
		Mont	5.083	.2887	12
		Total	5.508	.4827	60
	Total	Comm	5.750	.4053	36
		Coop	5.847	.2883	36
		Coord	5.819	.3197	36
		Leaders	5.403	.4754	36
		Mont	5.611	.4646	36
		Total	5.686	.4262	180

Continues

Descriptive Statistics Dependent Variable:Score					
OpStage	SubTeam	Behavior	Mean	SD	N
Total	Anesth	Comm	5.389	.6667	36
		Coop	5.847	.2624	36
		Coord	5.778	.3863	36
		Leaders	5.278	.8738	36
		Mont	5.903	.2007	36
		Total	5.639	.5934	180
	Nursing	Comm	5.736	.5139	36
		Coop	5.792	.3850	36
		Coord	5.750	.4706	36
		Leaders	5.278	.5270	36
		Mont	5.708	.5526	36
		Total	5.653	.5235	180
	Surgical	Comm	5.722	.4216	36
		Coop	5.806	.4188	36
		Coord	5.861	.2831	36
		Leaders	5.694	.4516	36
		Mont	5.597	.4754	36
		Total	5.736	.4209	180
	Total	Comm	5.616	.5621	108
		Coop	5.815	.3591	108
		Coord	5.796	.3869	108
		Leaders	5.417	.6680	108
		Mont	5.736	.4506	108
		Total	5.676	.5183	540

Analysis of Variance

The Analysis of Variance (ANOVA) is presented next. Tukey post hoc tests were performed for pairwise comparisons. Figure 4.2 illustrate the ANOVA decision tree deployed in this analysis. The first step in this process entailed reviewing all six teams' scores along each behavioral dimension.

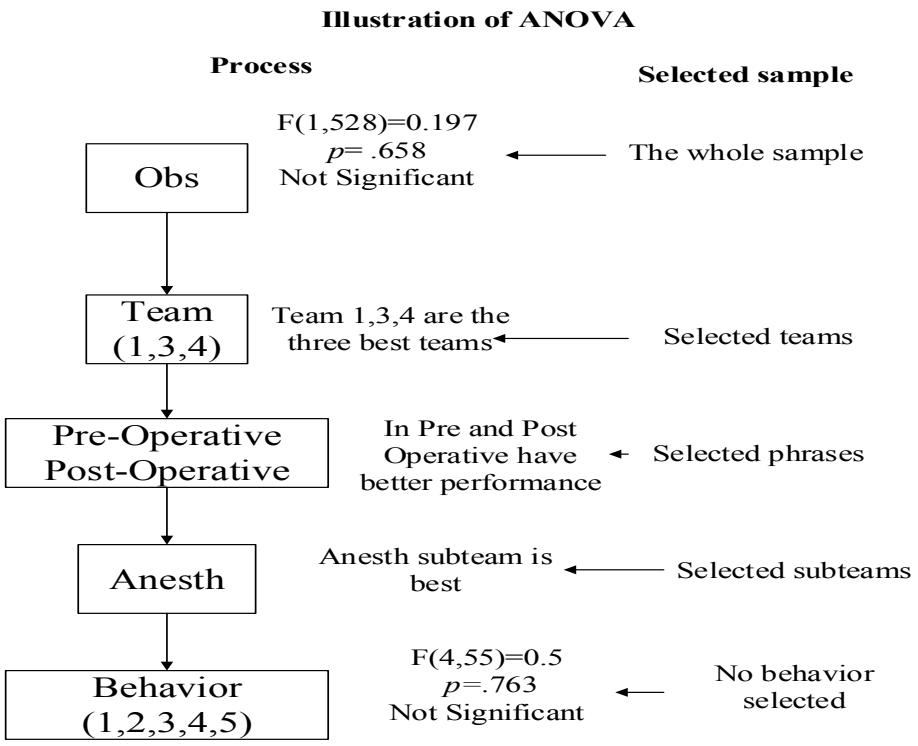

Figure 4.2. Illustration of the ANOVA Decisions Tree

Table 4.9 shows the between subject effects. Results reveal no significant difference in terms of team scores and team performance for each of the two team observations.

Table 4.9. *Two-way Nonparametric ANOVA for Between Subject Effects*

Tests of Between-Subjects Effects

Dependent Variable: Score

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	20.420[a]	11	1.856	7.881	.000
Intercept	17396.713	1	17396.713	73857.929	.000
Team	17.898	5	3.580	15.197	.000
Obs	**.046**	**1**	**.046**	**.197**	**.658**
Team * Obs	**2.476**	**5**	**.495**	**2.102**	**.064**
Error	124.367	528	.236		
Total	17541.500	540			
Corrected Total	144.787	539			

a. R Squared = .141 (Adjusted R Squared = .123)

The Tukey post hoc test was used to uncover any differences among the teams. Table 4.10 shows there are no significant differences in the means among teams 1, 2, 3 and 5 (subset 2). We also find there is no significant difference between teams 1, 3 and 4 at the significant level of .05 (subset 3). However, there is a significant difference found for team 6 (subset 1) and the other five teams. Further, the performance of teams 1, 3and 4 are the best among all six teams.

Table 4.10. *Tukey Pairwise Comparison for Teams and Behaviors*

Score	N	Subset		
Tukey HSD[a,b]				
Team		**1**	**2**	**3**
6	9	5.300		
2	9		5.661	
5	9		5.661	
1	9		5.789	5.789
3	9		5.794	5.794
4	9			5.850
Sig.		1.00	0.445	0.960

Means for groups in homogeneous subsets are displayed. Based on observed means.
The error term is Mean Square (Error) = .238.
a. Uses Harmonic Mean Sample Size = 90.000.
b. Alpha = .05.

As the best performing teams based on OTAS scores, teams 1, 3 and 4 were selected for further analysis. More specifically, a three-way non-parametric ANOVA (3*3*5).method was used for the factors of sub-teams, operating phases and behaviors. Table 4.11 shows that there is a significant difference for all factors with the exception of the sub-teams factor. The sub-teams are grouped into three categories: surgical, nursing, and anesthesia. In addition, there are significant differences for all interactions.

Table 4.11. *Three-way ANOVA for Sub-Team, Operating Stage and Behavioral Factors*

Tests of Between-Subjects Effects

Dependent Variable: Score

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	37.033[a]	44	.842	9.548	.000
Intercept	9117.633	1	9117.633	103435.336	.000
Behavior	**7.524**	**4**	**1.881**	**21.339**	**.000**
OpStage	**.556**	**2**	**.278**	**3.151**	**.045**
SubTeam	.206	2	.103	1.166	.313
Behavior * OpStage	**4.731**	**8**	**.591**	**6.710**	**.000**
Behavior * SubTeam	**2.804**	**8**	**.350**	**3.976**	**.000**
OpStage * SubTeam	**9.122**	**4**	**2.281**	**25.872**	**.000**
Behavior * OpStage * SubTeam	**12.091**	**16**	**.756**	**8.573**	**.000**
Error	19.833	225	.088		
Total	9174.500	270			
Corrected Total	56.867	269			

a. R Squared = .651 (Adjusted R Squared = .583)

Focusing on the three phases of the surgical process, Table 4.12 (Tukey post hoc) indicates no differences between intra-op and post-op phases; similarly, no differences are present when comparing pre-op and post-op phases. However, there is a significant difference between the means for the pre-op and intra-op phases.

Table 4.12. *Tukey Post Hoc Analysis of Operating Stages*

Score			
Tukey HSD			
		Subset	
OpStage	**N**	**1**	**2**
2Intra-op	90	5.756	
3Post-op	90	5.811	5.811
1Pre-op	90		5.867
Sig.		0.422	0.422

Means for groups in homogeneous subsets are displayed.
The error term is Mean Square (Error) = .088.

Comparisons of the mean behavior scores for teams 1, 3 and 4 in the pre-and post-op phases of the surgical process are presented in the next section of the analysis. Table 4.13 shows there is a significant difference in the means for each sub-team, as well as in the behavioral means. Further, there is an interaction effect between behavioral and sub-teams' means.

Table 4.13. *ANOVA for Sub-Team and Behaviors Factors*

Tests of Between-Subjects Effects					
Dependent Variable: Score					
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Corrected Model	6.619[a]	14	.473	3.767	.000
Intercept	6136.672	1	6136.672	48895.819	.000
Behavior	2.425	4	.606	4.830	**.001**
SubTeam	**1.769**	**2**	**.885**	**7.049**	**.001**
Behavior * SubTeam	2.425	8	.303	2.415	**.017**
Error	20.708	165	.126		
Total	6164.000	180			
Corrected Total	27.328	179			

a. R Squared = .242 (Adjusted R Squared = .178)

Table 4.14 displays Tukey post hoc results for each sub-team. Results indicate significant difference in the performance of the anesthesia sub-team: the anesthesia sub-

team performs better than the surgical and nursing sub-teams. As such, the anesthesia sub-team is selected for the next level of analysis.

Table 4.14. *Tukey Comparison for Sub-Team Factors*

Tukey HSD[a,b]			
		Subset	
Sub-Team	**N**	**1**	**2**
Surgical	60	5.742	
Nursing	60	5.800	
Anesth	60		5.975
Sig.		.675	1.000

Means for groups in homogeneous subsets are displayed. Based on observed means.
The error term is Mean Square (Error) = .143.

Table 4.15 displays the ANOVA for teams 1, 3 and 4 during the pre-op and post-op phases, and for the anesthesia sub-team. No significant difference is present. Therefore, post hoc tests were not conducted.

Table 4.15. *ANOVA for Anesthesia Sub-Team (Teams 1, 3 and 4)*

Tests of Between-Subjects Effects

Dependent Variable: Score

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	.025[a]	4	.006	.500	.736
Intercept	2142.037	1	2142.037	171363.000	.000
Behavior	.025	4	.006	.500	.736
Error	.687	55	.012		
Total	2142.750	60			
Corrected Total	.712	59			

a. R Squared = .035 (Adjusted R Squared = -.035)

The final next section presents the results of the mean for behaviors across sub-teams and for all three surgical teams (Table 4.16).

Table 4.16. *Mean Scores for Teamwork Related Behaviors Across Operating Stages and Sub-Teams*

Phase	Communication	Coordination	Leadership	Monitoring	Cooperation
Anesthesia					
…Preop	5.58±0,56	5.83±0.33	5.92±0.20	5.92±020	5.88±0.23
…Intraop	4.71±0.50	5.71±0.50	4.13±0.31	5.92±020	5.88±0.23
…Postop	5.88±0.23	5.79±0.33	5.79±0.33	5.88±0.23	5.79±0.33
Nurses					
Preop	5.42±0.70	5.63±0.53	5.54±0.66	5.46±0.75	5.83±0.33
Intraop	5.79±0.40	5.71±0.58	5.29±0.54	5.79±0.45	5.71±0.50
Postop	6.00±0.00	5.92±0.20	5.00±0.00	5.88±0.31	5.83±0.33
Surgeons					
Preop	5.92±0.20	5.92±020	5.79±0.45	5.92±0.20	5.58±0.63
Intraop	5.88±0.31	5.92±020	5.88±0.23	5.79±0.40	5.92±0.20
Postop	5.37±0.48	5.75±0.40	5.42±0.52	5.08±0.29	5.92±0.20

CHAPTER 5: CONCLUSIONS, INTERPRETATIONS, and RECOMMENDATIONS

Interpretations and Findings

Chapter 5 highlights the relationship between study themes introduced in Chapter 4 and the conceptual framework underpinning this case study and presented in Chapter 1. In addition, conclusions and sub-conclusions are presented as well as implications of this study for practice and research. First, 14 themes emerged from the analysis and synthesis of interview and observational data and are delineated below.

Emergent Themes

Theme 1: Team members exhibit discernable safety behaviors that reduce the likelihood of preventable errors.

Theme 2*:* Team leaders (surgeons) exhibit discernable safety behaviors that reduce the likelihood of preventable errors.

Theme 3: Team members-behave heedfully by noticing, paying attention, taking care, attending to, concentrating, and thinking about what they are doing and what comes next.

Theme 4*:* Patterns of interactions among and between team members are coordinated, interrelated, sequential, and timed.

Theme 5: Intact teams promote familiarity among and between team members and enhance team safety, efficiency, effectiveness, and overall team performance.

Theme 6: Social time together outside of work enhances the work time together and strengthens relationships among and between team members**.**

Theme 7: Protocols, standard operating procedures, checks and double checks, redundant processes, and structured hand-off communication tools help keep patients and the team safe.

Theme 8: Briefs, debriefs, and meetings at the Commitment to Safety learning board are manifestations of the learning system and the learning environment wherein the focus is on improvement and engagement and the leader is the guardian of the learning system.

Theme 9: Team members possess personal characteristics and attributes that are well- suited to the fast-paced, high-energy, high risks, high stakes, demanding, and stressful Orthopedic Surgery environment.

Theme 10: Team members prefer working with others and they value and derive satisfaction from the team experience.

Theme 11*:* Being a member of the team fulfills team members' basic need to belong.

Theme 12: Team members share a common purpose, mind-set, and overarching goal- the needs of the patient come first.

Theme 13: The collaborative environment makes it easy to be a member of the team and enables team performance.

Theme 14: Internal and external challenges make the work and the work environment more difficult and distract from the team's capacity to optimize team and individual teamwork performance and to keep patients and the team safe.

The aforementioned themes point to the theoretical framework portrayed in Chapter 1 and depicted in Figure 5.1 below. More specifically, team members and team leaders exhibit specific, discernable teamwork behaviors (task- related collaborative behaviors, team adjustment behaviors, and preparation of work accomplishment behaviors) coupled with unmeasured processes of collective mindfulness (patterns of mindful /heedful interrelating) that hold important implications for OR quality and patient safety in terms of the incidence of preventable medical errors.

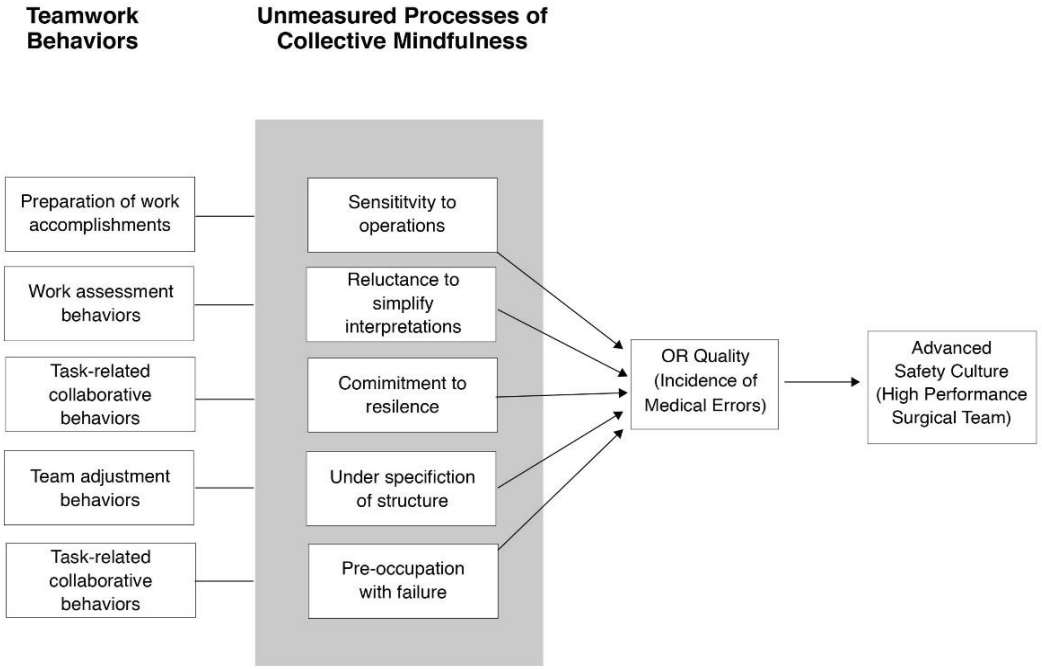

Figure 5.1. Conceptual Framework

Conclusions

As noted above, effective surgical teams exhibit patterns of behavior that reflect traditional teamwork behaviors; however, these patterns are integrated and embedded with less observable mindfulness patterns that enable the achievement of traditional social structures and enhance team capacity and performance. This conclusion is based on three sub- conclusions as presented and discussed below.

Sub-conclusion 1: Effective surgical teams exhibit traditional teamwork behavior patterns specific to task-related collaborative behaviors, team adjustment behaviors, and preparation of work accomplishment behaviors as formulated by Rousseau, Aube, and Savoie (2006) and presented in Chapter 1. First, task-related collaborative behaviors include cooperation, coordination, and information exchange. These behavioral dimensions of teamwork are reflected in Themes 8, 11, and 13 as outlined above and presented in Chapter 4. For example, Theme 8 highlights the premium placed on communication and information exchange among and between team members in the form of team briefs, debriefs, and meetings at the CTS learning board. Similarly, Theme 11 details the camaraderie and sense of belonging that exists among team members, thus enabling cooperative interactions among and between team members. Finally, we glean from theme 13 that surgical teamwork requires significant coordination and collaboration among and between team members. Team members come together when needed to complete a task and then return to their respective roles. Team members pull together to get the job done irrespective of formal roles and job descriptions.

Second, team adjustment behaviors include back-up behaviors, intra-team coaching, collaborative problem solving, and team practice innovation. Themes 5, 6, 9, and 10 speak to these behavioral dimensions of team adjustment behaviors. For example, Theme 5 highlights familiarity among team members that arises from time together on the team. Team members not only become expert in their respective roles, but also come to know each other's roles, responsibilities, and routines to the extent that they can provide seamless back-up and nearly "read each other's minds." Theme 6 notes that social time together outside of the work environment enhances working relationships and positions team members to support each other, help each other, and coach each other in times of personal or interpersonal distress. Similarly, Themes 9 and 10 address characteristics, attributes, and preferences of team members that enable collaborative problem solving and team practice innovations. For example, team members' prefer to work with others and value the team experience. As Participant S- 6 notes, "There is synergy when multiple people come together to get the work done." Team members share responsibility for patient outcomes. They believe that they accomplish more together and in a safe and efficient manner than they could on their own. Being a member of the team means making sure the patient is taken care of and getting everything done even if it is not their job. They support and help each other, learn from each other, and they watch out for each other. They make personal sacrifices for each other and the team. They recognize, value, and appreciate the unique contributions of each member of the team and believe that no one on the team is any more or less important than anyone else. Team members feel like they are part of a team and the camaraderie among them is palpable.

Finally, preparation of work accomplishments refers to behavioral dimensions of teamwork specific to team mission analysis, goal specification, and planning. Theme 12 particularly illuminates these behavioral dimensions of teamwork among Orthopedic Surgery team members in that the organization's mission and values shape and guide individual and team behavior, and overall teamwork performance. The organization's primary value, *the needs of the patient come first,* resonates with individual team members and inspires and guides individual and team performance. Team members believe that the only interest to be considered is the best interest of the patient, and their belief and shared mind-set in this regard keeps them on track and focused on acting in the best interest of the patient. Goals are set and expectations are clearly defined and communicated in terms of achieving the best outcomes possible for patients. Briefs ensure that team members are well informed and prepared to achieve stated goals and objectives specific to each patient, while protocols and standard operating procedures ensure that all steps in the process are fully executed as intended.

Sub-conclusion 2: Effective surgical teams possess unmeasured processes of collective mindfulness that enable and enhance team capacity and performance. As outlined in Chapter 2, five cognitive processes underpin and create the conditions for collective mindfulness: sensitivity to operations; reluctance to simplify interpretations; commitment to resilience; under specification of structure; and pre-occupation with failures (Weick & Sutcliff, 2001; Weick, Sutcliffe, & Obstfeld, 1999). First, sensitivity to operations refers to the extent to which team members are aware of and attuned to their surroundings and as such, remain alert to incoming information and respond accordingly. For example, intra-operatively the circulating nurse continuously scans the

environment maintaining a panoramic view of what is happening, anticipating what will be needed and when and, importantly, alert to anything that may signal trouble or the potential for concern. Similarly, again intra-operatively, the CRNA is in continuous communication with the anesthesiologist and immediately alerts the surgical and nursing teams of any changes in the patient's physiological condition. Team members are attuned to what is going on around them at all times and as such, exhibit advanced situational awareness skills.

Second, reluctance to simplify interpretations entails inviting feedback and suggestions from varying points of views, identifying all possible scenarios in advance, and guarding against assumptive behaviors. For example, while Orthopedic Surgery is protocol intense and team members have performed the same procedures thousands of times, they nonetheless recognize that anything can happen at any time and they have to be ready. As such, team members brief prior to the start of each case to identify all possible scenarios and to develop contingency plans. Further, throughout each phase of the surgical process, team members feel comfortable speaking up to offer suggestions and alternative points of view. Moreover, even seasoned clinicians, upon joining the Orthopedic Surgery team, undergo extension training and orientation prior to staffing a case signaling a reluctance to assume competency and preparedness.

Third, commitment to resilience refers to the extent to which team members detect, contain, and bounce-back from surprises and/or errors. In the surgical environment surprises are inevitable; for example, float staff joining the team, delays due to complicated anesthesia blocks, and incomplete communication transfers between

the surgical sub-team and the anesthesia sub-team. Yet, in the face of surprises or errors, team members maintain their composure, improvise, adapt, re-group, and start again.

Fourth, under specification of structure or deference to expertise arises when team members, particularly when time is of the essence, defer to the expert knowledge of others. For example, while the surgeon is the ultimate responsible party, intra-operatively, the surgeon defers to the expert knowledge of the anesthesiologist to address any changes in the patient's physiological condition.

Finally, pre-occupation with failures points to the regard with which team members treat errors and near-misses, including reporting of such events. Among Orthopedic Surgery team members this means not only a pre-occupation with failure, but also and importantly a pre-occupation with error prevention. For example, the quantity and quality of briefs and debriefs are tracked and monitored as are items identified and resolved in CTS meetings at the learning board. In addition, adherence to time-outs and the pre-procedure pause is strictly enforced. Similarly, white boards posted in the OR displaying patient-specific and team member information are complete and up-to-date for each case. And, structured hand-off communication tools facilitate complete and accurate information transfers between OR staff and recovery room staff.

Moreover, the Orthopedic Surgery team was the first surgical practice within the organization to embrace CTS focused on team member engagement, learning, and continuous improvement. In this way, team members are pre-disposed to scrutinize failures, large and small. For example, increases in post-operative surgical infections or decreases in the patient's core temperature upon transfer from the OR to the recovery room.

The aforementioned cognitive processes (sensitivity to operations, reluctance to simplify interpretations, commitment to resilience, under specification of structure, and pre-occupation with failures) underpin collective mind and represent mental functioning that embraces engagement, improvement, and continuous learning all of which come together in the form of the learning system and learning environment that enables team capacity and team performance and as reflected in Themes 1,2,3,8, 13 and 14.

Sub-conclusion 3: Mindfulness is a prerequisite to safety behaviors exhibited by team members in the surgical setting. Once established and enacted, processes of collective mindfulness among and between team members become integrated and embedded in patterns of behavior that reflect traditional teamwork behaviors. We find then that the relationship between traditional teamwork behaviors and unmeasured processes of collective mindfulness is one of order. That is, mindfulness precedes and enables the formation of traditional social structures, adds to team capacity, and elevates team performance. Overtime, traditional teamwork behavioral patterns are integrated and embedded with mindfulness processes. As such, the relationship between unmeasured processes of collective mindfulness and traditional teamwork behaviors is characterized as dynamic interplay wherein each continuously shapes, informs, and reinforces the other. This relationship is depicted in Figure 5.2 below.

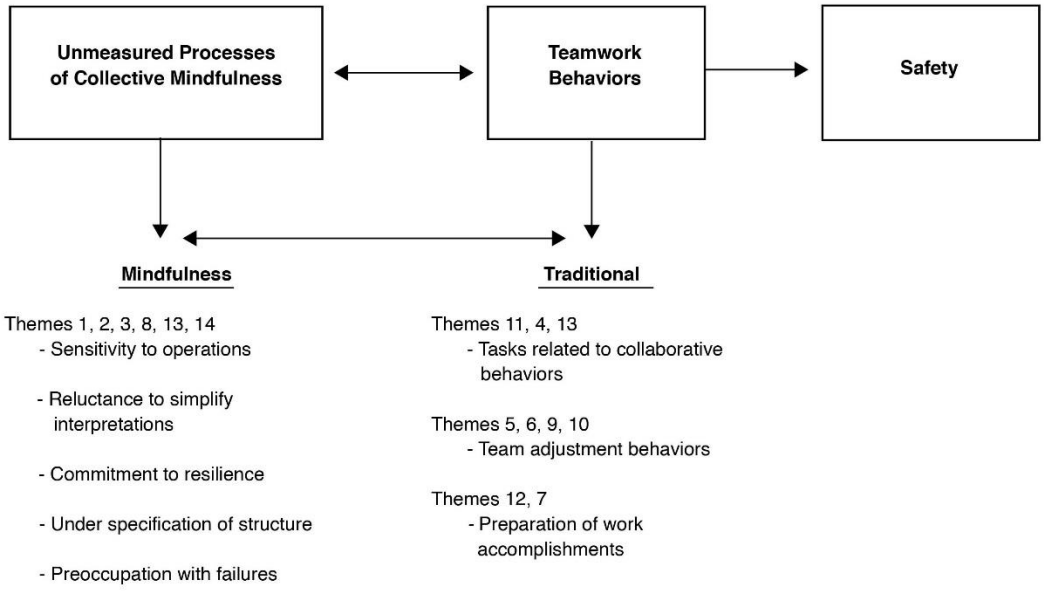

Figure 5.2. New Conceptual Framework

Contributions of This Study

Contributions of this study to theory, research, and practice are presented and discussed. First, contributions to theory and research are presented followed by implications of this study for practice.

This study contributes to theory in two ways. First, while Weick, Sutcliffe, and Obstfeld (1999) and Weick and Sutcliffe (2001) position collective mind and its constituent processes at the system or organizational level of analysis, this study finds that teamwork is a socially constructed phenomenon wherein team members acting singularly or as a group construct their reality based on socio-cultural norms and their own experiences (Berger & Luckmann, 1966). As Dewey (1925) posited, it is through collective or group activity that mind itself emerges. Hence, mind is a social

phenomenon. This point of view makes it plausible that shared biography, experience, and belief in what has been socially constructed manifest in collective thought or mind about the reality so constructed. In this way, this study extends and operationalizes the concept of collective mindfulness and its constituent processes to the group level of analysis envisioned by Weick and Roberts'(1993) in their original conceptualization of collective mind and group performance and by Walsh's (1995) position on group-level knowledge structures and the construct of social cognition.

Second, while Weick and Sutcliffe (2001) suggest "order" in pointing to the underlying style of mental functioning that exists in HROs, this study adds to existing theoretical perspectives in this regard as it finds that mindfulness is a pre-requisite to safety behaviors observed among and between surgical team members. That is, once enacted, these processes of collective mindfulness become integrated and embedded in patterns of behavior that reflect traditional teamwork behaviors. Thus, the relationship between processes of collective mindfulness and traditional teamwork behaviors is characterized as dynamic interplay as one continuously informs, shapes, and reinforces the other.

In addition to the above, this study offers three contributions to research. First, the inquiry takes the form of a case study wherein participant interviews were guided by observational data to present a more dynamic and nuanced understanding of teamwork behavioral patterns exhibited by high performance surgical teams. This approach is significant in that traditional phenomenological data analysis techniques were used in combination with a validated observational teamwork assessment tool for surgery. Second, this study was situated in the surgical environment where the incidence of

preventable errors is high. Third, this study presented the opportunity for theory and research specific to surgical team development to be informed by the voices and experiences of surgical team members.

Finally, this study holds four implications for practice. First, given the criticality of mindfulness coupled with traditional teamwork behaviors, the question of nature versus nurture arises in terms of behaviors that add to team capacity. More specifically, can advanced teamwork safety behaviors be taught or are they inherent to the individual and /or group? To answer the question, we first note that behaviors are distinct from individual and team attributes and characteristics in that behavior can be observed and measured (Rousseau, Aube, and Savoie, 2006). Observable behaviors include not only traditional teamwork behaviors, but also processes of collective mindfulness. For example, with respect to the latter, one measure of sensitivity to operations focuses on exemplary behaviors specific to situational awareness. It follows then that if behaviors are observable, they can be taught and hence, the emphasis on training, improvement, and continuous leaning that we find in high performance teams.

Second, while the Orthopedic Surgery practice is protocol driven, there is a lack of standard operating procedures that address behavioral issues. With this in mind and given the team's positive experience with OTAS, there is an opportunity to train surgical team members on the use of OTAS and to deploy the instrument as a further structure and manifestation of the learning system and learning environment. Further, the instrument could be used in tandem with existing training modalities including the Simulation Center and serve as a mechanism to: (a) provide immediate and substantive feedback; and (b) measure the impact of advances in the learning system and learning

environment. Finally, this study holds important implications for staff recruitment, selection, and retention given the elucidation of safety behaviors and elaboration of the relationship between processes of collective mindfulness and traditional teamwork behaviors. For example, screening and selection processes might include tools that assess the extent to which prospective team members possess and exhibit advanced safety behaviors. Similarly, performance appraisals and evaluations for existing staff might include a component specific to an assessment of mindfulness.

Suggestions for Future Research

Within Orthopedic Surgery, the opportunity exists to revisit the team as a year has passed since this study was conducted. During this time, new leaders have emerged at the department and unit levels. A second visit would present the opportunity to explore the impact of changes in on team performance.

Further, deployment of OTAS at this research site or elsewhere presents the opportunity to continually update and validate the instrument. For example, as team members become more secure and sophisticated using OTAS, the opportunity exists to add to dimensions of teamwork performance and exemplar teamwork behaviors currently presented in OTAS based on teams' experiences with the instrument and their ongoing efforts to advance the learning system within their respective departments.

As the current study includes only one surgical practice, more research is needed to explore study findings in other surgical specialties. In this way, the opportunity exists to gain an even more nuanced understanding of the relationship between processes of collective mindfulness and traditional teamwork behaviors.

Finally, one consistent theme emerging from this study points to the impact of familiarity and lack thereof among and between team members. More research is needed in this regard as lack of familiarity seems to place additional stress on team members and as such, holds the potential to compromise patient and team safety.

Summary, Thoughts, and Challenges

The goal of this case study was to develop a more informed perspective of teamwork behaviors and teamwork from the perspective of surgical team members. The primary research question was to discover behaviors exhibited by surgical team members that result in few if any preventable surgical errors and how such behaviors are enacted.

This study presented the opportunity to: (a) conduct empirical research on interdisciplinary team development in the surgical setting; (b) deploy traditional phenomenological data analysis techniques in combination with a case study approach; and (c) explore the relationship between traditional teamwork behaviors and processes of collective mindfulness.

This study set forth two theoretical constructs: integrative teamwork behavior (Rousseau, Aube, & Savoie, 2006); and collective mind (Weick & Roberts, 1993). Interviews with participants and observations by the researcher guided by the OTAS tool served to explore and more clearly describe the relationship between processes of collective mindfulness and traditional teamwork behaviors. While mindfulness emerges as a prerequisite to safety behaviors exhibited by surgical teams, the relationship between the two constructs is characterized as dynamic interplay as one continuously shapes, informs, and reinforces the other.

Future research opportunities include extending the research methodology to other surgical specialties, conducting observations after-hours and on weekends and holidays, and including recovery room nurses as research participants. Further, opportunity exists to redeploy the study design in Orthopedic Surgery in consideration of leadership changes, and to contribute to the ongoing development and advancement of OTAS instrument.

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Appendix A: Research Participant Consent and Privacy Authorization Form

Omitted

Name and Clinic Number

Approval Date: April 4, 2013
Not to be used after: December 20, 2013

CONTACT INFORMATION

You can contact …	At …	If you have questions or about …
Principal Investigator(s): Michelle Leak	Omitted	▪ Research-related injuries or emergencies ▪ Any research-related concerns or complaints ▪ Withdrawing from the research study ▪ Materials you receive ▪ Research-related appointments
[redacted] **Institutional Review Board (IRB)**		▪ Rights of a research participant
Research Subject Advocate (The RSA is independent of the Study Team)		▪ Rights of a research participant ▪ Any research-related concerns or complaints ▪ Use of your Protected Health Information ▪ Stopping your authorization to use your Protected Health Information

1. Why are you being asked to take part in this research study?

You are being asked to take part in this research study because you are a member of a surgical team. Your experiences and perceptions of surgical teams and interactions among surgical team members present an opportunity to enhance what is known about effective teamwork in the surgical environment. The plan is to have members of the Orthopedic surgical team take part in this study at [redacted].

2. Why is this research study being done?

The purpose of this study is to discover, describe, and codify patterns of social interactions or interrelating among surgical team members that contribute to patient safety and highly reliable surgical teams. This study is designed to find out how individual and team non-technical behaviors are enacted and contribute to patient safety.

3. How long will you be in this research study?

You will be in this study for two months or until the completion of the interview and observational phases of this study. During this time, you will participate in one (face-to-face) interview with the Principal Investigator for this study as needed. In addition, two observations will be conducted for each of the seven (7) surgeons participating in this study for a total of fourteen (14) observations of surgical teamwork. More specifically, this means that while each surgeon will participate in only two observations of surgical teamwork, non-surgeon members of the team may participate in up to fourteen (14) observations depending on staffing assignments for each surgical case or surgeon.

4. What will happen to you while you are in this research study?

If you agree to be in this study, you will be asked to participate in two data collection processes. First, you will be asked to participate in a one-on-one interview with the Principal Investigator as needed.

The interview will take place in a private conference room on the [redacted] campus. You will be asked to respond to the questions outlined below.

- What is your role on the team?
- How long have you been in this role?
- How long have you been on this team?
- What is being a member of this team like for you?
- What does it mean to be a member of this team?
- What is difficult/easy about being a member of this team?
- Describe a typical day for your team.
- How does it begin?

Omitted

Name and Clinic Number

Approval Date: **April 4, 2013**
Not to be used after: **December 20, 2013**

- What does each team member do?
- How does the team make decisions?
- How are problems identified and resolved?
- How do you feel about what the team does?

Your interview will be audio-taped and transcribed by the Principal Investigator. The Principal Investigator will also take notes during your interview in the event of an audiotape equipment failure or if you elect not to have your one-on-one interview audiotaped. Regarding the latter, please check the appropriate box below.

☐ Yes I agree to have my interview(s) audio-taped.

☐ No I do not agree to have my interview(s) audio-taped.

In addition to the interview, you will be asked to participate in the observational phase of this research study. This means that the Principal Investigator will observe, record, and assess overall surgical teamwork and behaviors in three phases of the surgical process: pre-operatively; intra-operatively; and post-operatively. Five dimensions of teamwork will be assessed: cooperation; coordination; communication; situational awareness; and leadership. As a member of the surgical team, you will be asked to permit the Principal Investigator to conduct the observational phase of this study as described above. No subject identifiers will be collected during the observational phase of this study.

5. What are the possible risks or discomforts from being in this research study?

This study includes prospective data collection involving participant contact, informed consent, and recording of identifiers. As with all research, there is a chance that confidentiality could be compromised.

6. Are there reasons you might leave this research study early?

You may decide to stop at any time. You should tell the Principal Investigator if you decide to stop. In addition, the Principal Investigator may stop you from taking part in this study at any time:

- if it is in your best interest;
- if you don't follow the study procedures;
- if the study is stopped.

If you leave this research study early, or are withdrawn from the study, no more information about you will be collected; however, information already collected about you in the study may continue to be used.

The Principal Investigator will tell you about any new information that may affect your willingness to stay in this research study.

7. What are the possible benefits from being in this research study?

You won't benefit from taking part in this research study. It is for the benefit of research.

8. What alternative do you have if you choose not to participate in this research study?

This study is only being done to gather information. You may choose not to take part in this study.

9. Will you be paid for taking part in this research study?

You won't be paid for taking part in this study.

10. How will the confidentiality of your records be protected?

[redacted] committed to protecting the confidentiality of information obtained about you in connection with this research study. Methods used by the Principal Investigator to safeguard the confidentiality of your data include coding data with numbers, storing research materials in locked areas, and password-protecting data stored on the Principal Investigator's computer. In addition, the Principal Investigator will de-identify your data upon completion of the data analysis phase of this research study. Regarding your audiotaped interview with the Principal Investigator, you will have the right to review and edit your tape. Further, your tape will be erased upon completion of the data analysis phase of this study. Similarly, the principle investigator's handwritten notes from your one-on-one interview will be shredded upon completion of the data analysis phase of this study. If the results of the research are made public, information that identifies you will not be used.

Representatives from the [redacted]nstitutional Review Board (the committee that reviews, approves, and monitors research on human subjects) may inspect study records during internal auditing procedures. However, these individuals are required to keep all information confidential.

Omitted

Name and Clinic Number

Approval Date: **April 4, 2013**
Not to be used after: **December 20, 2013**

ENROLLMENT AND PERMISSION SIGNATURES:

Your signature documents your permission to take part in this research.

	/ /	: AM/PM
Printed Name	Date	Time

Signature

Person Obtaining Consent

- I have explained the research study to the participant.
- I have answered all questions about this research study to the best of my ability.

	/ /	: AM/PM
Printed Name	Date	Time

Signature

Appendix B: Email Sent to Prospective Participants

Hello. My name is Michelle Leak and I work here at MCF. I am in the process of completing my doctorate degree at the George Washington University in DC and I have obtained approval from the [site name omitted] IRB to conduct a research study at MCF on teamwork among surgical team members.

The purpose of this research study is to discover and describe social interactions among surgical team members that contribute to nearly error-free team performance. This research study also presents the opportunity to incorporate research findings in the development of interventions aimed at continuously improving non-technical skills among surgical team members.

Data collection includes observations of Orthopedic surgical team members in the OR and one-on-one interviews. While observations will focus on interactions between all surgical team members, the one-on-one interviews will focus on the experience of teamwork in the OR from the perspective of individual surgical team members.

As a member of the Orthopedic Surgery team, I am writing to request your consideration of participating in this research study at MCF by carefully reviewing the attached Research Participant Consent and Privacy Authorization Form. Please know that your participation in this research study is completely voluntary and that you may choose not to participate or to withdraw from participation at any time.

I will be in attendance at your _____staff meeting to answer any questions you may have and to collect your signed consent form if you choose to participate in this research study. In the meantime, if you have questions or require additional information prior to our meeting, please contact me directly by email at [email omitted] pager at [number omitted].

Thanks so very much for your attention to this note and for your consideration of participating in this research study. Best regards, Michelle.

Appendix C: Protocol

IRB Minimal Risk Protocol Template

General Study Information

Principal Investigator: Michelle Antoinette Leak

Study Title: Teaming Up for Patient Safety: A Case Study of Social Interactions Among Surgical Team Members

Protocol version number and date: #1- December 4, 2012

Purpose

Hypothesis: The premise of the study is that the more heedful, mindful interrelating among surgical team members the less the opportunity for preventable errors in the surgical suite. With this in mind, the primary research question is: how are teamwork behaviors among surgical team members enacted to affect the incidence of preventable errors in the operating suite? Further, what are the behavioral dimensions of surgical teams and the patterns of teamwork among surgical team members that contribute to overall patient safety and more collective surgical team capacity to prevent errors?

Aims, purpose, or objectives:

1) To discover, describe and codify patterns of social interactions or interrelating among surgical team members.
2) To gain a deeper and richer understanding of the aspects of teamwork that result in nearly error free team performance in the operating suite.
3) To incorporate findings from the study in the development of interventions aimed at continuously improving non-technical skills among surgical team members.
4) To enhance surgical team members' capacity to eliminate preventable errors in the operating suite. The purpose of this study is to discover, describe, and codify patterns of social interactions or interrelating among surgical team members that contribute to nearly error-free team performance and patient safety. Further, the study is designed to uncover the essence of teamwork in the operating suite from the perspective of surgical team members. A case study approach will be utilized in conjunction with phenomenological data analysis methods.

Background (*Include relevant experience, gaps in current knowledge, preliminary data, etc*.):

Despite increased awareness of the link between teamwork and medical errors and the development and implementation of interventions aimed at improving team performance, the incidence of preventable medical error in hospitals and in the OR particularly remains high when compared with the safety record of other organizations similarly concerned with safety and reliability (Rosenthal & Sutcliffe, 2002). Absent from such efforts focused on improving teamwork is empirical evidence of what constitutes or characterizes the kind of teamwork that results in no needless harm to patients and nearly flawless team performance. Further, teamwork from the perspective of individual team members has not been fully if at all explored in the context of patient safety and reliability in the surgical setting, and as such, the opportunity for theoretical and empirical discovery and advancement is loss. For these reasons, the purpose of this study is to develop a more informed perspective of teamwork behaviors and teamwork with an eye towards the development and implementation of more effective teamwork improvement strategies and interventions. The primary research inquiry is to discover how teamwork behaviors are enacted in the OR to affect the incidence of preventable surgical errors. This study expands the existing literature in several ways. First, teamwork is explored in those operational units within the hospital environment known to have a high incidence of preventable adverse events and where there is little empirical research on interdisciplinary team development; namely, operating rooms (Rosenthal & Sutcliffe, 2002; Healey, Undre, & Vincent, 2004). Second, this study will add to the existing literature by testing the theory of heedful interrelating and by identifying more precise teamwork behaviors required for heedful interrelating among interdisciplinary team members. Third, while previous studies aimed at reducing medical errors have focused within a single discipline, this study is focused across disciplines. Finally, while existing studies of the causal factors contributing to the incidence of medical errors deploy the more traditional, retrospective review methodologies, this study invokes a prospective methodology to discern teamwork behaviors and patterns of heedful interrelating among team members that result in nearly error-free performance. This study not only addresses gaps in the existing literature as noted above, but also has the potential to illuminate important aspects of interdisciplinary teamwork in such a way as to affect the design and deployment of interventions aimed at improving team dynamics and effectiveness. Such improvements portend important implications for reducing errors and increasing overall patient safety.

Subject Information – charts, records, images, or specimens are considered 'subjects'

Target accrual: *Proposed number of subjects to be included in your study at your site. "Subjects" may include* [site omitted] *Clinic charts, records, or specimens,* ***and/or*** *charts, records, or specimens received at* [site omitted] *Clinic from external sources for collaborating analysis by the investigator under this IRB application*:

Subject population: The subject population includes surgical team members in: Orthopedic Surgery at MCF. Orthopedic Surgery team members participating in the

study include up to: six surgeons; five physician assistants; four circulating nurses; five surgical technicians; and two surgical assistants. In addition, up to 26 anesthesiologists and 45 CRNAs supporting the Orthopedic Surgery team round out the study population.

Inclusion Criteria: Surgical team members as noted above.

Exclusion Criteria: Other surgical teams and team members at MCF. In addition, surgical patients will not be included as subjects in this study and no data will be collected on any surgical patients.

Will a Certificate of Confidentiality be obtained? No. *If yes, provide an explanation*.

Study Design

Methods: *Describe, in detail, the research activities that will be conducted under this protocol*:

Data will be collected through one-on-one interviews with surgical team members and by observing surgical team members in the operating suite. Interviews will be audio-tapped and transcribed by the principle investigator. Alternatively, the principle investigator will take notes during the interview (in the event that audio equipment fails or research participants elect not to have their one-on-one interview audiotaped). Interviews will be conducted face-to-face in a meeting room on the campus of the research site.

With respect to observations, the Observational Teamwork Assessment for Surgery (OTAS) tool will be used to record and evaluate overall surgical teamwork as well as sub-team (anesthesia, surgical, and nursing) behaviors in three phases: pre-operatively, intra-operatively, and post-operatively. The OTAS tool highlights five dimensions of teamwork: cooperation; coordination; communication; situational awareness; and leadership, as well as exemplary behaviors specific to each dimension. The tool was developed based on general surgical cases and refined and applied to urology, vascular surgery and simulation-based non-technical skills training. Exemplar behaviors are observable indicators of good performance and are used to guide behavioral ratings. The tool has achieved content (Hull et al, 2011) and construct (Sevdalis et al., 2009) validity and more recently, assessors' learning curves have been demonstrated (Russ et al., 2012). Further, this study's principle investigator received training on how to use the tool over a 5 –day period with OTAS research team members at the Imperial College of London.

A total of twelve (12) observations are planned for this study using the OTAS tool described above. Two observations will be conducted for each of the six (6) surgeons and their respective team members participating in this study. Prior to each observation the PI will review the list of team members staffing each case. This list will be compared

to the PI's signed consent form list to ensure that all surgical team members staffing the case have given their consent to participate in this study. If all team members have not given their consent, the planned observation(s) will not occur. Rather, the PI will repeat the process until a total of twelve (12) observations have been identified wherein all surgical team members have consented to participate in this study. Further, no subject identifiers will be collected during the observational phase of this study.

Resources: *Describe the available resources to conduct the research (personnel, time, facilities, mentor commitment, etc.)*: The research will be conducted by the principal investigator during non-productive time and on the campus of the research site. Interviews with surgical team members will be conducted during non-productive time. The chair of surgical committee serves as a resource to the principle investigator and serves on the principle investigator's doctoral dissertation committee.

Check all that apply. If none apply, leave blank:

☐ This is a multisite study involving [site omitted] and non [site omitted] Clinic sites. When checked, describe the research procedures/activities being conducted **only** at [site omitted] Clinic:

☐ [Site omitted] Clinic staff will be engaged in research activity at a non-Clinic site. *When checked, provide the location and a detailed description of the* [site omitted] *Clinic research staff involvement*.

☐ This study is to establish and/or maintain an ongoing database or registry for research purposes only.

☒ The research involves contact or interaction with subjects, for example, surveys, questionnaires, observation, blood draw.

☒ The study involves audiotaping or videotaping

Blood Collection

If this study involves prospective blood collection by finger, heel, ear stick or venipuncture, complete the following:

☐ **From healthy, non pregnant, adult subjects who weigh at least 110 pounds**. For a minimal risk application, the amount of blood drawn from these subjects may not exceed 550ml in an 8 week period and collection may not occur more frequently than 2 times per week.
Volume per blood draw: _____ml
Frequency of blood draw (e.g. single draw, time(s) per week, per year, etc.) _____

☐ **From other adults and children considering age, weight, and health of subject.**
For a minimal risk application, the amount of blood drawn from these subjects may not exceed the lesser of 50 ml or 3 ml per kg in an 8 week period, and collection may not occur more frequently than 2 times per week.
Volume per blood draw: _____ml
Frequency of blood draw (e.g. single draw, time(s) per week, per year, etc.)_____

Review of Chart, Images, Specimens
Provide the date range for collection of data and/or specimens that will be included in your research dataset. (*Example: 01/01/2000 to 12/31/2012*)
Date range: From 12/17/2012 to 01/31/2013

Check all that apply:

☐ This study involves only data and/or specimens that exist at the time this application is submitted to the IRB (IRB submission date). No data or specimens will be collected beyond this date.

☒ This study involves only data and/or specimens that will be collected after submission to the IRB.

☐ The study involves data and/or specimens that exist at the time of submission to the IRB **and** data and/or specimens that will be collected after submission to the IRB, for example a study that includes collection of existing data and prospective collection of specimens.

☐ Data and/or specimens used in this study are collected under another IRB protocol. *When checked, provide the IRB number(s) from which the research material will be obtained and check the box below to attest that subjects have provided consent for future use of their data and/or specimens, as described in this protocol*.

IRB Number(s):

□Subjects have provided consent for use of their data and/or specimens, as described in this protocol.

☐ Other data sources will be utilized in this study. When checked, provide all data sources:

Data Confidentiality, HIPAA Subject Identifiers

Review the list of subject identifiers below and, if applicable, check the box next to each subject identifier being recorded at the time you are collecting/abstracting data/specimens for use in this study.

Subject Identifiers: Individually identifiable information, including demographic data, that identifies the individual or for which there is reasonable basis to believe it can be used to identify the individual. NOTE: Identifiers apply to subjects enrolled in your study and to the subject's relatives, household members, employers, etc.

Internal refers to subject identifiers that will be included in the dataset maintained by the study team.
External refers to subject identifiers that will be shared with persons outside of the immediate study team, for example, sent to an external collaborator or shared with a national registry.

SUBJECT IDENTIFIERS **Check all that apply**	**INTERNAL IDENTIFIER**	**EXTERNAL IDENTIFIER**
Name	X	
Social Security number		
Medical record/patient registration number, lab accession, specimen or radiologic image number		
Study number, subject ID, or any other unique identifying number, characteristic or code that can be used to link the identity of the subject to the data		
Dates: All elements of dates [month, day, and year] directly related to an individual. Their birth date, date of death, date of diagnosis, etc. Note: Recording a year only is not a unique identifier.		
Medical device identifiers and serial numbers		
Biometric identifiers, including finger and voice prints, full face photographic images and any comparable images		
Web Universal Resource Locators (URLs), Internet Protocol (IP) address numbers, email address		
Street address, city, county, precinct, zip code, and their equivalent geocodes		
Phone or fax numbers		
Account, member, certificate or professional license numbers, health beneficiary numbers		
Vehicle identifiers and serial numbers, including license plate numbers		
If None of the above identifiers will be recorded or maintained in the dataset and/or sent outside of the study team, please check "None".	☐ None	☐ None

Statistical Information

Note: Power analyses and study endpoints are not needed for a pilot or feasibility studies.

☐ No statistical information. If checked, please explain:

Statistical Considerations

Power Statement:

Data Analysis Plan:
Interviews with surgical team members and the Observational Teamwork Assessment for Surgery (OTAS) tool will be used to collect study data. Regarding interviews, analysis of each transcribed interview will proceed in accordance with Moustakas' (1994) phenomenological data analysis techniques. More specifically, the process of horizonalization will produce relevant transcribed statements which can then be reduced to core horizons or meaning units, and subsequently clustered into themes. Upon validation of core horizons and themes, textual and structural descriptions of teamwork will be constructed followed by the construction and integration of composite textual and composite structural descriptions of the experience of teamwork. This synthesis of meanings and essences will describe then the essential invariant structure of the experience of good teamwork from the perspective of surgical team members.

The OTAS tool will be used to observe team members in the operating suite. The OTAS is comprised of a 7-point scale: 0 (team function severely hindered) to 6 (exemplary-team function very highly enhanced). Sub teams and overall surgical team scores will be displayed for each phase of the surgical process (pre-op, intra-op and post-op) and by each of the five dimensions of surgical teamwork.

Endpoints

Primary:

Secondary:

Appendix D: Observational Teamwork Assessment for Surgery Instrument

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CPSSQ

Centre for Patient Safety & Service Quality

Observational Teamwork Assessment for Surgery

OTAS is a psychometrically robust (i.e. reliable and valid) tool that captures comprehensively the quality of teamwork in the OR.

OTAS consists of five dimensions of teamwork:

- **Communication**: quality and quantity of information exchanged among members of the team.
- **Coordination**: management and timing of activities and tasks.
- **Cooperation /Back up behaviour**: assistance provided among members of the team, supporting others and correcting errors.
- **Leadership**: provision of directions, assertiveness and support among members of the team.
- **Team Monitoring/Situational Awareness**: team observation and awareness of ongoing processes.

Each behaviour is scored on a seven-point scale (0-6). On this scale:

RATING ANCHORS	BRIEF ANCHOR DEFINITION
6	Exemplary behaviour; very highly effective in enhancing team function
5	Behaviour enhances highly team function
4	Behaviour enhances moderately team function
3	Team function neither hindered nor enhanced by behaviour
2	Slight detriment to team function through lack of/inadequate behaviour
1	Team function compromised through lack of/inadequate behaviour
0	Problematic behaviour; team function severely hindered

Pre-Operative

Surgical Team	Exemplar Behaviours	Rating
Communication	• Communicates changes to operation or case list • Talks to team and encourages communication from sub-teams • Verbal confirmation of procedure and intra-op requirements	
Coordination	• Arrive in preparation for patient entry to theatre and set-up • Final assessments of pt and equipment made before scrubbing • Scrub while N-team and A-team complete patient set-up	
Cooperation/ Back up behaviour	• Respond to questions and requests from N-team • Respond to questions and requests from A-team • Provide assistance in pt set-up	
Leadership	• Enquiry into any equipment problems encountered by N-team and pt problems encountered by A-team • Provide confirmation with N-team for specific surgical requirements	
Monitoring/ Situational Awareness	• Monitor final stages of patient and equipment set-up • Reassess set-up and intra-op requirements in advance • Monitor progress of anaesthesia	
Nursing Team	**Exemplar Behaviours**	**Rating**
Communication	• Confirms case specific requirements with S-team • Communicates any problems regarding equipment and/or staffing to team	
Coordination	• Prepare trolley and theatre in readiness for operation • SN prepared for operation waiting in prep room to maintain sterility • Arrange stack appropriately for laparoscopic operation • Final arrangements of equipment and provisions as surgeons finish set-up	
Cooperation/Back up behaviour	• Cooperate with any last minute requests from S-team • Provide support and assistance to A-team when needed • Help surgeons with gowns and dress patient in preparation for operation	
Leadership	• Provides supervision for junior staff • Ensures S-team available for the start of the case	
Monitoring/Situational Awareness	• Check that pt is comfortable and heating blanket etc fitted	

Anaesthetic Team	Exemplar Behaviours	Rating
Communication	• Confirms pt details and condition with pt and informs N-team • Verbal communication to theatre team on pt transfer • Asks S if patient positioning ok	
Coordination	• Consultant A present to supervise A trainee during anaesthetic process • ODP and A present when pt enters • ODP prepares the drugs and hands the equipment to the A in a timely fashion for anaesthesia to progress in a smoothly and co-ordinated manner	
Cooperation/Back up behaviour	• ODP provides assistance to A • Provide timely information on request from N-team • Respond to requests from S-team concerning results or condition of patient	
Leadership	• Take lead on transfer of pt to operating table and set-up • Questions asked about drugs and antibiotics to S-team	
Monitoring/Situational Awareness	• Check correct pt and procedure • Check condition of equipment, gases and provisions • Check pt is comfortable and stable on set-up	

Intra-Operative

Surgical Team	Exemplar Behaviours	Rating
Communication	• Asks team if all prepared to begin the operation • Requests and instructions to team communicated clearly and effectively • Provides information to whole team on progress • Informs team of technical difficulties/changes of plan	
Coordination	• Gives prior notification of requirements to team to enhance timing of tasks (e.g. instrument exchange) • Coordinate use of equipment, such as camera in minimal access surgery providing adequate view of operating field • Contribute to smooth exchange of instruments and provisions with SN	
Cooperation/ Back up behaviour	• Responds to requests and questions from N-team • Responds to requests or questions from A-team • Helps with smooth instrument exchange with SN • Supports Surgical group assistants and compensates for lack of experience	
Leadership	• Instructions and explanations provided to assistants • Advises A-team or N-team to call for additional help if required • Supervision provided for staff lacking familiarity with tasks or equipment • Assertive in controlling noise and distractions in theatre	
Monitoring/ Situational Awareness	• Asks A about pt condition • Asks SN if swabs, needles, and instrument count correct	

Nursing Team	Exemplar Behaviours	Rating
Communication	• SN acknowledges and confirms surgeon's requests through verbal or non-verbal behaviour (e.g. eye contact, responding to requests) • SN provides clear and audible requests for provisions to CN • Swabs needles and instrument s count confirmed verbally between CN and SN	
Coordination	• CNs check provisions prepared and ready for SN during operation • SN anticipates S requirements for instruments • A CN is always present to provide backup to SN	
Cooperation/Back up behaviour	• SN responds effectively to requests from S-team and provides smooth exchange of instruments • CN responds to instructions and requests from SN	
Leadership	• Informs S-team of any concerns in equipment • Minimizes noise and distractions in theatre	
Monitoring/Situational Awareness	• Final checks on equipment and diathermy connections • SN observes procedure closely • CN monitors the needs of the SN and responds appropriately	

Anaesthetic Team	Exemplar Behaviours	Rating
Communication	• Provides update on pt condition • A enquires about progress of operation	
Coordination	• Ready for operation when S-team are ready to operate • A-team ensures all provisions at hand	
Cooperation/Back up behaviour	• Responds to S-team requests immediately • Provides team with information requested • ODP acts on requests and inquiry from team • ODP being proactive and provide support when needed	
Leadership	• Lead A instructs ODP and team on crisis contingency plans • Supervision provided for junior staff	
Monitoring/Situational Awareness	• Checks and refines set-up • Maintains monitoring of pt condition, blood loss and of surgical progress • ODP monitors requirements of drugs for anaesthetist	

Post-Operative

Surgical Team	Exemplar Behaviours	Rating
Communication	• Discusses requirements of the next case • Debriefs team member(s)	
Coordination	• Remain to help on patient transfer to trolley	
Cooperation/ Back up behaviour	• Remain to help with safe pt transfer to trolley • Ensures documentation is up-to-date and transferred with the pt	
Leadership	• Provides recovery team with post-operative requirements for pt	
Monitoring/ Situational Awareness	• Monitors pt transfer to trolley and exit	
Nursing Team	**Exemplar Behaviours**	**Rating**
Communication	• Provides information concerning surgical procedure and pt condition to recovery nurses • Recovery N listens carefully to information transferred from theatre team	
Coordination	• Immediate dismantle and removal of instruments and equipment before patient exit • Recovery N prepared for patient transfer and set-up in recovery • Ensures that pt documents are with pt in recovery	
Cooperation/Back up behaviour	• CN and SN co-operate in dismantling equipment and clearing theatre • Acknowledge requests from S-team and A-team • Recovery N responds to pt entry and to theatre team instructions	
Leadership	• Proactive in ensuring any post-op requirements are met.	
Monitoring/Situational Awareness	• Monitor pt positioning on transfer to trolley • Monitor handling of specimens and their labelling	

Anaesthetic Team	Exemplar Behaviours	Rating
Communication	• Instructs team on pt transfer to trolley • Asks team if ready to transfer pt and instructs on process • Information on patient condition and drugs provided to recovery nurse	
Coordination	• Lines and pt set-up on trolley checked before transport • ODP available to assist A in transfer of pt to trolley	
Cooperation/Back up behaviour	• ODP provides support and responds to A-team requests during anaesthetic reversal • ODP responds well to requests from the team • Responds effectively to questions from others	
Leadership	• Takes lead on anaesthesia reversal and manoeuvring of pt • Ensures sufficient staff remain to help transfer pt safely • ODP proactive in supporting A	
Monitoring/Situational Awareness	• Monitors pt condition upon transfer to trolley • Check that lines and pt set-up are correct for transport	

Appendix E: OTAS Scores- Teamwork Performance (Teams 1-6)

Table E.1. *OTAS Team #1Teamwork Behavioral Means*

			(TEAM 1) OTAS TEAMWORK BEHAVIOURAL MEANS (SD)					
			COMMUNICATION	COOPERATION /BACK UP BEHAVIOUR	COORDINATION	LEADERSHIP	TEAM MONITORING/ SITUATIONAL AWARENESS	**OVERALL TEAMWORK SCORE**
OPERATIVE PHASE	**PRE**	A-TEAM	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	**6.00 (0.00)**
		N-TEAM	5.25 (1.06)	6.00 (0.00)	6.00 (0.00)	5.25 (0.35)	5.75 (0.35)	**5.65 (0.53)**
		S-TEAM	6.00 (0.00)	4.50 (0.71)	6.00 (0.00)	5.25 (1.06)	6.00 (0.00)	**5.55 (0.76)**
	INTRA	A-TEAM	5.50 (0.71)	6.00 (0.00)	5.30 (1.06)	4.50 (0.71)	6.00 (0.00)	**6.00 (0.00)**
		N-TEAM	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	5.75 (0.35)	6.00 (0.00)	**5.15 (0.41)**
		S-TEAM	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	**5.96 (0.32)**
	POST	A-TEAM	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	**6.00 (0.00)**
		N-TEAM	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	5.00 (0.00)	6.00 (0.00)	**5.80 (0.42)**
		S-TEAM	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	5.50 (0.71)	5.00 (0.00)	**5.70 (0.48)**
								5.79 (0.48)

Table E.2. *OTAS Team #2 Teamwork Behavioral Means*

			(TEAM 2) OTAS TEAMWORK BEHAVIOURAL MEANS (SD)					
			COMMUNICATION	COOPERATION /BACK UP BEHAVIOUR	COORDINATION	LEADERSHIP	TEAM MONITORING/ SITUATIONAL AWARENESS	**OVERALL TEAMWORK SCORE**
OPERATIVE PHASE	**PRE**	A-TEAM	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	**6.00 (0.00)**
		N-TEAM	5.25 (0.35)	5.50 (0.71)	5.25 (0.35)	5.00 (0.00)	4.75 (0.35)	**5.15 (0.41)**
		S-TEAM	6.00 (0.00)	5.50 (0.71)	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	**5.90 (0.32)**
	INTRA	A-TEAM	4.50 (0.00)	5.75 (0.35)	5.75 (0.35)	4.00 (0.00)	6.00 (0.00)	**5.20 (0.86)**
		N-TEAM	5.50 (0.71)	5.75 (0.35)	6.00 (0.00)	5.25 (0.35)	5.75 (0.35)	**5.65 (0.41)**
		S-TEAM	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	5.75 (0.35)	6.00 (0.00)	**5.95 (0.16)**
	POST	A-TEAM	5.75 (0.35)	5.75 (0.35)	5.75 (0.35)	5.75 (0.35)	5.75 (0.35)	**5.75 (0.26)**
		N-TEAM	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	5.00 (0.00)	6.00 (0.00)	**5.80 (0.50)**
		S-TEAM	5.25 (0.35)	6.00 (0.00)	6.00 (0.00)	5.50 (0.71)	5.00 (0.00)	**5.55 (0.50)**
								5.66 (0.51)

Table E.3. *OTAS Team #3 Teamwork Behavioral Means*

			(TEAM 3) OTAS TEAMWORK BEHAVIOURAL MEANS (SD)					
			COMMUNICATION	COOPERATION / BACK UP BEHAVIOUR	COORDINATION	LEADERSHIP	TEAM MONITORING/ SITUATIONAL AWARENESS	**OVERALL TEAMWORK SCORE**
OPERATIVE PHASE	**PRE**	A-TEAM	5.75 (0.35)	5.75 (0.35)	5.75 (0.35)	6.00 (0.00)	6.0 (0.00)	**5.85 (0.24)**
		N-TEAM	5.50 (0.70)	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	5.25 (1.06)	**5.75 (0.54)**
		S-TEAM	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	**6.00 (0.00)**
	INTRA	A-TEAM	4.75 (0.35)	6.00 (0.00)	6.00 (0.00)	4.00 (0.00)	6.00 (0.00)	**5.35 (0.88)**
		N-TEAM	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	5.00 (0.00)	6.00 (0.00)	**5.80 (0.42)**
		S-TEAM	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	**6.00 (0.00)**
	POST	A-TEAM	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	**6.00 (0.00)**
		N-TEAM	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	5.00 (0.00)	6.00 (0.00)	**5.80 (0.42)**
		S-TEAM	5.00 (0.00)	6.00 (0.00)	6.00 (0.00)	5.50 (0.70)	5.50 (0.70)	**5.60 (0.52)**
								5.79 (0.47)

Table E.4. *OTAS Team #4 Teamwork Behavioral Means*

			(TEAM 4) OTAS TEAMWORK BEHAVIOURAL MEANS (SD)					
			COMMUNICATION	COOPERATION /BACK UP BEHAVIOUR	COORDINATION	LEADERSHIP	TEAM MONITORING/ SITUATIONAL AWARENESS	**OVERALL TEAMWORK SCORE**
OPERATIVE PHASE	**PRE**	A-TEAM	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	**6.00 (0.00)**
		N-TEAM	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	**6.00 (0.00)**
		S-TEAM	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	**6.00 (0.00)**
	INTRA	A-TEAM	4.50 (0.00)	6.00 (0.00)	6.00 (0.00)	4.00 (0.00)	6.00 (0.00)	**5.30 (0.92)**
		N-TEAM	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	5.75 (0.35)	6.00 (0.00)	**5.95 (0.16)**
		S-TEAM	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	**6.00 (0.00)**
	POST	A-TEAM	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	**6.00 (0.00)**
		N-TEAM	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	5.00 (0.00)	6.00 (0.00)	**5.80 (0.42)**
		S-TEAM	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	5.33 (0.52)	5.67 (0.52)	**5.80 (0.41)**
								5.85 (0.43)

Table E.5. *OTAS Team #5 Teamwork Behavioral Means*

			(TEAM 5) OTAS TEAMWORK BEHAVIOUR }|}}}L MEANS (SD)					
			COMMUNICATION	COOPERATION /BACK UP BEHAVIOUR	COORDINATION	LEADERSHIP	TEAM MONITORING/ SITUATIONAL AWARENESS	**OVERALL TEAMWORK SCORE**
OPERATIVE PHASE	**PRE**	A-TEAM	5.00 (0.00)	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	6.00(0.00)	**5.80 (0.42)**
		N-TEAM	6.00 (0.00)	6.00 (0.00)	5.50 (0.70)	6.00 (0.00)	6.00 (0.00)	**5.90 (0.32)**
		S-TEAM	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	**6.00 (0.00)**
	INTRA	A-TEAM	4.50 (0.00)	6.00 (0.00)	6.00 (0.00)	4.00 (0.00)	6.00 (0.00)	**5.30 (0.92)**
		N-TEAM	6.00 (0.00)	5.25 (1.06)	5.25 (1.06)	5.25 (1.06)	6.00 (0.00)	**5.56 (0.72)**
		S-TEAM	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	6.00 (0.00)	5.50 (0.32)	**5.90 (0.32)**
	POST	A-TEAM	6.00 (0.00)	5.50 (0.71)	5.50 (0.71)	5.50 (0.71)	6.00 (0.00)	**5.70 (0.48)**
		N-TEAM	6.00 (0.00)	5.50 (0.71)	6.00 (0.00)	5.00 (0.00)	5.50 (0.71)	**5.60 (0.52)**
		S-TEAM	5.00 (0.00)	6.00 (0.00)	5.00 (0.00)	5.00 (0.00)	5.00 (0.00)	**5.20 (0.42)**
								5.66 (0.56)

Table E.6. *OTAS Team #6 Teamwork Behavioral Means*

			(TEAM 6) OTAS TEAMWORK BEHAVIOURAL MEANS (SD)					
			COMMUNICATION	COOPER-ATION /BACK UP BEHAVIOUR	COORDINATION	LEADERSHIP	TEAM MONITORING/ SITUATIONAL AWARENESS	**OVERALL TEAMWORK SCORE**
OPERATIVE PHASE	**PRE**	A-TEAM	4.75 (0.35)	5.50 (0.00)	5.25 (0.35)	5.50 (0.00)	5.50 (0.00)	5.30 (.34)
		N-TEAM	4.50 (0.71)	5.50 (0.00)	5.00 (0.71)	5.00 (1.41)	5.00 (1.41)	5.00(0.82)
		S-TEAM	5.50 (0.00)	5.50 (0.00)	5.50 (0.00)	5.50 (0.00)	5.50 (0.00)	5.50 (0.00)
	INTRA	A-TEAM	4.50 (0.71)	5.50 (0.00)	5.25 (0.35)	4.25 (0.35)	5.50 (0.00)	5.00 (0.62)
		N-TEAM	5.25 (0.35)	5.25 (0.35)	5.00 (0.71)	4.75 (0.35)	5.00 (0.71)	5.05 (0.44)
		S-TEAM	5.25 (0.35)	5.50 (0.00)	5.50 (0.00)	5.50 (0.00)	5.25 (0.35)	5.40 (0.21)
	POST	A-TEAM	5.50 (0.00)	5.50 (0.00)	5.50 (0.00)	5.50 (0.00)	5.50 (0.00)	5.50 (0.00)
		N-TEAM	6.00 (0.00)	5.50 (0.00)	5.50 (0.00)	5.00 (0.00)	5.75 (0.35)	5.55 (0.37)
		S-TEAM	5.00 (0.00)	5.50 (0.00)	5.50 (0.00)	6.00 (0.00)	5.00 (0.00)	5.40 (0.39)
								5.30 (0.47)

Appendix F: OTAS Scores- Overall Teamwork Performance

Table F.1. *OTAS Scores-Overall Teamwork Performance*

			ALL TEAMS-OTAS TEAMWORK BEHAVIOUR MEAN (SD)					
			COMMUNICATION	COOPERATION /BACK UP BEHAVIOUR	COORDINATION	LEADERSHIP	TEAM MONITORING/ SITUATIONAL AWARENESS	**OVERALL TEAMWORK SCORE**
OPERATIVE PHASE	**PRE**	A-TEAM	5.58 (0.56)	5.88 (0.23)	5.83 (0.33)	5.92 (0.19)	5.92 (0.19)	**5.83 (0.34)**
		N-TEAM	5.42 (0.70)	5.83 (0.33)	5.63 (0.53)	5.54 (0.66)	5.46 (0.75)	**5.58 (0.61)**
		S-TEAM	5.92 (0.19)	5.58 (0.63)	5.92 (0.19)	5.79 (0.45)	5.92 (0.19)	**5.83 (0.39)**
	INTRA	A-TEAM	4.71 (0.50)	5.88 (0.22)	5.71 (0.50)	4.13 (0.31)	5.92 (0.19)	**5.27 (0.81)**
		N-TEAM	5.79 (0.40)	5.71 (0.50)	5.71 (0.58)	5.29 (0.54)	5.79 (0.45)	**5.66 (0.52)**
		S-TEAM	5.88 (0.31)	5.92 (0.19)	5.92 (0.19)	5.88 (0.23)	5.79 (0.40)	**5.88 (0.27)**
	POST	A-TEAM	5.88 (0.23)	5.79 (0.33)	5.79 (0.33)	5.79 (0.33)	5.88 (0.23)	**5.83 (0.29)**
		N-TEAM	6.00 (0.00)	5.83 (0.33)	5.92 (0.19)	5.00 (0.00)	5.88 (0.31)	**5.73 (0.43)**
		S-TEAM	5.38 (0.48)	5.92 (0.19)	5.75 (0.40)	5.42 (0.51)	5.08 (0.29)	**5.50 (0.48)**
								5.68 (0.52)