Understanding the Impact of Safety Climate, Teamwork Climate, and Mindful Organizing on Safety Outcomes at a Large Community Hospital - A Mixed-Methods Study

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Abstract

Aim: The current study examined the impact of staff perceptions of safety climate (i.e., senior and supervisory leadership support for safety), teamwork climate, and mindful organizing on three self-reported measures of safety outcomes (i.e., overall perceptions of patient safety, overall patient safety grade, and turnover intention) at a large community hospital in Southern Ontario.

Methods: Survey and interview data were collected from nurses, allied health professionals, and unit clerks working on one of four units: ICU, general medicine, adult mental health, or the ED. In total, 183/247 eligible clinical staff returned a completed survey (response rate = 74%); 4-6 semi-structured interviews were conducted on each unit.

Results: Hierarchical regression analyses showed teamwork climate was significantly associated with all three study's predictor variables while senior leadership was significantly associated with overall perceptions of patient safety and overall patient safety grade. Non-significant associations were found between supervisory leadership, mindful organizing and the three outcome variables.

The qualitative findings corroborated the survey results while also providing important insights into why certain statistical relationships were found to be non-significant – e.g., interviewees perceived the safety specific responsibilities of frontline supervisors much more broadly compared to the narrower conceptualization of the construct in the survey. In addition, the qualitative findings helped expand the characteristics of the study's key concepts – e.g., interviewees highlighted the prevalent negative impact of unit and profession boundaries on teamwork climate.

Practice Implications: Healthcare organizations should recruit into leadership roles and retain individuals who prioritize safety and possess adequate relational competencies. Furthermore, it is important to provide on-site workshops on topics (e.g., conflict and stress management) that can strengthen working relationships across professional and unit boundaries. The frontline clinicians would also benefit from on-site clinical training and presence of adequate staffing levels so they can provide high quality patient care.

Conclusions: There is increasing empirical evidence regarding the importance of context-specific factors for patient and staff safety, however, certain literature gaps still remain – e.g., an over-reliance on non-theory driven quantitative research. The current study has addressed some of these gaps, together with adding to our understanding of how context influences safety.

Acknowledgements

I wish to acknowledge Dr. Liane Ginsburg for her continuous guidance and support in the past 9 years of my academic career, without which I would not have been successful in my graduate studies.

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I want to dedicate my PhD dissertation report to my family for their continuous love and support throughout my life.

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Chapter 1: Literature Review and Study Hypotheses

The complexity of healthcare delivery has steadily increased as a consequence of a number of factors including advancements in medical technologies, aging population, intricately organized care processes, comorbid chronic illnesses etc. (Institute of Medicine, 2000). At the same time, certain areas of healthcare organizations such as emergency departments, surgical and intensive care units are increasingly exhibiting tight coupling in terms of processes, personnel, equipment, and other resources (Perrow, 1999). Under these circumstances, occurrence of medical errors by well-intentioned, highly skilled and educated clinicians is unavoidable. Most of these medical errors cause no or minor patient harm but some adverse events have serious consequences for patients including permanent disability and death. Empirical evidence suggests that an adverse event occurs in up to 10% of hospitalizations, about half of which are preventable (e.g., Baker et al., 2004; Davis et al., 2001; Thomas et al., 2000). Evidence further suggests that healthcare error is costly. For example, surgical site infections in Canadian acute care hospitals result in $24.4 million in extra health care costs annually and 65% of these infections are preventable (Etchells et al., 2012).

In the health care domain, application of standardized clinical interventions such as hand hygiene guidelines (Goldmann et al., 2009), and surgical checklists (World Health Organization, 2008) has seen much success in improving anaesthesia care and reducing medication, diagnostic and surgical errors (Ruchlin, Dubbs, & Callahan, 2004). There is, however, also evidence that the climate and/or culture of a setting is an important contextual factor which has influenced the likelihood of successful implementation of patient safety improvement interventions such as checklists (e.g., Bosk, Dixon-Woods, Goeschel, & Pronovost,

2009) and initiatives to reduce central line infections in the intensive care unit (e.g., Pronovost et al., 2006). Furthermore, recent work in hospital and nursing home settings is beginning to provide empirical support for the relationship between safety climate/culture and patient safety outcomes (e.g., Bonner, Castle, Men, & Handler, 2009; Singer et al., 2009b; Thomas et al., 2012).

The culture and climate research has distinct origins – the concept of culture emerged from anthropological research that focused on understanding the collective nature of a group of individuals by relying on an aggregated unit of analysis (e.g., at department or organization level), whereas, the concept of climate was first introduced by industrial psychologists interested in understanding individual perceptions by relying on the individual unit of analysis (Schneider, Ehrhart, & Macey, 2013). Even though the origins of culture and climate research differ, both concepts suffer from a lack of definitional precision and associated measurement problems – there are ongoing debates on the dimensions that should be considered components of organizational culture/climate and how best to measure them (Zohar & Hofmann, 2012). To complicate matters further, some organizational researchers have used the terms culture and climate interchangeably without clarifying subtle yet important differences between these two concepts.

Most scholars agree that culture consists of deep and surface level elements (Zohar & Hofmann, 2012). The deep-level elements of culture consist of (a) basic assumptions about past organizational actions that proved successful in overcoming internal or external challenges and (b) core values that serve as a moral compass for individuals and organizations. Over time, these unquestioned basic assumptions and core values are unconsciously ingrained making it

difficult for the organizational employees to decipher them. Consequently, it is suggested that the only reliable way to discover the deep level elements of culture is to conduct in-depth longitudinal qualitative studies (Flin, 2007; Halligan & Zecevic, 2011; Schneider, Ehrhart, & Macey, 2013).

The surface level elements of culture – i.e., climate – involve perceptions of observable (a) artifacts (e.g., organizational myths and stories, policies, procedures, and practices) and (b) behaviours that are rewarded or supported by leaders (Zohar & Hofmann, 2012). Furthermore, perceptions of climate are domain specific – e.g., safety climate, innovation climate, customer service climate etc. – rather than global or generic in nature (Ginsburg, Tregunno, Norton, Mitchell, & Howley, 2014). This domain specific definition of climate also implies the simultaneous existence of a number of interacting climates at any given organization. For example, a teaching hospital should have coexisting climates for safety, efficiency, teamwork, research and innovation etc. Furthermore, many of the complex contemporary organizations are loosely coupled systems where frontline supervisors often exercise discretion while implementing or supporting policies created by the senior management. Consequently, employees take into consideration organizational hierarchy while forming perceptions of a given domain specific climate, i.e., domain specific climates are multi-level (Zohar, 2000; Zohar, 2008; Zohar & Hofmann, 2012; Zaheer, Ginsburg, Chuang, & Grace, 2015).

In health care settings, contemporary researchers have primarily relied upon survey instruments to capture climate perceptions of safety. However, some of these surveys are erroneously labelled safety culture surveys (e.g., Agency for Healthcare Research and Quality's Hospital Survey on Patient Safety Culture) even though they are only capable of measuring

surface manifestations of culture (i.e., climate). Furthermore, most of these safety climate surveys lack sufficient psychometric rigor and contain antecedent or outcome dimensions in addition to components of safety climate (Ginsburg et al., 2014; Singer & Vogus, 2013a). In fact, it is suggested that safety climate should be defined and measured much more narrowly by adhering to Zohar's (1980) original definition of the concept as employee perceptions of management commitment to safety – see the section below on safety climate, page 8, for further discussion on this topic.

At this juncture, it is also useful to note that climate level (i.e., mean, median, or percent positive response) and climate strength (i.e., within group variability) are different. In the organizational literature, safety climate by and large is defined as a shared team property and consequently much of the empirical research has focused on group level analysis of climate perceptions (Ginsburg & Oore, 2015; Gonzalez-Roma, 2011; Schneider & Salvaggio, 2002). In contrast, climate strength has been treated as a mere statistical hurdle to justify aggregation of individual level climate data to team/unit level. This approach to climate research has ignored instances when there is a lack of consensus/agreement among team members resulting in an incomplete utilization of the safety climate construct (Ginsburg & Oore, 2015; Singer & Vogus 2013a). For instance, this has hindered the ability of hospitals to successfully implement appropriate targeted safety improvement initiatives as a clinical unit with weak safety climate will require different safety improvement strategies compared to a clinical unit with low safety climate. Consequently, the use of a climate profile that contains information on both climate *level* and climate *strength*, in healthcare research should facilitate implementation of targeted safety enhancing initiatives at a given clinical unit (Ginsburg & Oore, 2015). In the current study,

all hypotheses focus on mean climate perceptions (i.e. climate level) at the individual level of analysis, however, in keeping with the recommendation of Ginsburg and Oore (2015), climate profiles of clinical units will also be examined in order to provide a holistic picture of the climate personality of the clinical units participating in this study.

Given the complexity of health care delivery systems, the prevalence of preventable medical errors, and the importance of culture/climate, the aim of the current mixed methods study is to examine the influence of pertinent context-related factors (e.g., teamwork climate) on self-reported safety outcomes (e.g., turnover intention) at a hospital setting.

Study Background - Speak Up Workshop

Part of the inspiration for the current study can be ascribed to a safety culture improvement initiative, the "Speak Up" (SU) intervention, previously held for frontline staff in the emergency department (ED) at a large community hospital in Southern Ontario to improve inter- and intra-professional safety related communication. The SU intervention included a ½ day simulation workshop for inter-professional staff held in June 2014 as well as follow-up activities to try to sustain attention to and improve practice around speaking up about unsafe and/or unprofessional behaviours that can threaten patient care. Feeling able to speak up reflects one important dimension of climate in an organization or work unit.

During the simulation workshop, five focus groups were held for frontline health professionals to elicit responses from participants on the content and effectiveness of the workshop. In addition, longitudinal teamwork climate survey (Sexton et al., 2006b) data were collected from ED staff (SU intervention unit) and staff in an intensive care unit (control unit) to evaluate the effectiveness of the SU intervention.

Analyses of the wave 1 (baseline) survey data collected just prior to the start of the intervention revealed significant differences between the teamwork climate scores in the ED and ICU. Moreover, informal analyses of the focus groups revealed a number of thematic ideas consistent with high reliability theory. For example, focus groups' discussions highlighted some of the factors responsible for the quality of communication and teamwork in the ED including deference to nurse's expertise during a bedside crisis, physician leader's support for improving safety related communication, importance of fast pooling of resources to contain an emerging crisis etc. These qualitative thematic ideas along with the quantitative teamwork climate survey findings, showing variation across clinical units in the same hospital, provided the impetus for the current cross-sectional study and helped inform the selection of clinical units, survey scales and semi-structured interview questions (discussed in Chapter 2).

Enabling, Enacting, and Elaborating Safety Culture Framework

As an overview, figure 1.1 outlines the conceptual model for this study, adopted from the enabling, enacting, and elaborating safety culture framework proposed by high reliability theorists (i.e., Vogus, Sutcliffe, & Weick, 2010; Singer & Vogus, 2013b). This framework indicates that external (e.g., accreditation) and internal actions (e.g., leader behaviours, human resource practices) shape safety climate perceptions of frontline staff by prioritizing or subordinating safety over other organizational goals (e.g., efficiency) – the enabling piece. This in turn motivates or discourages, the frontline staff to participate in safety enhancing behaviours (e.g., teamwork, mindful organizing, error reporting) capable of improving safety outcomes (e.g., fewer hospital errors) – the enacting piece. In this model, safety climate is an important internal mechanism/motivator that links preceding enabling and subsequent

enacting safety interventions. Finally, enabling and enacting activities can be refined and enlarged through elaborating practices (e.g., team-based training) to further reinforce safe behaviours. In sum, the framework stipulates that a positive safety culture will emerge over time through a continuous cycle of enabling, enacting, and elaborating activities.

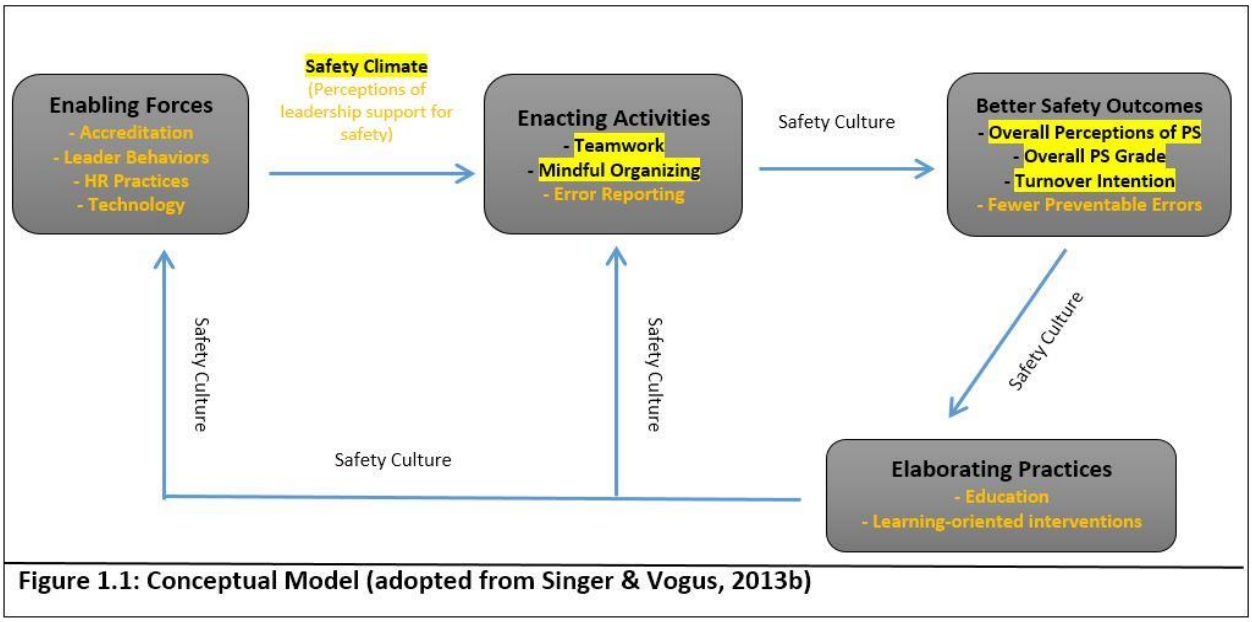

Figure 1.1: Conceptual Model (adopted from Singer & Vogus, 2013b)

This framework categorizes a wide range of safety interventions/activities as enabling, enacting, or elaborating a culture of safety. However, the current study will focus on safety climate, teamwork climate, mindful organizing and a handful of pertinent safety outcomes, highlighted in yellow in figure 1.1. More specifically, the current study will examine the influence of staff perceptions of leadership support for safety (i.e., safety climate), mindful organizing, and teamwork climate on staff self-reported perceptions of safety outcomes (i.e., overall perceptions of patient safety and overall patient safety grade). The current study will also examine employee's self-reported turnover intention as an individual level staff outcome. The rationale for including turnover intention as an outcome is threefold. First, past empirical research suggests that a wide variety of constructs are significant predictors of turnover

intention including national culture (Liou & Cheng, 2010), organizational and occupational commitment (Liou & Grobe, 2008), job satisfaction and burnout (Meeusen et al., 2011), remuneration (Fochsen, Sjogren, Josephson, & Langerstrom, 2005), quality of teamwork and interpersonal relationships (Estryn-Behar et al., 2007), workload (Zeytinoglu et al., 2007), unit size (Sellgren, Kajermo, Ekvall, & Tomson, 2009), supportive management (Smith et al., 2005) and supportive colleagues (Hwang & Chang, 2009). Second, a strong and significantly positive relationship exists between turnover intention and actual leaving behaviours (Bluedorn, 1982; Schwepker, 2001). Consequently, in research, turnover intention can serve as a valid proxy for the actual leaving behaviours (Bothma & Roodt, 2013). Third, employee turnover has negative economic (e.g., costs associated with hiring and training of new employees) and operational (e.g., poor quality of care delivery due to inadequate staffing) implications for an organization (Hayes et al., 2012).

At this juncture, it is important to note that past empirical research on turnover intention has rarely defined this concept precisely, perhaps because the term is assumed to be self-explanatory (Bothma & Roodt, 2013). However, this ambiguity has led to conceptual and measurement concerns as an employee's intent to leave or stay can be defined in terms of unit/department, organization, or occupation (Chan, Tam, Lung, Wong, & Chau, 2013). Furthermore, past research has often relied upon single item scales to measure turnover intention with obvious scale psychometric limitations (Bothma & Roodt, 2013). To address these concerns, turnover intention in the current study was operationalized as behavioural intent of an employee to transfer to a different unit in the same organization or to seek employment at a different organization while staying in his/her occupation. Moreover, the

current study relied upon a multi-item turnover intention scale with good psychometric properties (see Chapter 2, p. 37).

Next, justification for examining the influence of each of the study's predictor variable on selected safety outcomes is discussed in detail.

Safety Climate

As mentioned previously, most of the current safety climate surveys contain *antecedent* or *outcome* dimensions in addition to *components* of safety climate (Ginsburg et al., 2014; Singer & Vogus, 2013a). The construct of safety climate was originally defined as employee's perceptions of management commitment to safety (Zohar, 1980) and the research community needs to return to this original definition of safety climate for conceptual, measurement, and practical purposes (Singer & Vogus, 2013a; Zaheer et al., 2015). The current study has adhered to this proposition by defining safety climate in terms of employee's perception of leadership support for safety at two levels – senior and supervisory. Employees differentiate between the priorities of senior management and unit supervisors, resulting in the emergence of perceptions of two concurrent levels safety climate (Zohar, 2000; Zohar, 2008; Zohar & Hofmann, 2012). Adopting a multi-level safety climate perspective is especially important in loosely coupled organizations such as hospitals where unit supervisors can often exercise discretion in implementing policies created by senior management. Indeed, one key aspect of evaluating patient safety climate lies in examining consistency between organizational level safety policies and procedures, and implementation practices in subunits that are subject to supervisory discretion (Zohar & Hofmann, 2012). Finally, leadership support for safety is one of

the most important and psychometrically robust dimensions of climate in the safety literature (Flin et al., 2000; Zohar, 2008), lending support to the inclusion of this construct in our study.

Health care organizations trying to implement leadership-level initiatives to improve patient safety have traditionally relied on research literature from aviation and industrial sectors (e.g., Flin & Yule, 2004). Moreover, much of the empirical research that does exist in healthcare settings has primarily focused on safety related behaviours of leaders that can improve employees' perceptions of safety climate such as participative leadership style (e.g., Zaheer et al., 2014), empowering leadership style (e.g., Yun et al., 2005), executive safety walk-rounds (e.g., Frankel et al., 2008; Thomas et al., 2005), adopt-a-work unit (e.g., Pronovost et al., 2004), and frontline safety forums (e.g., Tucker et al., 2008). The Institute of Medicine (2000) report, '*To Err is Human'* suggested that the presence of strong, visible, and supportive leadership is not only important for creating a positive safety climate but also for improving safety outcomes. However, empirical support for the predictive power of staff perceptions of leadership on safety outcomes remains limited. Studies that have examined these relationships include work by Laschinger and Leiter (2006) on the impact of nursing work environments on nurse burnout and patient safety outcomes using a cross-sectional research design. Survey data were collected from hospital-based nurses in Ontario (N = 4,606) and Alberta (N = 3,991). The structural equation modeling analysis suggested that supportive leadership provided by nurse managers significantly influences nursing work environments (e.g., staffing adequacy, nurse/physician relationships) that in turn significantly effects nurse burnout and frequency of adverse events (i.e., falls, nosocomial infections, medication errors, and patient complaints).

In a focused ethnographic study, Cole and Crichton (2006) explored the effects of human factors (e.g., communication and inter-professional relationships) on the performance of ED trauma teams in a hospital in London, UK. Data were collected by direct observations of 6 trauma events and 11 semi-structured interviews with staff members of the trauma teams. The qualitative data analyses indicated that a leader of a trauma team plays a critical role in facilitating team coordination and improving individual/team performance leading to optimal patient outcomes. Moreover, it was suggested that staff perceptions of a leader's competence, experience, status, and supportiveness are positively related to trauma team performance and patient outcomes.

A 2010 cross-sectional empirical study examined the relationships between staff perceptions of patient safety climate variables and a composite measure of in-hospital adverse events (Mardon, Khanna, Sorra, Dyer, & Famolaro, 2010). The study sample consisted of 179 U.S. hospitals that had voluntarily submitted survey data from 56,480 staff to the 2007 Hospital Survey on Patient Safety Culture (HSOPS) Comparative Database. The Agency for Healthcare Research and Quality's (AHRQ) HSOPS survey collects data on 15 climate variables including 2 on perceptions of leadership support for safety (i.e., "senior management support for patient safety" and "supervisor/manager expectations and actions promoting safety"). The bivariate analyses revealed that both of these patient safety climate leadership variables were negatively and significantly associated with the adverse events composite measure. However, these relationships became non-significant in a multiple linear regression analysis that adjusted for hospital characteristics (i.e., teaching status, bed size, and ownership) and other climate

variables, suggesting the need for further empirical work to evaluate the effects of leadership on safety outcomes in a hospital setting. In keeping with these findings, it is proposed that:

Hypothesis 1a: *Perceptions of senior leadership support for safety will be positively associated with overall patient safety perceptions and overall patient safety grade. However, perceptions of senior leadership support for safety will be negatively associated with turnover intention (see figure 1.2).*

Hypothesis 1b: *Perceptions of supervisory leadership support for safety will be positively associated with overall patient safety perceptions and overall patient safety grade. However, perceptions of supervisory leadership support for safety will be negatively associated with turnover intention (see figure 1.2).*

Mindful Organizing

The processes of enabling (which occurs, in part, by the role that leadership plays as just described) creates contexts where safety is given priority over other organizational or departmental goals (e.g., production), thereby strengthening safety climate; however, enabling by itself is not sufficient to produce a safety culture. Frontline staff must also consistently engage in safety enacting practices/behaviours to reduce hospital errors (Singer & Vogus, 2013b; Vogus, Sutcliffe, & Weick, 2010).

High reliability organizations (HROs), such as nuclear power plants, are able to operate almost error free in highly complex and tightly coupled environments. There is growing realization that healthcare organizations can reduce the occurrence of preventable errors by implementing safety enacting practices/behaviours from HROs. These safety practices are characterized by five interrelated processes of mindful organizing – a) continuous tracking of small failures, b) resisting oversimplifications, c) attending to the needs of frontline operations, d) developing capabilities for resilience, and e) migrating decision making towards expertise

(Weick & Sutcliffe, 2007; Weick, Sutcliffe, & Obstfeld, 1999; Shrivastava, Sonpar, & Pazzaglia, 2009). The first three principles of mindful organizing help an organization prevent unexpected errors while the last two principles help mitigate errors that have already transpired before they can develop into debilitating disasters.

Before discussing the processes of mindful organizing in more detail, it is important to note here that Vogus and Sutcliffe (2007a) originally conceived mindful organizing as a safety climate dimension. However, Zohar (2008) has argued that mindful organizing is an example of 'proactive' or 'extra-role' behaviours resulting from work-ownership climate – he describes the relationship between work-ownership climate and mindful organizing in a similar manner to the antecedent-outcome relationship that exists between safety climate and safety behaviours. The current study adheres to Zohar's (2008) conceptualization of mindful organizing as employees' discretionary or voluntary extra-role behaviours that are distinct from safety behaviours such as safety specific teamwork or communication among employees.

Preoccupation with failure implies that HROs pre-emptively seek out weak signals of any failure or near miss and respond to these weak signals strongly as they might be indicators of much larger system wide problems (Weick & Sutcliffe, 2007). HROs accomplish the task of continuous tracking of small failures by fostering a climate of openness where employees feel safe to report and discuss errors (Weick, Sutcliffe, & Obstfeld, 1999). For example, increased rates of needle pricks suffered by the cleaning staff in an emergency department can either be ignored as irrelevant or seen as weak signals that the cleaning staff are handling medical waste without carefully surveying the surrounding areas. A hospital preoccupied with failures will respond to this weak signal with a strong response such as improving the quality of training

given to the cleaning staff or increasing the number of cleaning staff assigned to the ED so that they do not feel rushed while performing their daily activities.

HROs are **reluctant to simplify** contexts, expectations, and actions by using generic categories and labels. Categorization of information is unavoidable; however, over reliance on generic categories can create blind spots that conceal early signs of unexpected events (Weick, Sutcliffe, & Obstfeld, 1999; Weick, 1987; Weick & Sutcliffe, 2007). For example, ED patients are assigned to five different triage levels based on the severity of their symptoms (i.e., level 1 resuscitation to level 5 non-urgent). However, triage is not a static process as the symptoms of a given patient can fluctuate quite rapidly necessitating reassessment and assignment to a different triage level. The problem arises when clinicians start to live-up to these labels by treating level 4 (less urgent) and level 5 (non-urgent) patients as though they are of low significance. When low significance or value is assigned to a task, workers are more likely to act mindlessly and pay less attention while completing such a task (Weick & Sutcliffe, 2007). In essence, generic categories (e.g., less urgent, non-urgent, urgent) can blind the ED staff and prevent them from detecting small discrepancies in the symptoms of patients. As a consequence, HROs simplify mindfully and take conscious steps to complicate their assumptions and simplifications. HROs complicate their simplifications by (a) seeking out disconfirming evidence to refine their existing expectations, (b) cultivating conceptual slack or requisite variety, that is, the presence of analytical variance on technologies, structures, processes etc., and (c) emphasizing respectful communication so team members with divergent views can reach a general or working consensus.

Sensitivity to operations in HROs is described as having a bubble or a higher level of situational awareness (Weick, Sutcliffe, & Obstfeld, 1999; Weick & Sutcliffe, 2007). This implies that members of an organization are able to integrate a number of diverse inputs from their environment to construct a cognitive map of frontline operations and be continuously able to update this map as new information becomes available. Due to human cognitive limitations, no single individual is able to develop a complete cognitive map of frontline operations. Therefore, sensitivity to operations is a shared undertaking that requires team/unit/organization members to speak-up and openly share information with each other (Weick, Sutcliffe, & Obstfeld, 1999). Furthermore, rapid allocation of resources by leaders to fulfil an evolving need at the frontlines is an essential ingredient for achieving sensitivity to operations.

Commitment to resilience involves containing an unexpected error in real time while having incomplete information on its etiology, progression, and potential solutions (Sutcliffe & Vogus, 2003; Weick & Sutcliffe, 2007; Weick, Sutcliffe, & Obstfeld, 1999). HROs develop their resilience capabilities by fostering strategies such as improvisation, conceptual slack, respectful communication, reliance on generalist teams, and formation of temporary networks of knowledgeable members to overcome an unexpected event. In a hospital setting, all these strategies are apparent each time a code blue (i.e., a patient in need of resuscitation) is announced over a public-address system.

Deference to expertise occurs when problems are linked with expertise and decision-making responsibility migrates (both up and down) to a person or a group with specific knowledge of the problem (Weick & Sutcliffe, 2007; Weick, Sutcliffe, & Obstfeld, 1999). Most traditional organizations defer to hierarchical authority and decisions are exclusively made by

senior management. Hierarchical authority structures also exist in HROs but these organizations have learned to loosen these structures for effective real time decision making.

Much of the empirical evidence on the capacity of mindful organizing to minimize occurrences of errors/failures comes from outside of the healthcare domain. These studies can be grouped under two broad categories: a) direct observations of operations at highly successful HROs (e.g., heedful interrelating on aircraft carriers by Rochlin, LaPorte, & Roberts, 1987) and b) retrospective investigations of disasters/near disasters (e.g., Three Mile Island by LaPorte, 1982; Mann Gulch fire disaster by Weick, 1993; Columbia disaster by Weick, 2005).

In the healthcare domain, empirical research on mindful organizing and safety outcomes is limited. Weick and Sutcliffe (2003; 2007) conducted a descriptive retrospective analysis of excessive paediatric cardiac surgical deaths at Bristol Royal Infirmary (BRI) in England where the mortality rate of open heart surgery for children under 1 year of age was approximately twice that of the other 11 paediatric cardiac surgical centers in five of the seven years between 1988 and 1994. The retrospective analysis of the BRI culture suggested that all five principles of mindfulness were violated resulting in a higher mortality rate compared to other paediatric programs. For example, a culture of blame and fear persisted at BRI resulting in under-reporting of medical errors – violation of preoccupation with failure; deaths were simplistically labeled as either anomalies or overly complex cases – violation of resisting oversimplifications; there was no dedicated pediatric cardiac surgeon at BRI – violation of sensitivity to frontline operations; the nursing staff felt that they received conflicting treatment orders from anesthetists and surgeons hindering the ability of the ICU unit to successfully contain and bounce back from adverse events – violation of commitment to resilience; safety concerns raised by a consultant

anesthetist were repeatedly ignored by the senior leadership – violation of deference to expertise.

Vogus and Sutcliffe (2007a) conducted a cross-sectional study for the development and validation of the Safety Organizing Scale (SOS). Data were collected from 1,685 registered nurses in 125 clinical units at 13 U.S. hospitals. The 9-item SOS, based on the 5 principles of mindful organizing, was found to have good psychometric properties. Further, results of the study suggested that higher mindful organizing at nursing units resulted in fewer reported medication errors and patient falls for a subsequent 6 months' period. Similarly, a cross-sectional survey study conducted at 78 nursing units in 10 U.S. acute-care hospitals found a statistically negative relationship between mindful organizing and reported medication errors (Vogus & Sutcliffe, 2007b). Interestingly, the study also found that presence of a nurse manager who is perceived as fair, supportive, and trustworthy amplify the impact of mindful organizing on reducing medication errors. In keeping with these findings, it is proposed:

Hypothesis 2: *Perceptions of mindful organizing will be positively associated with overall patient safety perceptions and overall patient safety grade. However, it will be negatively associated with turnover intention (see figure 1.2).*

Teamwork Climate

The modern health care delivery system is highly decentralized where important stakeholders such as primary care physicians and hospitals often operate in silos leading to poor communication of patient information (e.g., medical history, prescribed medications etc.) and infrequent coordination of patient care across different settings (e.g., primary care, emergency department, home care etc.). This cottage industry operating structure leads to fragmented care, loss of patient information, wasted resources, unnecessary handoffs,

frustrated medical professionals and patients, and preventable medical errors (Institute of Medicine, 2001). In the past, health care delivery was primarily concerned with the diagnosis and treatment of acute illnesses. Consequently, highly specialized professionals operating in silos were often sufficient to provide appropriate treatment to patients. However, changing disease patterns and growing complexity of care delivery have now necessitated the healthcare system to emphasize teamwork behaviours including open communication (Sutcliffe, Lewton, & Rosenthal, 2004) and semi-synchronous cooperation (Berlin & Carlstrom, 2008) across providers and provider groups in order to reduce medical errors and improve patient safety outcomes (e.g., Berwick, 2003; Institute of Medicine, 2000).

There is emerging empirical evidence linking staff perceptions of teamwork climate and safety outcomes in hospitals. For example, in the cross-sectional study by Mardon and colleagues described above, they also examined the relationship between staff perceptions of teamwork and a composite measure of in-hospital adverse events (Mardon, Khanna, Sorra, Dyer, & Famolaro, 2010). The bivariate analysis revealed that the relationship between staff perceptions of teamwork and adverse events composite measure was negative and statistically significant. This relationship remained negatively significant in the linear regression analysis that adjusted for hospital characteristics (e.g., teaching status) and other patient safety related variables (e.g., nonpunitive response to error).

In a recent multivariate cross-sectional survey study, data were collected from staff on 136 acute psychiatric wards in England to examine the relationships between ward/unit leadership, teamwork climate, ward structure (e.g., ward rules and procedures), staff burnout, staff attitudes towards patients (e.g., feelings of warmth, absence of anger), conflict (i.e.,

harmful behaviours of psychiatric patients such as substance use, aggression towards staff, and self-harm etc.) and containment (i.e., staff actions to prevent or contain harmful behaviours of patients including the use of manual restraints and sedating medications) (Bowers, Nijman, Simpson, & Jones, 2011). Structural equation modeling (SEM) suggested that ward structure, burnout, and attitudes towards patients were all more strongly influenced/determined by teamwork climate and to a lesser degree by unit leadership. Moreover, cluster analysis found that better functioning wards (N = 78) used significantly fewer (undesirable) containment methods (i.e., 10% fewer) compared to the wards (N = 56) with poorer scores on teamwork climate, unit leadership, and burnout even though both clusters of wards experienced similar rates of conflict per day.

Similarly, negative perceptions of teamwork climate are associated with increased odds of poor surgical outcomes (Mazzocco et al., 2009) while positive perceptions of teamwork climate are associated with positive safety outcomes including reduced incidence of unexpected cardiac arrests (Buist et al., 2002). Fortunately, teamwork behaviours can be taught and teamwork enhancing strategies including checklists (e.g., Pronovost et al., 2006) and crew resource management (e.g., Haller et al., 2008) have shown promise in improving safety in healthcare settings. In keeping with these findings, it is proposed:

Hypothesis 3: *Teamwork climate perceptions will be positively associated with overall patient safety perceptions and overall patient safety grade while being negatively associated with turnover intention (see figure 1.2).*

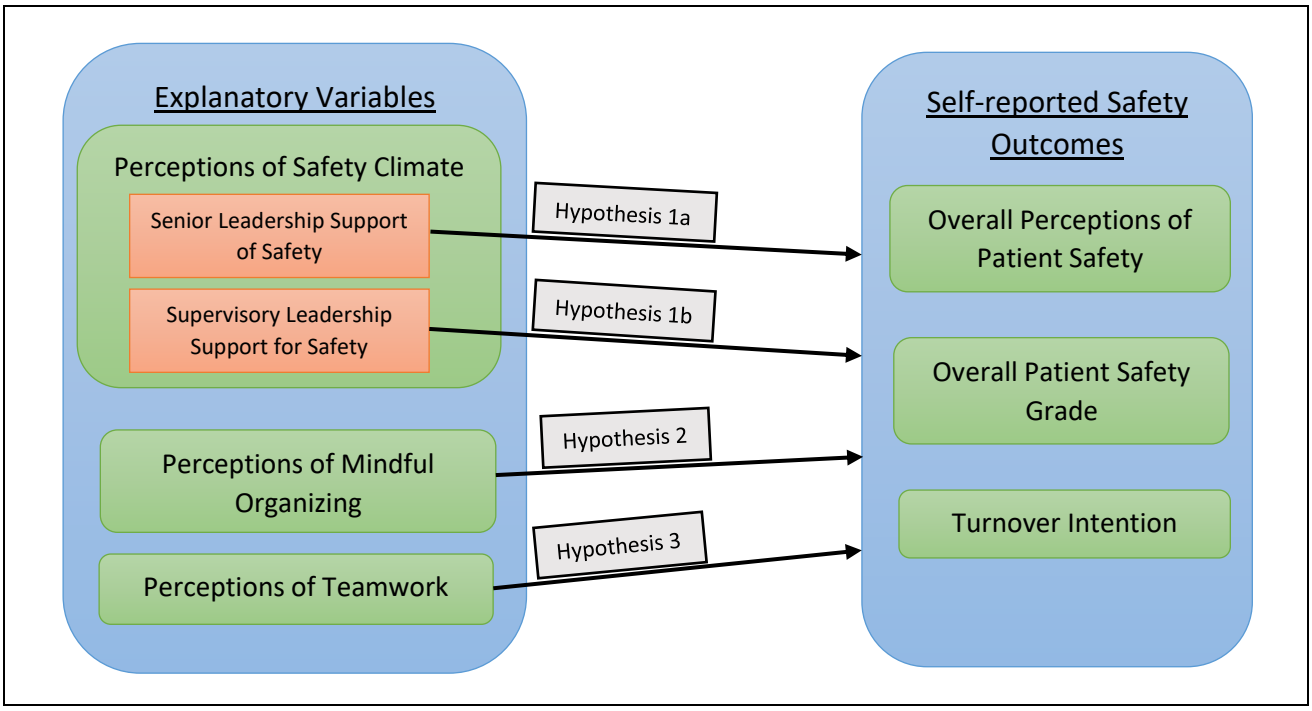

Figure 1.2: Study Hypotheses

Justification for the Current Study

The healthcare research community has made important inroads in understanding the role of context-related factors in improving staff and patient safety, however, certain literature gaps still remain. The current study will attempt to address five specific literature gaps: (1) underuse of qualitative or mixed methods research (Woodward et al., 2010), (2) lack of empirical research rooted in theory (Singer & Vogus, 2013a), (3) limited empirical evidence of the beneficial impact of certain contextual factors (e.g., mindful organizing) on safety outcomes while being primarily focused on understanding the perceptions of nurses, (4) relegation of climate strength as a mere statistical hurdle to justify aggregation of individual level climate data to team/unit level (Ginsburg & Oore, 2015), and (5) imprecise conceptualization of the safety climate construct (Zohar, 2008). First, much of the empirical research on contextual factors has employed quantitative time-series, before-and-after, or cross-sectional research

designs (Woodward et al., 2010). However, context-related factors such as climate and culture are inherently socially constructed phenomenon and greater use of qualitative or mixed methods designs can provide valuable insights that may be missed by over-reliance on quantitative research (Singer & Vogus, 2013b; Turner & Gary, 2009). Second, there is a need for the empirical research focused on contextual factors including safety climate/culture to rely more heavily on conceptual models driven by theory (Singer & Vogus, 2013a). Third, most of the empirical research on leadership and safety in healthcare settings has primarily focused on senior leadership behaviours that can improve perceptions of safety climate (e.g., Frankel et al., 2008; Thomas et al., 2005). In loosely coupled organizations such as hospitals, staff distinguish between the safety priorities of senior and unit leadership, leading to staff perceptions of two concurrent levels safety climate (Zohar, 2000; Zohar, 2008; Zohar & Hofmann, 2012). However, only a handful of empirical studies have attempted to simultaneously evaluate the impact of staff perceptions of senior and supervisory leadership on safety outcomes (e.g., Zohar, Livne, Tenne-Gazit, Admi, & Donchin, 2007). Similarly, there is limited empirical work on mindful organizing in medical settings and the research that does exist has focused exclusively on perceptions of nurses (e.g., Vogus and Sutcliffe, 2007a). Fourth, in organizational literature, climate strength has primarily been treated as a statistical hurdle for the justification of aggregating individual level climate data to team/unit level. This has resulted in an incomplete understanding of the climate construct as a lack of consensus among the team members on climate perceptions is often ignored (Ginsburg & Oore, 2015; Singer & Vogus 2013a). Fifth, there has been a proliferation of safety climate dimensions, many of which can arguably be considered *antecedents* or *outcomes* rather than *components* of safety climate (Zohar, 2008)

and it has been suggested that we return to a more focused definition of safety climate for conceptual, measurement, and practical purposes (Singer & Vogus, 2013a). A return to a more focused definition of safety climate will help the research community to distinguish this concept from other safety related dimensions so we can better understand its antecedents and its effects.

The aim of the current empirical study is to draw on high reliability theory and utilize a mixed methods approach to examine more holistically the influence of nurses, allied health professionals, and unit clerks' perceptions of leadership support for safety (i.e., safety climate), mindful organizing, and teamwork climate on self-reported perceptions of three safety outcomes (i.e., overall perceptions of patient safety, overall patient safety grade, and turnover intention), thereby addressing some important gaps in the organizational safety literature.

Chapter 2: Methods

Research Paradigms

A research paradigm can be defined in terms of ontological (i.e., what is the nature of reality?), epistemological (i.e., what is the relationship between the inquirer and research objects/subjects?), and methodological (i.e., how knowledge can be acquired?) assumptions or beliefs that mould all stages of a disciplined inquiry from the formulation of a research question to the dissemination of results (Guba, 1990; Hatch, 2002).

The research enterprise in social sciences usually adheres to one of these five research paradigms: positivism, post-positivism, constructivism, critical/feminist, and pragmatism. The ***positivists*** believe in a reality driven by universal and unchanging natural laws that exist independent of human mind (i.e., positivism relies on realist ontology). The responsibility of a researcher is to discover the true nature of reality without influencing or being influenced by the phenomenon/subjects under study (i.e., positivism relies on objectivist epistemology). The positivists primarily conduct empirical experiments that preserve the mutual exclusivity of the researcher and subjects, thereby, keeping the research process value free (i.e., positivism relies on manipulative methodology) (Guba, 1990; Hatch, 2002).

The ***post-positivists*** also believe in reality independent of human mind but they concede that its true nature is not completely discoverable because of human cognitive and perceptual limitations. Furthermore, they acknowledge that an inquirer can never achieve absolute objectivity during the research process as values are part of human psyche. However, a researcher can stay as objective as possible (i.e., post-positivism adheres to modified objectivist epistemology) while trying to discover a close approximation of the true nature of the

phenomenon under study (i.e., post-positivism relies on critical realist oncology). This is achieved by (a) being cognizant of and forthcoming on human biases and limitations, (b) relying on multiple sources of data, methods and/or investigators, and (c) subjecting the results of the study to close scrutiny by self and peers. The post-positivists seek to study a phenomenon of interest under natural settings and consequently they shy away from empirical experiments instead relying on cross-sectional and survey research. Moreover, systematic qualitative data collection (e.g., interviews and focus groups) and data analysis (e.g., constant comparison) techniques are encouraged by post-positivists to capture perspectives of participants (Guba, 1990; Hatch, 2002).

The ***constructivists*** believe in the existence of multiple realities created by individuals based on their everyday life experiences (i.e., constructivism adheres to a relativist oncology). An individual mental construction can only be elicited, refined, and understood through subjective interactions between the researcher and a participant (i.e., constructivism relies on a subjective epistemology). The aim of research is to identify all the available mental constructions of a phenomenon (i.e., hermeneutic aspect of methodology) and then find as much consensus among these individual constructions as possible through a continuous dialogue between the researcher and each of the study participant (i.e., dialectic aspect of methodology). This necessitates the inquirer to spend a considerable amount of time in the field interviewing and observing participants. Consequently, case studies and naturalistic inquiries are the archetypical research methods used by constructivists (Guba, 1990; Hatch, 2002).

The ***critical theorists*** believe that deeply entrenched social structures (e.g., neo-liberal capitalism) lead to the (a) clustering of resources and power in the hands of business elites, and (b) differential outcomes for individuals based on race, gender, and social class. Through sustained subjective interactions and dialogue, an inquirer seeks to raise awareness or consciousness of the oppressed study participants about the true nature of these real social structures (i.e., critical theory adheres to realist ontology and subjectivists epistemology). The data collection and analysis procedures are adopted from post-positivism and constructivism such as interviews, case studies, and naturalistic inquiries. However, the primary aim of critical theory research is to facilitate revolutionary or transformative action in order to improve the living conditions of marginalized individuals. Consequently, the methodology of critical theory is referred to as transformative (Guba, 1990; Hatch, 2002).

The ***pragmatists*** reject the duality between an objective (as in postpositivism) and a subjective (as in constructivism) reality. Pragmatists believe that reality exists both in the mind as well as independent of the mind. Instead of focusing on ontological and epistemological concerns, the focus should be on better understanding a research problem by relying on pluralistic methodological approaches (Creswell, 2009; Morgan, 2007). The current mixed methods study adheres to pragmatic philosophical assumptions and relies on both quantitative and qualitative approaches to grasp an expanded/enriched understanding of constructs and/or hypotheses.

Mixed Methods Study Design

The issues facing the health sector are complex requiring interdisciplinary solutions, making mixed methods designs ideal for conducting research in this setting. There are several

classification systems of mixed methods designs in social and health sciences research (Creswell & Plano Clark, 2007). Creswell (2009) identified 6 types of mixed methods designs based on four important aspects of timing, weighting, mixing, and theorizing. Timing refers to whether quantitative and qualitative data collection occurs concurrently (i.e., in a single phase) or sequentially (i.e., in distinct phases). Weighting refers to whether quantitative or qualitative research is given priority in a study. Mixing of quantitative and qualitative data can occur at data collection, data analysis, and/or interpretation stages. Lastly, a mixed methods study may or may not utilize a theoretical perspective to guide the entire design.

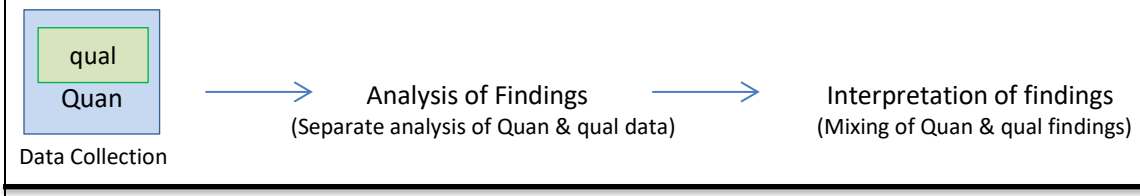

Figure 2.1: Concurrent Embedded Mixed Methods Design (adopted from Creswell, 2009)

The *current study* utilized the concurrent embedded mixed methods design during which:

a) Quantitative survey data and qualitative semi-structured interview data were collected concurrently, in a single phase, over a four-month period (September 30th, 2015 – February 1st, 2016).

b) Analyses of quantitative survey data and qualitative semi-structured interview data occurred separately.

a) Mixing of quantitative results and qualitative findings occurred at the discussion stage of the current dissertation project where participants' direct quotes from semi-

structured interviews were used to provide a more nuanced understanding of the relationships among the study variables (see figure 2.1).

Setting

The current study was conducted at a large community hospital, located in Southern Ontario. The hospital has approximately 400 inpatient beds and offers a variety of speciality services including cancer care, cardiac care, paediatrics and mental health services.

Sampling

For the current study, data were obtained from frontline nurses (RNs and RPNs), allied health professionals (e.g., occupational therapists, social workers, respiratory therapists, physiotherapists, pharmacists), and clerical staff who worked on one of the four participating clinical units (i.e., ICU, general medicine, adult inpatient mental health, and ED). The rationale for picking these 4 specific units was threefold: empirical research has shown that (a) staff perceptions of safety climate differ between hospital work areas (e.g., ED staff perceive weaker safety climate than staff from ICU, operating room, and post-anesthesia care unit) (Singer et al., 2009a), (b) rates of adverse events are significantly higher in complex clinical settings (e.g., EDs) compared to less complex practice settings (Brennan et al., 1991; Thomas et al., 2000), and (c) EDs and ICUs may attract greater resources due to greater case acuity, specialized focus, and higher status of physicians and nurses. By contrast, clinical areas such as mental health have been noted for resource scarcity, quality issues, and inadequate staff training (Armstrong et al., 2009) that may lead to negative staff perceptions of patient safety.

The current study's inclusion criteria included frontline clinical staff (i.e., those in direct contact with patients including nurses, allied health professionals, and unit clerks) who have worked for at least six months on one of the four participating clinical care units. The exclusion criteria included anyone with a leadership role (e.g., nurse manager, nurse educator etc.) or anyone who is not in direct contact with patients receiving care on a given unit (e.g., clerical staff responsible for administrative duties such as booking appointments for a nurse manager).

Physicians were not invited to participate in the current study for three inter-related reasons. First, it is difficult to enlist them in patient safety improvement initiatives (Wachter, 2010). In research, for instance, this has often translated into low physician survey response rates when compared to other clinical staff (e.g., Singer et al., 2009a). Second, only a small number of full time physicians worked on two of the participating clinical units (i.e., general medicine and mental health). Moreover, unlike nurses and unit clerks, physicians are often not physically present on a clinical unit throughout a shift, making it difficult to recruit them given the current study's data collection procedures (discussed in the next section). Third, physicians are more likely to be informally considered team leaders by other clinical staff. This would have further limited the pool of potential physician participants given the current study's exclusion criteria.

Survey Sample

The four participating clinical units rely on a variety of casual clinical staff to provide appropriate care for their patients. Many of these casual clinicians met the study's inclusion criteria, however, it was not feasible to acquire accurate staffing numbers from the hospital /unit manager as these casual staff are often supplied by the healthcare staffing agencies and

are assigned to a given clinical unit based on need. During survey data collection, the aim was therefore to approach and recruit as many eligible full-time and part-time frontline clinical staff as possible by using non-probability convenience and snowball sampling procedures. The primary researcher visited each of the participating clinical unit for 4-6 weeks to distribute surveys. These on-site visits were spread across both the day and night shifts so the researcher could meet and give surveys to as many eligible staff as possible. In total, 245 eligible clinical staff (i.e., ICU = 66, General Medicine = 49, ED = 88, and Mental Health = 42) were given a survey by the primary researcher during the 4-6 months' data collection period (4 units visited consecutively for approximately 6 weeks each = 6 months on site). On very rare occasions, clinical staff that met the study's inclusion criteria refused to take a survey from the researcher (i.e., ICU = 2, ED = 1, and Mental Health = 1).

Semi-Structured Interview Sample

For logistical and practical reasons, it was decided from the outset of the research project to limit the total number of semi-structured interviews conducted on each participating clinical unit to a manageable number. First, the hospital's ethics board granted approval for the study with the understanding that the data collection phase would be completed within a 4-month time period. Second, there was resistance from nurse managers around granting the research team access to their clinical units as they had concerns the study would require too much time commitment from frontline clinical staff. Given these practical concerns, five to six semi-structured interviews, lasting an average of 30 to 40 minutes each, were planned for each participating clinical unit.

A non-probability quota sampling procedure was utilized to recruit participants for the semi-structured interviews. This sampling procedure was utilized to ensure that at least one member of each of the targeted professional groups (i.e., RNs, RPNs, allied health professionals, and clerical staff) was interviewed if a professional group had more than 5 full time members on staff on a participating clinical unit (see table 2.1). The use of this type of quota system is a common approach for improving the quality of samples obtained through non-probability sampling procedures (Fowler, 2009). To accomplish this task, full time staffing numbers at each participating clinical unit were obtained from nurse managers.

Table 2.1: Interview Participants per Unit

	ICU		General Medicine	
	Full Time Staff	# of Interview Participants	Full Time Staff	# of Interview Participants
RPN	0	0	17	1
RN	80	3	27	3
AHP	10	2	7	1
Clerical Staff	3	0	2	0
	ED		**Mental Health**	
	Full Time Staff	# of Interview Participants	Full Time Staff	# of Interview Participants
RPN	1	0	20	2
RN	79	3	40	3
AHP	4	0	4	0
Clerical Staff	17	1	3	0

Data Collection Procedures

The primary researcher visited the participating hospital for approximately 2 times per week from September 30th, 2015 to February 1st, 2016 to collect data from the 4 clinical units. However, the data collection was interrupted twice: once in late November – early December for 2 weeks as the primary researcher needed time to recover from influenza and the second time in late December – early January for another 2 weeks due to Christmas – New Year

holidays. On average, the primary researcher's visits on each unit were spread over a 4 to 6 weeks' time period (see table 2.2).

The nurse manager was the primary logistical/contact person for each participating clinical unit. Each nurse manager helped identify time periods on a given day when frontline clinical staff may have sufficient slack time to participate in the study. This allowed the collection of data while having a minimal impact on clinical care provided by the frontline clinical staff.

On each of the 4 clinical units, survey and interview data were collected in a single phase. However, during the first few days on a given unit, the researcher primarily focused on building rapport with the frontline clinical staff and only distributed surveys. On subsequent days, both survey and interview data were collected on that unit. A clinical staff person participated in an interview only after the primary researcher had built good rapport with him/her and successfully recruited that individual to complete the survey on a previous occasion, e.g., at a different time, shift, day, or week. Collection of survey and interview data from any single individual were separated by several days to limit people's tendency to try to make their survey and interview data internally consistent. More detailed data collection procedures for surveys and interviews are discussed below.

Table 2.2: Data Collection Timeline

Unit	Start of Data Collection	End of Data Collection	Total # of Days On-site
ICU	September 30th, 2015	November 16th, 2015	10
General Medicine	October 14th, 2015	November 16th, 2015	8
Mental Health	November 16th, 2015	February 1st, 2016	11
ED	November 18th, 2015	February 1st, 2016	9

Survey - Data Collection Procedures

The primary researcher was responsible for all facets of survey data collection on each of the 4 clinical units. A short oral presentation (< 1 minute in length) was prepared to solicit frontline clinical staff participation in the survey. This oral presentation introduced each potential survey respondent to the: a) study's aim (i.e., the examination of patient safety perceptions of frontline clinical staff), b) inclusion criteria, c) and survey characteristics (i.e., voluntary, anonymous, cross-sectional, 29 items). Furthermore, each potential participant was informed that: a) the study's ethics approval was obtained from the hospital's Ethics board and b) the results will be shared with the staff at the completion of data analyses. The primary researcher handed out surveys to only those clinical staff that acknowledged that they meet the study's inclusion criteria and are willing to participate in the study. Survey respondents were asked to indicate the clinical unit they work on; however, no individual identifiers were solicited (i.e., survey data were anonymous).

A survey drop-box was placed at each participating clinical unit to ensure that frontline clinical staff felt safe while returning completed surveys. As a small inducement to participate, chocolates were handed out to participants during the distribution of surveys and a $20 gift card raffle draw was held on the final day of data collection on each participating clinical unit.

Semi-Structured Interviews - Data Collection Procedures

An interview guide consisting of open-ended questions with multiple probes was utilized to help keep discussions focused on study variables (the interview guide can be found in Appendix 1). These open-ended questions and associated probes solicited staff perceptions of how (a) safety climate (i.e., senior and supervisory leadership support for safety) and (b)

teamwork climate influence safety outcomes at their clinical unit – the key variables of interest in this study's conceptual model. The interviewer took hand-written notes and each session was audio recorded to ensure accuracy and to facilitate subsequent data transcription and analyses.

All semi-structured interviews were conducted on-site and each nurse manager was responsible for providing access to office space on their respective clinical unit where the primary researcher conducted interviews. Before the start of an interview, the participant was provided with a consent form (two copies – one of these copies was kept by the participant for his/her personal record). The consent form: (a) highlighted details of the study (e.g., purpose and procedures), (b) assured confidentiality of the collected data, and (c) provided contact information of the research team. An interview commenced only after the participant: (a) read and signed the consent forms, and (b) received adequate answers to any questions he/she had relating to the study. At the end of each interview, a $5 gift card was given to the participant as a small token of appreciation for participating in the study.

Privacy and confidentiality of participants was assured to the fullest extent possible by law. During the transcription process, all instances where names of individuals were mentioned in an interview were removed (i.e., interview data were anonymized). Finally, participants were assured of confidentiality in any final reports/publications arising from this research (i.e., they were informed that only aggregate results will be reported).

Ethics

Ethics approval for the study was obtained from both the participating hospital's Ethics Board and the Human Participants Review Sub-Committee, York University's Ethics Review Board (Certificate #STU 2016 - 016).

Quantitative Survey Measures

A standardized 29-item survey instrument was constructed from previously validated scales to assess frontline health care staff (i.e., nurses, allied health professionals, unit clerks) perceptions of safety climate, teamwork climate, mindful organizing, overall perceptions of patient safety, overall patient safety grade, and turnover intention – study variables used in this research project which are described in detail below. In addition, the questionnaire collected demographic characteristics (i.e., age, tenure on unit, profession, and gender) from the survey respondents.

Senior and Supervisory Leadership Support for Safety

Senior leadership support for safety and supervisory leadership support for safety dimensions of safety climate were measured using the Canadian Patient Safety Climate Survey (Can-PSCS) (Ginsburg et al., 2014). The Can-PSCS is a 19-item theory based instrument that has strong psychometric properties validated by confirmatory factor analysis and is currently being used across a number of care settings as part of Accreditation Canada's Qmentum Accreditation Program.

The senior leadership support for safety scale has four items (e.g., "s*enior management considers patient safety when program changes are discussed*") and reflects staff perceptions of senior leadership commitment to patient safety (see table 2.3). The supervisory leadership

support for safety scale has two items (e.g., "*my supervisor/manager seriously considers staff suggestions for improving patient safety")* and reflects staff perceptions of frontline-level leadership commitment to patient safety (see table 2.3). Senior and supervisory leadership support for safety were both previously shown to have strong internal consistency reliability, $\alpha > 0.80$ (Ginsburg et al., 2014). Both of these safety climate dimensions were measured using a five point Likert scale where 1 corresponds to "strongly disagree" and 5 corresponds to "strongly agree".

The Safety Organizing Scale (SOS)

The Safety Organizing Scale (SOS) captures the 5 principles of mindful organizing and consists of 9 items (e.g., "*when errors happen, we discuss how we could have prevented them")*, each measured on a seven point Likert scale (1 = "not at all", 2 = "to a very limited extent", 3 = "to a limited extent", 4 = "to a moderate extent", 5 = "to a considerable extent", 6 = "to a great extent", and 7 = "to a very great extent") (see table 2.3).

The internal reliability, convergent validity (i.e., the degree to which items in a scale converges on the same construct), discriminant validity (i.e., the degree to which a construct differs from other theoretically related constructs), and criterion validity (i.e., the ability of a scale to show expected relationships with its theoretically proposed causes and effects) of the SOS scale were assessed in a cross-sectional survey study of 1685 registered nurses from 125 clinical units in 13 US hospitals (Vogus & Sutcliffe, 2007a). The confirmatory factor analysis (CFA) showed that 9 items of the SOS scale were reflective of a single underlying factor providing evidence for the convergent validity of the scale. Moreover, CFA modelling showed that items associated with SOS and two related safety climate constructs (i.e., trust in manager

and employee commitment) loaded onto a 3-factor measurement model, lending support for the discriminant validity of the SOS scale. The multilevel regression analyses lent support for the criterion validity of the scale as SOS was negatively related to reported medication errors and reported patient falls while positively related to trust in manager and employee commitment. In addition, the SOS scale was shown to have high internal consistency reliability (Cronbach's alpha = 0.88). The psychometric properties of the SOS scale have also been examined in nursing home settings (Ausserhofer, Anderson, Colon-Emeric, & Schwendimann, 2013), indicating that staff with different clinical backgrounds can easily understand and complete this scale.

Teamwork Climate

The Safety Attitudes Questionnaire (SAQ) has good psychometric properties and can be administered across a variety of care settings to evaluate frontline staff attitudes about 6 safety related domains (Sexton et al., 2006a). In the current study, the SAQ teamwork climate scale was used to measure staff perceptions about quality of teamwork on their respective care units. The SAQ teamwork climate scale has 6 items (e.g., "*the physicians and nurses here work together as a well-coordinated team"*), each measured on a five point Likert scale (1= "disagree strongly" to 5 = "agree strongly") (see table 2.3). The SAQ teamwork scale was found to have good psychometric properties at the individual (Etchegaray & Thomas, 2012) and unit level (Sexton et al., 2006b) of analysis in hospital settings.

Outcome Variables

The current study utilized 3 self-reported safety outcomes. Two of the safety outcomes were taken from the Agency for Healthcare Research and Quality (AHRQ) Hospital Survey on

Patient Safety Culture (HSOPSC): overall perceptions of patient safety and overall patient safety grade (AHRQ, 2015). The HSOPSC overall perceptions of patient safety scale has 4 items (e.g., "*we have patient safety problems in this unit*"), each measured on a five point Likert scale (1= strongly disagree to 5 = strongly agree). The overall perceptions of patient safety scale was previously shown to have strong internal consistency reliability, $\alpha > 0.76$ (Etchegaray & Thomas, 2012). The overall patient safety grade has one item that asks to select a letter grade (A= excellent to E = failing) for the clinical unit's performance on patient safety (see table 2.3).

Turnover intention is the final safety outcome that was utilized in the current study. This 3-items (e.g., "there is a good chance that I will leave this job in the next year or so") scale has good psychometric properties – e.g., Cronbach's $\alpha > 0.80$ (Alexander, Lichtenstein, Oh, & Ullman, 1998; Lichtenstein, Alexander, McCarthy, & Wells, 2004). Each of the 3 items are measured using a seven point Likert scale where a higher score indicates a higher likelihood that a person would quit his/her current job (see table 2.3).

Senior leadership support for safety, supervisory leadership support for safety, mindful organizing, teamwork climate, and the three outcome variables were all treated as continuous variables in the current study (see Assumptions of Multiple Linear Regression section on page 46 for justification). The negatively phrased items (i.e., 4d, 5c, 5d, 5h) associated with these scales were reverse coded to ensure that a high score on an item corresponded to a high score on a scale. However, we did not reverse code the three negatively phrased items associated with turnover intention scale (i.e., 5e, 5f, 5g) as it made intuitive sense that a high score on the scale corresponded to higher intention to leave.

Missing scores on items were imputed using Expectation-Maximization (EM) estimation (see Chapter 3) and a mean score for each scale was then calculated for every survey respondent. However, it is recommended that statistical analyses should be run both with and without missing data imputations as that lends credence to a study's findings (Tabachnick & Fidell, 2001). Consequently, in order to conduct hierarchical regression analyses without missing data imputations, a mean score for each scale was calculated if a respondent answered at least half of the questions associated with a scale.

Table 2.3: Scales & Associated Items (*Note: see Appendix 2 for the full survey instrument***)**

Scale	Items
Senior Leadership Support for Safety	3a) Senior management has a clear picture of the risk associated with patient care.
	3b) Patient safety decisions are made at the proper level by the most qualified people.
	3c) Senior management provides a climate that promotes patient safety.
	3d) Senior management considers patient safety when program changes are discussed.
Supervisory Leadership Support for Safety	3e) My supervisor/manager says a good word when he/she sees a job done according to established patient safety procedures.
	3f) My supervisor/manager seriously considers staff suggestions for improving patient safety.
Teamwork Climate	4a) It is easy for personnel in this unit to ask questions when there is something that they do not understand.
	4b) I have the support I need from other personnel to care for patients.
	4c) Team input is well received in this unit.
	4d) In this unit, it is difficult to Speak Up if I perceive a problem with patient care.
	4e) Disagreements in this unit are resolved appropriately (i.e., not who is right, but what is best for the patient).
	4f) The physicians and nurses and other team members here work together as a well-coordinated team.
Safety Organizing Scale	4k) When giving report to an oncoming nurse, we usually discuss what to look out for.
	4m) We spend time identifying activities we do not want to go wrong.
	4j) We discuss alternatives as to how to go about our normal work activities.
	4g) We have a good "map" of each other's talents and skills.
	4i) We discuss our unique skills with each other so we know who on the unit has relevant specialized skills and knowledge.
	4h) We talk about mistakes and ways to learn from them.

	4n) When errors happen, we discuss how we could have prevented them.
	4l) When attempting to resolve a problem, we take advantage of the unique skills of our colleagues.
	4o) When a patient crisis occurs, we rapidly pool our collective expertise to attempt to resolve it.
Overall PS Perceptions	5a) Patient safety is never sacrificed to get more work done.
	5b) Our procedures and systems are good at preventing errors from happening.
	5c) It is just by chance that more serious mistakes don't happen around here.
	5d) We have patient safety problems in this unit.
Turnover Intention	5e) There is a good chance that I will leave this job in the next year or so.
	5f) I frequently think of quitting this job.
	5g) I will probably look for a new job in the next year.
Overall PS Grade	5h) Please give your work area/unit in this hospital an overall grade on patient safety.

Demographic Variables

The survey also obtained data on five socio-demographic variables: clinical unit, unit tenure, age, gender, and professional background. Clinical unit was categorized into four groups: “ICU”, “general medicine”, “ED” and “mental health”, while tenure in a given clinical unit was categorized into three groups: “6-24 months”, “2-5 years” and “> 5 years”. Age was categorized into five groups: “$\leq$ 30 years”, “31-40 years”, “41-50 years”, “51-60 years” and “> 60 years”. Professional background was categorized into four groups: “registered practical nurse”, “registered nurse”, “allied health professional” and “clerical staff”, while gender was categorized into two groups: “female” and “male”.

All five of these demographic variables were transformed into multiple categorical variables (dummy variables) in order to use them in hierarchical regression analyses. A dummy variable must represent at least five percent of a study’s sample to carry statistically meaningful information (Katz, 2006). Consequently, two categories of age (i.e., 51-60 years and > 60 years) were combined to create a new category labelled, “$\geq$ 51 years”.

The categories of “general medicine”, “6-24 months”, “≥ 51 years”, “male”, and “clerical staff” were used as the reference groups for creating multiple categorical variables for clinical unit (3 dummy variables), tenure (2 dummy variables), age (3 dummy variables), gender (1 dummy variable), and professional background (3 dummy variables) respectively. We then used the crosstabs function in SPSS to check for the accuracy of dummy variables against the original variables.

Quantitative Statistical Analyses

Survey data were entered into SPSS in small batches, less than 20 surveys, on any given day to minimize data entry mistakes associated with fatigue. Moreover, manual double entry of survey data, considered the gold standard for electronic data entry, was utilized to minimize the possibility of data entry errors (Paulsen, Overgaard, & Lauritsen, 2012). Each survey was assigned a unique identifier at the time of data entry. This allowed the random selection and rechecking of approximately 20% of entered data for errors. Furthermore, descriptive statistics (i.e., the range, minimum and maximum values) were utilized for identifying any out of range data values. However, no data entry errors were discovered during this whole process.

Missing Values Analysis (MVA)

All quantitative analyses were carried out using the SPSS software. First, Missing Values Analysis (MVA) with Expectation-Maximization (EM) estimation was used to impute missing values for 29 non-demographic survey items. MVA is a statistical procedure which 1) identifies patterns of missing values in a data set, 2) determines whether or not these values are missing at random, and 3) calculates mean values that can be inserted in place of missing values (Dancey, Reidy, & Rowe, 2012; Tabachnick & Fidell, 2001). In SPSS, these mean values can be

calculated based on data missing pairwise, data missing listwise, Expectation-Maximization (EM) estimation, and regression. Any one of these four missing data techniques is appropriate when the amount of missing data per survey item ranges from 1 to 5 percent (Roth, 1994). However, we utilized EM estimation for imputation of missing values as this procedure preserves the relationships among the survey items and is simpler to implement compared to imputations by regression (Graham, 2009; Roth, 1994).

EM estimation produces the "Little's MCAR test" statistic. The significance level of this statistic determines whether the data are missing at random ($p > .05$ – non-significant) or not missing at random ($p < .05$ - significant). It is appropriate to insert the means generated through EM estimation for missing values if the data are found to be missing at random (i.e., the "Little's MCAR test" is non-significant). However, when the data are not missing at random (i.e., the "Little's MCAR test" is significant) then multiple regression analysis must be utilized to calculate means for missing values (Dancey, Reidy, & Rowe, 2012).

Cronbach's Alpha

Second, Cronbach's alpha values were calculated for all the main study variables (i.e., senior leadership support for safety, supervisory leadership support for safety, teamwork climate, SOS, overall perceptions of patient safety, and turnover intention) to assess their reliability in the current data set. Overall patient safety grade consisted of a single survey item; consequently, Cronbach's alpha was not calculated for this particular variable. Cronbach's alpha is a statistical test that examines the correlational strength between the items of a scale. A scale is considered internally reliable when cronbach's alpha correlation coefficient value is > 0.70 (Dancey, Reidy, & Rowe, 2012; Katz, 2006).

Bivariate & Multivariate Analyses

Third, simple bivariate analyses (Pearson r) were carried out to assess the strength and significance of relationships among the dependent and non-demographic independent variables. Pearson r values were also examined to ensure that multicollinearity was not a concern. Multicollinearity refers to the correlation strength between independent variables. High multicollinearity (i.e., $r > 0.8$) renders the results of regression analysis uninterpretable as it leads to statistically non-significant β coefficients even when R^2 is high and statistically significant (Katz, 2006; Pedhazur & Schmelkin, 1991).

Next, statistical analyses were run to determine whether or not demographic characteristics (i.e., gender, profession, tenure, and age) of the sample differed significantly across the 4 clinical units. First, chi-square statistic was calculated for each of the two nominal demographic variables (i.e., gender and profession) through the contingency table analysis. It is important to note here that the contingency table analysis has three specific assumptions: (a) categories of each nominal variable must be mutually exclusive, (b) at least one observation must be present in each cell of the table, and (c) the expected count must not fall below 5 in more than 20% of the cells (Dancey, Reidy, & Rowe, 2012). If more than 20% of the cells has an expected count of < 5 then the p-value for Fisher's exact test should be reported instead of pearson chi-square test as the Fisher's exact test is not vulnerable to low expected counts. Second, Kruskal-Wallis ANOVA was performed on each of the two ordinal demographic variables (i.e., tenure and age) to determine whether or not these variables differed significantly across the 4 clinical units. In case of a statistically significant Kruskal-Wallis test, pairwise comparisons were conducted by using the Mann-Whitney test. The p-value for each

Mann-Whitney test was adjusted using the Bonferroni correction to prevent the inflation of type 1 error rates (Dancey, Reidy, & Rowe, 2012). A type 1 error occurs when the null hypothesis is rejected when it is in fact true.

In order to test our study hypotheses, hierarchical regression analyses were utilized. Hierarchical regression analysis permits a researcher to examine the unique variance accounted for by a predictor, over and above the variance contributed by independent variables entered earlier in an analysis (Petrocelli, 2003). Demographic variables are typically good candidates for the first step in a hierarchical regression analysis (Cohen & Cohen, 1983), as they are static variables and should be entered in an analysis before the dynamic variables (Petrocelli, 2003). Hence, the current study placed the demographic dummy variables in block 1 of each hierarchical regression analysis.

The enabling, enacting, and elaborating safety culture framework stipulates that leadership behaviours shape frontline staff perceptions of senior and supervisory leadership support for safety – the enabling piece. This in turn motivates or discourages, the frontline staff to participate in safety enhancing behaviours (e.g., teamwork and mindful organizing) capable of improving safety outcomes – the enacting piece. Finally, both enabling and enacting activities can be modified, refined and enlarged through elaborating practices (e.g., team-based simulation training), resulting in the emergence of a positive safety culture over time as a consequence of a continuous cycle of enabling, enacting, and elaborating processes (Vogus, Sutcliffe, & Weick, 2010; Singer & Vogus, 2013b). However, according to the framework, the direct link between enabling and enacting activities is sequential and not bidirectional. Consequently, perceptions of enabling activities (i.e., senior leadership support for safety and

supervisory leadership support for safety) were entered in block 2 while perceptions of enacting activities (i.e., teamwork climate and safety organizing scale) were entered in block 3 of the hierarchical regression analysis. Also, it is strongly recommended to run statistical analyses with and without missing data imputations if the sample size of a study is small, the proportion of missing values are high, and/or data are not missing at random (Tabachnick & Fidell, 2001). Consequently, the hierarchical regression analysis for each outcome variable was conducted twice, once with and once without missing data imputations.

Unit of Analysis

All study hypotheses were evaluated at the individual-level. However, at the unit-level, climate profiles for participating clinical units were calculated on each of the four explanatory (i.e., senior leadership support for safety, supervisory leadership support for safety, mindful organizing, and teamwork climate) and two of the three outcome variables (i.e., overall perceptions of patient safety and overall patient safety grade) – climate profile for turnover intention was not calculated as it is truly an individual level and not a unit level construct.

The unit climate profile consists of three metrics: level, strength, and shape (Ginsburg & Oore, 2015). Simple histograms were created for visually examining and categorizing the shape of the distribution into one of the three types (i.e., normal, bimodal, or rectangular shape). Climate level per unit was calculated through a mean response score on each of the six variables. Finally, climate strength per unit was calculated by the interrater agreement (IRA) indices of r_{WG} for the single-item overall patient safety grade and $r_{WG(j)}$ for the multi-item senior leadership support for safety, supervisory leadership support for safety, teamwork climate, mindful organizing, and overall perceptions of patient safety. However, $r_{WG(j)}$ was not calculated

for turnover intention as it is truly an individual-level construct and not a group-level shared construct. Aggregation of scores is appropriate when survey respondents are rating the same object, person, or process (e.g., a nurse manager, teamwork climate), however, it is inappropriate when respondents are rating their own emotional states or intentions (Bowers, Nijman, Simpson, & Jones, 2011). The r_{WG} and $r_{WG(j)}$ can be mathematically presented by the following equations:

$$r_{WG} = 1 - \frac{S_X^2}{\sigma_E^2} \qquad \text{Equation 1}$$

$$r_{WG(J)} = \frac{J\left(1 - \frac{S_{Xj}^2}{\sigma_E^2}\right)}{1 + (J-1) * \left(1 - \frac{S_{Xj}^2}{\sigma_E^2}\right)} \qquad \text{Equation 2}$$

Where S^2_X (in equation 1) is the observed variance for a single item variable (e.g., overall patient safety grade), S^2_{Xj} (in equation 2) is the mean of the observed variances for *J* number of items of a variable, and σ^2_E (in equations 1 & 2) is the expected variance when responses of participants show a complete lack of agreement (Biemann, Cole, & Voelpel, 2012; LeBreton & Senter, 2008). The expected variance is usually based on a uniform or rectangular null response distribution (e.g., on a 5 point Likert scale, each response option has a 20% chance of being selected by a participant). However, climate survey research is prone to response leniency bias and it is recommended to use skewed null distributions during the calculation of $r_{WG}/r_{WG(j)}$ (LeBreton & Senter, 2008). Consequently, rectangular and slightly skewed null distributions were utilized in the current study. The $r_{WG}/r_{WG(j)}$ values can range from 0 (i.e., lowest agreement or highest variability among respondents on a unit) to 1 (i.e., highest agreement or lowest variability among respondents on a unit).

Assumptions of Multiple Linear Regression

Multiple linear regression is used when the outcome is an interval variable such as blood pressure, weight, and temperature. However, in clinical research, multiple linear regression is often used to analyze variables constructed from Likert type scales that may include cues such as 1 = “strongly disagree”, 2 = “disagree”, 3 = “neutral”, 4 = “agree”, and 5 = “strongly agree”. Such a scale is not truly interval because the interval between strongly disagree and disagree is not necessarily the same size as the interval between agree and strongly agree. However, when variables constructed from such Likert type scales are used as dependent variables they work satisfactorily as long as they fulfill the three assumptions of multiple linear regression: (a) the presence of a linear relationship between dependent and independent variables, (b) dependent variables are normally distributed, and (c) dependent variables have equal variance around the mean (Dancey, Reidy, & Rowe, 2012; Katz, 2006).

The linearity assumption can be tested by constructing simple bivariate scatter plots of independent versus dependent variables. Consequently, simple bivariate scatter plots were constructed between each of the non-demographic independent variables and the three dependent variables to ensure the relationships were linear (see Appendix 3). However, even if bivariate scatter plots show linear relationships, it is possible that in multiple linear regression models, a non-linear relationship (e.g., U-shape, J-shape) may emerge between independent and dependent variables due to the presence of a confounding factor (Katz, 2006).

A preferable method of detecting linearity, normal distribution, and equal variance is by plotting the residual scatter plots - scatter plots of the standardized residuals as a function of standardized predicted values (Osborne & Waters, 2002). The assumptions of linearity, normal

distribution, and equal variance are met when the residuals are close to zero and evenly distributed – symmetrical above and below zero (Katz, 2006; Osborne & Waters, 2002). In addition, Probability-Probability plot (P-P plot) of regression standardized residuals of an outcome variable can confirm normal distribution and equal variance assumptions of multiple linear regression if the P-P plot appears as a straight line (Katz, 2006). Consequently, we employed both residual scatter plots and P-P plots to make sure that assumptions of multiple linear regression are met (see Appendix 4). The standardized residuals appear to be evenly distributed and fall within the three standard deviations (i.e., there are no outliers) on each of the three residual scatter plots. Furthermore, the P-P plots for overall perceptions of patient safety, overall patient safety grade, and turnover intention appear as straight lines.

The skewness statistic for each of the three dependent variables was also calculated to determine whether or not they are normally distributed. A variable is considered skewed (i.e., not normally distributed) if the skewness value is greater than twice the standard error of skewness (Dancey, Reidy, & Rowe, 2012). Overall perceptions of patient safety and overall patient safety grade were both found to be normally distributed while turnover intention was found to be slightly skewed (see Appendix 5). However, if the sample size is greater than 100, than the central limit theorem postulates that a variable should be considered normally distributed (Katz, 2006). The sample size of the current study is > 100 and as a consequence the use of multiple linear regression is appropriate. Moreover, multiple linear regression is a fairly robust statistical procedure and only significant violations of linearity, normal distribution, and/or equal variance can erode the confidence in the validity of the results (Katz, 2006).

Qualitative Analysis

Two undergraduate research assistants transcribed all the semi-structured interviews, verbatim. Before commencing qualitative data analysis, the primary researcher: (a) compared each transcript with audio-recording of a given interview to confirm the completeness of the data and (b) anonymized the transcripts to protect the privacy and confidentiality of the participants (e.g., each interviewee was given a pseudonym).

Analytical Techniques

The qualitative analysis is a systematic process of organizing and examining data for the discovery or verification of patterns, structures, relationships, and/or theories (Hatch, 2002). A number of systematic qualitative analytical techniques have been developed and refined but it is important to first briefly outline the four dimensions/characteristics that influences the choice of an analytical technique for a qualitative study. The first dimension of ***induction-deduction*** refers to the 'place of theory' in a given study (Goetz & LeCompte, 1981; LeCompte & Preissle, 1993; Lincoln & Guba, 1985). A deductive research study begins with a theoretical perspective, operationally defines concepts related to that theory, and then evaluates whether or not the relationships between these concepts hold within the data set. On the other hand, an inductive research study begins with data collection, followed by the creation of a theory based upon the concepts and relationships discovered within the collected data. The second dimension of ***generation-verification*** refers to the 'position of evidence' in a given study (Goetz & LeCompte, 1981; LeCompte & Preissle, 1993; Lincoln & Guba, 1985). A verificative research tries to verify or falsify hypotheses that were previously proposed or developed in other scientific inquiries, that is, the creation of hypotheses is based on evidence from previous

research studies. On the other hand, a generative research tries to discover propositions or hypotheses from within the collected data, that is, the source of evidence for hypotheses creation are collected during the study.

The third dimension of ***construction-enumeration*** refers to how the 'units of analysis' – what's observed or counted by a researcher – are formulated in a study (Goetz & LeCompte, 1981; LeCompte & Preissle, 1993; Lincoln & Guba, 1985). In a constructive research, units of analysis are developed during data collection and analysis phases of a study. On the other hand, in an enumerative research, units of analysis are formulated before the start of the data collection phase of a study. The fourth dimension of ***subjective-objective*** refers to how the conceptual constructs are arrived at in a study (Goetz & LeCompte, 1981; LeCompte & Preissle, 1993; Lincoln & Guba, 1985). A subjective research relies on participants' own conceptual constructs to understand a phenomenon under study. On the other hand, an objective research relies on conceptual constructs created by external observers while trying to understand a phenomenon experienced by the study's participants. Each of these four dimensions can be viewed as being on a continuum and the two sides of a continuum are not mutually exclusive. For example, a study can rely on both subjective and objective constructs to understand a research question and/or first generate hypotheses and then verify them in a subsequent phase.

Goetz and LeCompte (1981) organized five qualitative data analysis techniques from across disciplines under a single classification umbrella by using the dimensions of induction-deduction, generation-verification, construction-enumeration, and subjective-objective (see table 2.4 and figure 2.2).

Table 2.4: Analytical Techniques & Associated Characteristics/Dimensions	
Qualitative Analytical Techniques	**Associated Dimensions**
Analytic Induction	Exclusively inductive and generative while being primarily constructive and subjective.
Constant Comparison	Exclusively inductive and generative while being primarily constructive and subjective.
Typological Analysis	An intermediate technique that is more likely to be deductive, verificative, enumerative, and objective.
Enumeration	Exclusively enumerative while being primarily deductive, verificative, and objective.
Standardized Observational Protocols	Exclusively verificative, enumerative, and objective while being primarily deductive

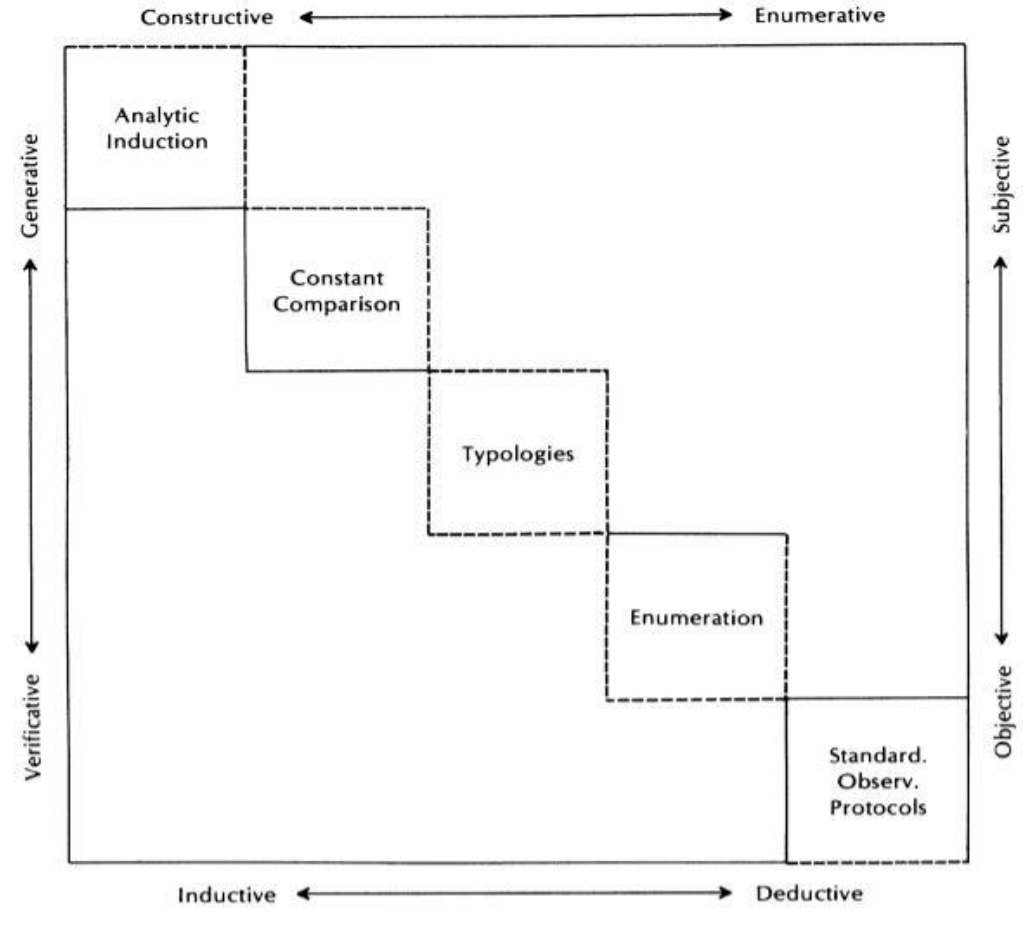

Figure 2.2: Analytical Techniques – ***a broken line indicates that a technique can employ either side of a dimension while a solid line indicates invariance (cited from Goetz and LeCompte, 1981).***

Analytic Induction involves scanning the qualitative data for the discovery of preliminary categories, patterns, themes and relationships. These preliminary concepts and relationships are continuously modified and/or refined as new information is revealed during the progression of data analysis (LeCompte & Preissle, 1993; Lincoln & Guba, 1985). An important feature of analytic induction is the conscious search for disconfirming information about a category, relationship, or hypothesis (LeCompte & Schensul, 1999). This conscious search for negative cases helps refine existing categories/relationships and protect researchers from prematurely concluded data analysis. In ***constant comparison,*** formal data analysis begins right after the collection of initial set of data. The information gleaned inductively from this initial data set is then used to refine or modify the subsequent phases of data collection (LeCompte & Preissle, 1993). In other words, constant comparison is a process of simultaneous collection and processing of qualitative data (Lincoln & Guba, 1985). Analytic induction and constant comparison are designed specifically for the generation of social theory (LeCompte & Preissle, 1993) and can be used in a wide array of qualitative studies including ethnographies, participant observation studies, grounded theory studies, and phenomenological studies (Hatch, 2002). ***Typological Analysis*** starts with the selection of pre-determined categories generated from theory, atheoretical hypotheses, and/or common sense. The initial data processing stage then involves dividing the whole data set into chunks based on these predetermined categories (LeCompte & Preissle, 1993). As typological analysis is only practical when it is easy to identify the initial categories, it is ideally suited for the analysis of interview data with fairly focused research questions (Hatch, 2002). In ***enumeration*** data analysis, frequencies of categories are counted. This necessitates that: (a) data collection methods are

consistent across sites and (b) categories are precisely identified and defined (LeCompte & Preissle, 1993). In ***standardized observational protocols*** data is collected and coded simultaneously requiring careful operationalizing and field-testing of categories before the commencement of data collection. Consequently, such protocols are used in a study only after being developed and standardized, often by other researchers (LeCompte & Preissle, 1993).

The Choice of an Analytical Technique

The choice of an analytical technique is effected by both internal (i.e., study related) and external (i.e., environment related) constraints (Goetz & LeCompte, 1981; LeCompte & Preissle, 1993). The internal constraints include: (a) the purpose/goal of the study (e.g., verification of hypotheses or generation of a theory) and (b) strategies utilized for the collection of data in a study (e.g., direct or participant observations, semi-structured interviews etc.). On the other hand, external constraints refer to resources such as time and money. It might not be feasible for a researcher with limited resources to rely on more time consuming analytical strategies such as constant comparison or analytical induction.

The current study relied on typological analysis and was deductive, verificative, enumerative, and objective. However, the study also relied upon inductive thought process to discover subjective constructs during the intermediate-late stages of data analysis (see table 2.5).

Table 2.5: Characteristics of Typological Analysis in the Current Study

Dimension Continuum	Associated Dimension
Induction-Deduction	Data analysis was primarily deductive but induction was utilized for the discovery of some categories & relationships.
Verification-Generation	Data analysis was verificative in nature as interview data was used in support of study's hypotheses.
Construction-Enumeration	Data analysis was enumerative. The units of analysis were defined as verbal episodes, that is, sentences or paragraphs

	between the beginning and end of a specific topic (e.g., teamwork climate) on any given transcript.
Subjective-Objective	Data analysis primarily relied on researcher constructs (i.e., objective constructs), however, some participant constructs (i.e., subjective constructs) were also utilized.

The typological analysis in the current study was implemented in 6 sequential steps adopted from Hatch (2002), LeCompte and Schensul (1999). In **step 1**, initial categories were identified from the Enabling, Enacting, and Elaborating Safety Culture Framework at the domain and factor levels. In **step 2**, each interview transcript was read completely with only one of the domain level category (e.g., safety climate) in mind and all places in the data were marked where evidence of this category was present. This was followed by reading only the data pertaining to a specific domain to isolate factor level categories. In **step 3**, data pertaining to each factor were analyzed separately in all transcripts for the discovery of sub-factor level constructs. In **step 4**, each interview transcript was re-read to ensure that the non-coded data did not contain important and/or contradictory information that should either be integrated into existed categories or coded into new categories. In **step 5**, relationships between the factor/sub-factor categories and safety outcomes were delineated. This process was guided by the information on these relationships from the research literature, study hypotheses, and declarations from interview participants. In **step 6**, direct quotes from different interview participants were selected to support the relationships that were discovered in the previous step.

Triangulation: Combining Quantitative Results and Qualitative Findings

The concept of triangulation was adopted in the social sciences research from navigation where it refers to the use of two reference points to discover the location of an

object by forming a triangle (Jick, 1979; Thurmond, 2001). Initially, the concept of triangulation was applied in social sciences research as a test for validity of the measurement instruments (Moran-Ellis et al., 2006). This meant, the emergence of convergent findings from two or more data collection methods indicated the phenomenon of interest has been measured accurately while divergent findings indicated that one or more of the measurement instruments were defective. However, this narrow conceptualization of triangulation was untenable as qualitative and quantitative data collection methods often yield divergent findings. Eventually, the research community came to see these divergent results as representing complementary aspects or dimensions of a measured phenomenon and not a sign of flawed measurement instruments. In essence, the concept of triangulation has been broadened, whereby the presence of convergence increases confidence in the results while the emergence of divergent results is an opportunity to provide enriching alternative explanations of a phenomenon occurring in a complex multifaceted social world (Jick, 1979; Moran-Ellis et al., 2006).

The ***methodologic triangulation*** – combination of two or more data collection methods – can be classified into within-method and across-method triangulation (Thurmond, 2001). The within-method triangulation employs either quantitative or qualitative data collection methods. For example, a research study may rely upon focus groups and participant observations for within-method triangulation. On the other hand, across-method triangulation employs both quantitative and qualitative data collection methods. For example, a research study may rely upon interviews and closed-ended surveys for across-method triangulation. In addition to methodologic triangulation, three other common types of triangulation in social sciences research are data sources triangulation, investigator triangulation, and theoretical triangulation

(Denzin, 1970; Thurmond, 2001). ***Data sources triangulation*** examines the similarities and/or differences of findings in a given data collection method based on when (i.e., time), where (i.e., setting), and/or from whom (i.e., people) the data were collected. For example, data sources triangulation can be utilized in a focus group study on the coping strategies of different students (e.g., freshman vs sophomore) at different educational settings (e.g., community college vs university) during the final examination period. ***Investigator triangulation*** refers to the use of two or more interviewers, participant observers, and/or data analyst with different or complementary skills to minimize researcher bias during data collection, data analysis, and reporting of research findings. ***Theoretical triangulation*** refers to the use of two or more theoretical perspectives to investigate a phenomenon of interest.

The current study relied upon data sources triangulation to investigate instances of convergence and divergence in semi-structured interview findings across settings (i.e., ICU, ED, adult in-patient mental health, and general medicine) and professionals (i.e., nurses, allied health staff, and clerical staff). This was followed by the use of across method triangulation to investigate similarities and differences between survey results and interview findings.

Chapter 3: Results

Quantitative Survey Results

Response Rate

Table 3.1 shows the survey response rate for the current study. From September 30th, 2015 to February 1st, 2016, a total of 245 surveys were distributed to frontline clinical staff at a large community hospital by the primary researcher. Of these 245 frontline clinical staff, 185 staff returned a completed survey. Of these 185 returned surveys, 2 surveys were excluded (1 from ED and 1 from Mental Health) from the study analyses as the respondents indicated they had worked for < 6 months on their clinical unit. As noted above, on rare occasions, a clinical staff that met the study's inclusion criteria refused to take a survey being handed out by the primary researcher (2 from ICU, 1 each from ED and Mental Health). These 4 individuals were included in the denominator for purposes of calculating the survey response rate (see Table 3.1).

The overall survey response rate was 74% (183/247), lending credibility to our study's statistical inferences as there was relatively small potential for error due to non-response (Fowler, 2009). The survey response rates from intensive care unit, emergency department, and adult in-patient mental health were quite similar, ranging from 67% to 72% (see Table 3.1). The response rate at the general medicine unit was relatively higher than the other 3 clinical units. It is possible that the 92% survey response rate on the general medicine unit was facilitated by the physical space constraints of the unit – i.e., presence of semi-private patient rooms necessitated the charge nurse or the unit clerk to ask all the staff to gather for a quick huddle on most of the occasions when the primary researcher was on-site. These huddles made it easier for the primary researcher to build good rapport with staff and at the same time

provided the participants an opportunity to complete the survey on the spot. Staff huddles were also conducted at other clinical units to help facilitate survey data collection but these occurred less frequently compared to the general medicine unit.

Table 3.1: Survey Response Rate by Clinical Unit

	Distributed	Refused Survey at Handout	Returned	Excluded	Response Rate
Intensive Care Unit	66	2	49	0	49/68 = 72%
General Medicine	49	0	45	0	45/49 = 92%
Emergency Department	88	1	60	1	59/88 = 67%
Mental Health	42	1	31	1	30/42 = 71%
Total	**245**	**4**	**185**	**2**	**183/247 = 74%**

Sample Characteristics

As shown in table 3.2, the survey sample consisted of 183 frontline clinical staff (i.e., nurses, allied health professionals, and unit clerks). Most of the survey respondents were females (89.6%), nurses (79.8%), < 41 years of age (56.9%), and had tenure of > 5 years on the unit (54.1%).

Table 3.2: Demographic Information of the Whole Sample (N = 183)

		Frequency	Percent
Tenure	6-24 months	24	13.1
	2-5 years	51	27.9
	> 5 years	99	54.1
	No response	9	4.9
	Total	183	100
Age	≤ 30 years	53	29
	31-40 years	51	27.9
	41-50 years	43	23.5
	≥ 51 years	31	17
	No response	5	2.7
	Total	183	100
Gender	Female	164	89.6
	Male	16	8.7
	No response	3	1.6

	Total	183	100
Profession	Registered Practical Nurse (RPN)	21	11.5
	Registered Nurse (RN)	125	68.3
	Allied Health Professional (AHP)	18	9.8
	Clerical Staff	14	7.7
	No response	5	2.7
	Total	183	100

Furthermore, statistical analyses were carried out to test whether or not demographic characteristics (i.e., gender, profession, tenure, and age) of the survey respondents differed significantly across the 4 clinical units. The Fisher's exact test showed that there were no significant differences in gender among the clinical units (p = .80 in table 3.3) – see Appendix 6 for the SPSS output of the chi-square tests.

The study's sample contained no RPNs in two of the clinical units (i.e., ICU and ED), consequently, categories of RPN and RN were collapsed into a single category, labelled nurses before running the contingency table analysis on profession by clinical unit. The Fisher's exact test showed that there were no significant differences in profession among the clinical units, p = .10 – see table 3.3 and Appendix 6 for the SPSS output of the chi-square tests.

Table 3.3: Demographic Information of the Sample at the Unit Level (N = 183)

		ICU		**General Medicine**		**ED**		**Mental Health**		
		N	Valid %	N	Valid %	N	Valid %	N	Valid %	P-value
Tenure	6-24 months	3	6.7	10	22.2	7	12.7	4	13.8	.001
	2-5 years	5	11.1	15	33.3	18	32.7	13	44.8	
	> 5 years	37	82.2	20	44.4	30	54.5	12	41.4	
Age	≤ 30 years	4	8.2	22	53.7	17	28.8	10	34.5	.003
	31-40 years	21	42.9	8	19.5	18	30.5	4	13.8	
	41-50 years	12	24.5	7	17.1	14	23.7	10	34.5	
	≥ 51 years	12	24.5	4	9.7	10	17	5	17.2	
Gender	Female	43	87.8	38	90.5	55	93.2	28	93.3	0.80
	Male	6	12.2	4	9.5	4	6.8	2	6.7	
Profession	Nurses	40	81.6	36	81.8	44	77.2	26	92.8	0.10

	AHP	8	16.3	5	11.4	4	7	1	3.6
	Clerical Staff	1	2	3	6.8	9	15.8	1	3.6

A Kruskal-Wallis ANOVA showed that there was a statistically significant difference in tenure between the clinical units (chi-square = 16.10, df = 3, p = .001 in table 3.3). The Mann-Whitney test, with significance levels corrected for multiple testing (Bonferroni correction) showed that tenure differed significantly between: a) ICU and General Medicine (Mann-Whitney U = 627.50, p < .001), b) ICU and ED (Mann-Whitney U = 904.50, p = .036), and c) ICU and Mental Health (Mann-Whitney U = 395.50, p = .006). We did not find statistically significant differences in the other 3 pairwise comparisons – see Appendix 6 for the SPSS output of Kruskal-Wallis ANOVA.

A Kruskal-Wallis ANOVA showed that there was a statistically significant difference in age categories between the clinical units (chi-square = 14.11, df = 3, p = .003 in table 3.3). The Mann-Whitney test, with significance levels corrected for multiple testing (Bonferroni correction) showed that age differed significantly between ICU and General Medicine (Mann-Whitney U = 551.00, p < .001). We did not find statistically significant differences in any of the other 5 pairwise comparisons – see Appendix 6 for the SPSS output of Kruskal-Wallis ANOVA.

Missing Values Analysis (MVA)

Frequency tables were used to examine the percentage of missing values per survey item. The percentage of missing values was found to be less than 3% for 33 out of 34 survey items. The percentage missing for survey item # 2 (i.e., *tenure*) was found to be 4.9%.

MVA with EM estimation was conducted on all 34 survey items. We treated the 5 demographic survey items (i.e., clinical unit, tenure, age, gender, and profession) as categorical and all other survey items as continuous. It is important to note here that EM estimation does

not impute values for demographic items/variables. The MVA was carried out on the whole data set and the "Little's MCAR test" was found to be non-significant (p = .587). Consequently, it was appropriate to use EM estimation imputations for our data set. We generated frequency tables post imputation to ensure that all the inserted values fall within the expected range.

Internal Consistency Reliability (Cronbach's α)

The Cronbach's α of all of the study's main scales was found to be > 0.7 (see table 3.4). Overall patient safety grade consisted of a single survey item, consequently Cronbach's alpha was not calculated for this particular variable. It was also examined whether the Cronbach's α value of a scale improved with the deletion of a given item. It was found that the Cronbach's α for the teamwork climate scale improved from 0.78 to 0.79 with the deletion of item 4d (i.e., *"in this unit, it is difficult to Speak Up if I perceive a problem with patient care"*). Similarly, Cronbach's α for turnover intention improved from 0.89 to 0.91 with the deletion of item 5f (i.e., *"I frequently think of quitting this job"*). However, it was decided to retain both of these items because their deletion led to extremely marginal improvement in the Cronbach's α value of their respective scale and both items have a strong theoretical rationale to be included in their respective scale (e.g., Alexander, Lichtenstein, Oh, & Ullman, 1998; Sexton et al., 2006a).

Table 3.4: Cronbach's α Values

Scale	Total # of Items	Cronbach's α
Senior Leadership Support for Safety	4	0.87
Supervisory Leadership Support for Safety	2	0.82
Teamwork Climate	6	0.78
Safety Organizing Scale	9	0.89
Overall Perceptions of Patient Safety	4	0.81
Turnover Intention	3	0.89

Simple Bivariate Analyses

First, we created scatter plots between study's dependent variables (i.e., overall perceptions of patient safety, overall patient safety grade, and turnover intention) and independent variables (i.e., senior leadership support for safety, supervisory leadership support for safety, teamwork climate, and safety organizing scale) to visually examine their relationships (see Appendix 3). A positive linear trend was observed between overall perceptions of patient safety and each of the 4 independent variables. Similarly, a positive linear trend was observed between overall patient safety grade and each of the 4 independent variables. As expected, a negative linear trend was observed between turnover intention and each of the 4 independent variables.

Second, simple bivariate analyses (Pearson r) were carried out to assess the strength and significance of relationships among the independent and dependent variables. As shown in table 3.5, bivariate analyses revealed significant relationships among the dependent and independent variables. Multicollinearity was not a concern since: (a) all of the study's independent variables were correlated with each other at < 0.6, and (b) the variance inflation factor (VIF) score for each of the 4 independent variables was < 4 (Katz, 2006).

Table 3.5: Means, Standard Deviations (SD), and Pearson r Correlations (N = 183)

	Mean	SD	1	2	3	4	5	6
1. Senior Leadership	3.01	.94						
2. Supervisory Leadership	3.61	1.02	.492**					
3. Teamwork Climate	3.61	.67	.400**	.598**				
4. SOS (7-pt scale)	4.34	.93	.252**	.370**	.520**			
5. Overall PS Perceptions	2.83	.87	.520**	.404**	.522**	.317**		
6. Overall PS Grade	3.08	.87	.570**	.468**	.558**	.387**	.676**	
7. Turnover Intention	3.20	1.72	-.185**	-.134*	-.338**	-.232	-.332**	-.349**

**p < .01, *p < .05. Scale means by unit are reported with histograms in Appendix 8.

Hierarchical Linear Regression Analyses

Hierarchical Regression Analyses with Missing Data Imputations

Tables 3.6a, 3.6b, and 3.6c show the results of the three hierarchical regression analyses that examine the variance explained by the demographic (i.e., clinical unit, tenure, age, gender, and professional background) and explanatory variables (i.e., senior leadership support for safety, supervisory leadership support for safety, teamwork, and safety organizing scale) on overall perceptions of patient safety, overall patient safety grade, and turnover intention, respectively.

Table 3.6a: Results of First Hierarchical Regression Analysis (DV = Overall Perceptions of PS)

	Model 1, β	**Model 2, β**	**Model 3, β**
Block 1 – Socio-Demographic Dummy Variables			
ICU	.823***	.768***	.594**
ED	.073	.055	-.009
Mental Health	-.592**	-.358	-.366*
Tenure (2-5 Years)	-.061	.002	.135
Tenure (> 5 Years)	-.435*	-.280	-.180
Age (≤ 30 Years)	-.172	-.041	-.102
Age (31-40 Years)	-.174	-.095	-.116
Age (41-50 Years)	-.104	-.087	-.085
Female	-.298	-.123	-.095
RPN	.149	.354	.273
RN	-.180	.105	.078
AHP	-.013	.091	.191
Block 2 – Leadership Support for Safety (i.e., Safety Climate)			
Senior Leadership		.403***	.336***
Supervisory Leadership		.013	-.102
Block 3 – Frontline Clinical Staff Behaviours			
Teamwork Climate			.426***
SOS			.035
Total R^2 (adjusted)	.203***	.373***	.441***
Change in R^2	.261***	.165***	.069***

***p < .001, **p < .01, *p < .05. (N = 165). Reference groups: General Medicine, Tenure (6-24 months), Age (≥ 51 years), Male, and Clerical Staff.

The first hierarchical regression analysis shows that demographic variables, when entered in block 1 of the regression model, explain a statistically significant amount of variance in overall perceptions of patient safety (adj. $R^2 = .203$, $p < .001$ in table 3.6a). However, only the β coefficients for ICU (β = .823, p < .001), mental health (β = -.592, p < .01), and tenure > 5 years (β = -.435, P < .05) in model 1 were significant. These β coefficient values indicate that overall perceptions of patient safety scores are: a) higher for ICU compared to the general medicine, adjusting for the other demographic variables, b) lower for mental health compared to the reference group, general medicine, and c) lower for tenure > 5 years compared to the reference group, tenure 6-24 months.

Senior leadership support for safety and supervisory leadership support for safety, when entered in block 2 of the regression model, explain a statistically significant amount of variance in overall perceptions of patient safety (block 2 $\Delta R^2 = .165$, $p < .001$ in table 3.6a), over and above that which is explained by demographic dummy variables. However, only the β coefficient of senior leadership support for safety is significant (β = .403, p < .001).

Finally, teamwork climate and safety organizing scale, when entered in block 3 of the regression model, explain a statistically significant amount of variance in overall perceptions of patient safety (block 3 $\Delta R^2 = .069$, $p < .001$ in table 3.6a), over and above that which is explained by independent variables entered earlier in the analysis. However, only the β coefficient of teamwork climate is significant (β = .426, p < .001). Overall, the first hierarchical regression analysis accounts for approximately 44% of the variance in overall perceptions of patient safety.

Table 3.6b: Results of Second Hierarchical Regression Analysis (DV = Overall PS Grade)

	Model 1, β	Model 2, β	Model 3, β
Block 1 – Socio-Demographic Dummy Variables			
ICU	.887***	.810***	.656***
ED	.331	.311*	.250
Mental Health	-.491*	-.188	-.184
Tenure (2-5 Years)	-.260	-.182	-.061
Tenure (> 5 Years)	-.333	-.142	-.046
Age (≤ 30 Years)	.041	.210	.156
Age (31-40 Years)	.027	.126	.115
Age (41-50 Years)	.358	.386*	.375*
Female	-.302	-.089	-.062
RPN	.179	.423	.344
RN	-.057	.282	.264
AHP	-.152	-.022	.086
Block 2 – Leadership Support for Safety (i.e., Safety Climate)			
Senior Leadership		.470***	.412***
Supervisory Leadership		.043	-.058
Block 3 – Frontline Clinical Staff Behaviours			
Teamwork Climate			.327**
SOS			.085
Total R^2 (adjusted)	.195***	.438***	.490***
Change in R^2	.254***	.232***	.054***

***p < .001, **p < .01, *p < .05. (N = 165). Reference groups: General Medicine, Tenure (6-24 months), Age (≥ 51 years), Male, and Clerical Staff.

The second hierarchical regression analysis shows that demographic variables, when entered in block 1 of the regression model, explains a statistically significant amount of variance in overall patient safety grade (block 1 adj. R^2 = .195, p < .001 in table 3.6b). However, only the β coefficients for ICU (β = .887, p < .001) and mental health (β = -.491, p < .05) are significant. This indicates that overall patient safety grade scores are higher for ICU and lower for mental health when compared to the general medicine reference group, adjusting for the other demographic dummy variables.

Senior leadership support for safety and supervisory leadership support for safety, when entered in block 2 of the regression model, explain a statistically significant amount of variance in overall patient safety grade (block 2 $\Delta R^2 = .232$, $p < .001$ in table 3.6b), over and above that which is explained by demographic dummy variables. However, only the β coefficient of senior leadership support for safety is significant ($\beta = .470$, $p < .001$).

Finally, teamwork climate and SOS, when entered in block 3 of the regression model, explain a statistically significant amount of variance in overall patient safety grade (block 3 $\Delta R^2 = .054$, $p < .001$ in table 3.6b), over and above that which is explained by independent variables entered earlier in the analysis. However, only the β coefficient of teamwork climate is significant ($\beta = .327$, $p < .01$). Overall, the second hierarchical regression analysis account for approximately 49% of the variance in overall patient safety grade.

Table 3.6c: Results of Third Hierarchical Regression Analysis (DV = Turnover Intention)

	Model 1, β	Model 2, β	Model 3, β
Block 1 – Socio-Demographic Dummy Variables			
ICU	-.815	-.781	-.325
ED	-.615	-.604	-.424
Mental Health	.481	.339	.332
Tenure (2-5 Years)	-.039	-.076	-.436
Tenure (> 5 Years)	.518	.425	.144
Age (≤ 30 Years)	-.001	-.080	.080
Age (31-40 Years)	.237	.189	.226
Age (41-50 Years)	.346	.335	.361
Female	.054	-.051	-.130
RPN	-.731	-.854	-.623
RN	-.235	-.405	-.348
AHP	-1.549*	-1.611*	-1.924**
Block 2 – Leadership Support for Safety (i.e., Safety Climate)			
Senior Leadership		-.240	-.067
Supervisory Leadership		-.010	.291
Block 3 – Frontline Clinical Staff Behaviours			

Teamwork Climate			-.993***
SOS			-.229
Total R^2 (adjusted)	.048	.051	.169***
Change in R^2	.118	.015	.118***
***p < .001, **p < .01, *p < .05. (N = 165). Reference groups: General Medicine, Tenure (6-24 months), Age (≥ 51 years), Male, and Clerical Staff.			

The third hierarchical regression analysis shows that demographic variables when entered in block 1 of the regression model do not explain a significant amount of variance in turnover intention (block 1 adj. R^2 = .048, NS in table 3.6c), however, the β coefficient of AHP is shown to be statistically significant (β = -1.549, p < .05). This indicates that turnover intention scores for AHPs are lower (i.e., better) compared to the reference group, clerical staff.

Furthermore, senior leadership support for safety and supervisory leadership support for safety do not explain a significant amount of variance in turnover intention (block 2 ΔR^2 = .015, NS in table 3.6c), over and above that which is accounted by demographic dummy variables.

Finally, teamwork climate and SOS, when entered in block 3 of the regression model, explain a statistically significant amount of variance in turnover intention (block 3 ΔR^2 = .118, p < .001 in table 3.6c), over and above that which is explained by independent variables entered earlier in the analysis. However, only the β coefficient of teamwork climate is significant (β = -.993, p < .001). The β coefficient value of -.993 indicates that turnover intention decreases by .993 with every one-unit increase in teamwork climate. Overall, the third hierarchical regression analysis account for approximately 17% of the variance in turnover intention.

In the current study, the proportion of missing values were low (i.e., < 5% per survey item) and data were missing at random, however, the sample size (N = 183) could be

considered relatively small. Consequently, hierarchical regression analyses were also run *without* missing data imputations and these results were found to be nearly identical to the results of hierarchical regression analyses *with* missing data imputations being reported in this section (see Appendix 7).

Climate Profile

Table 3.7 shows mean (column A), standard deviation (column A), mean R_{WG} (column B), and range of R_{WG} values (column C) for each of the six study scales. Table 3.8 shows the upper and lower bound R_{WG} values at each of the four participating clinical units. The upper bound unit R_{WG} values approach or exceed .70 for all six scales at both ICU and ED. At the general medicine unit, the upper bound unit R_{WG} values approach or exceed .70 for five of the six scales (i.e., senior leadership support for safety, teamwork climate, mindful organizing, overall perceptions of patient safety, and overall patient safety grade). However, at the adult in-patient mental health unit, only four of the six scales (i.e., senior leadership support for safety, teamwork climate, mindful organizing, and overall perceptions of patient safety) show sufficient inter-rater agreement (i.e., $R_{WG} \geq .69$). The lower bounds of R_{WG}s (Table 3.8, columns A-D, in parentheses) are quite a bit lower compared to the corresponding upper bounds of R_{WG}s.

Table 3.7: Scale Means, Standard Deviations (SD), and Range of RWG Values

	A	*B*	*C*
	Scale Mean (SD)	Scale Mean R_{WG} (lower bound)*	Range of R_{WG} (lower bound)* n = 4 units
Senior Leadership	3.01 (0.94)	0.72 (0.28)	0.68–0.77 (0.08–0.49)
Supervisory Leadership	3.61 (1.02)	0.65 (0.37)	0.54–0.80 (0.11–0.68)
Teamwork	3.61 (0.67)	0.87 (0.65)	0.77–0.93 (0.19–0.88)
Mindful Organizing	4.34 (0.93)	0.93 (0.87)	0.92–0.94 (0.85–0.90)
Overall Perceptions of PS	2.83 (0.87)	0.78 (0.48)	0.71–0.83 (0.26–0.67)

Overall PS Grade	3.08 (0.87)	0.67 (0.51)	0.49–0.78 (0.24–0.67)

* Columns B & C report both the upper and lower bound (in parentheses) values of R_{WG}s. The upper and lower bound values were calculated using rectangular and slightly skewed distributions, respectively.

Table 3.8: RWG values at the Four Clinical Units

	A	*B*	*C*	*D*
	ICU	**General Medicine**	**ED**	**Mental Health**
	R_{WG} (LB)*	R_{WG} (LB)*	R_{WG} (LB)*	R_{WG} (LB)*
Senior Leadership	0.68 (0.08)	0.77 (0.49)	0.75 (0.40)	0.69 (0.14)
Supervisory Leadership	0.80 (0.68)	0.58 (0.21)	0.70 (0.46)	0.54 (0.11)
Teamwork	0.93 (0.88)	0.88 (0.74)	0.89 (0.78)	0.77 (0.19)
Mindful Organizing	0.94 (0.89)	0.92 (0.85)	0.94 (0.90)	0.92 (0.87)
Overall Perceptions of PS	0.83 (0.67)	0.71 (0.26)	0.83 (0.66)	0.73 (0.34)
Overall PS Grade	0.78 (0.67)	0.69 (0.53)	0.73 (0.59)	0.49 (0.24)

* Columns A-D report both the upper and lower bound (in parentheses) values of R_{WG}s. The upper and lower bound values were calculated using rectangular and slightly skewed distributions, respectively.

Safety climate shape on its own can also reveal important information about the climate personality of a clinical unit (Ginsburg & Oore, 2015). Figure 3.1 illustrates two examples where the participating clinical units had quite different safety climate shapes. The top two histograms show that the general medicine unit (mean = 3.07, RWG = .77) and the mental health unit (mean = 2.54, RWG = .69) had quite different climate shapes on perceptions of senior leadership support for safety. The shape of the climate perceptions at the general medicine unit can be classified as rectangular, whereas, it is bimodal in nature at the mental health unit. Similarly, the bottom two histograms show that ED and the mental health unit had quite different climate shapes (ED = normally distributed shape; mental health = bimodal shape) – Appendix 8 contains the complete set of histograms for senior leadership support for safety, supervisory leadership support for safety, safety organizing scale, teamwork climate, overall perceptions of patient safety, and overall patient safety grade.

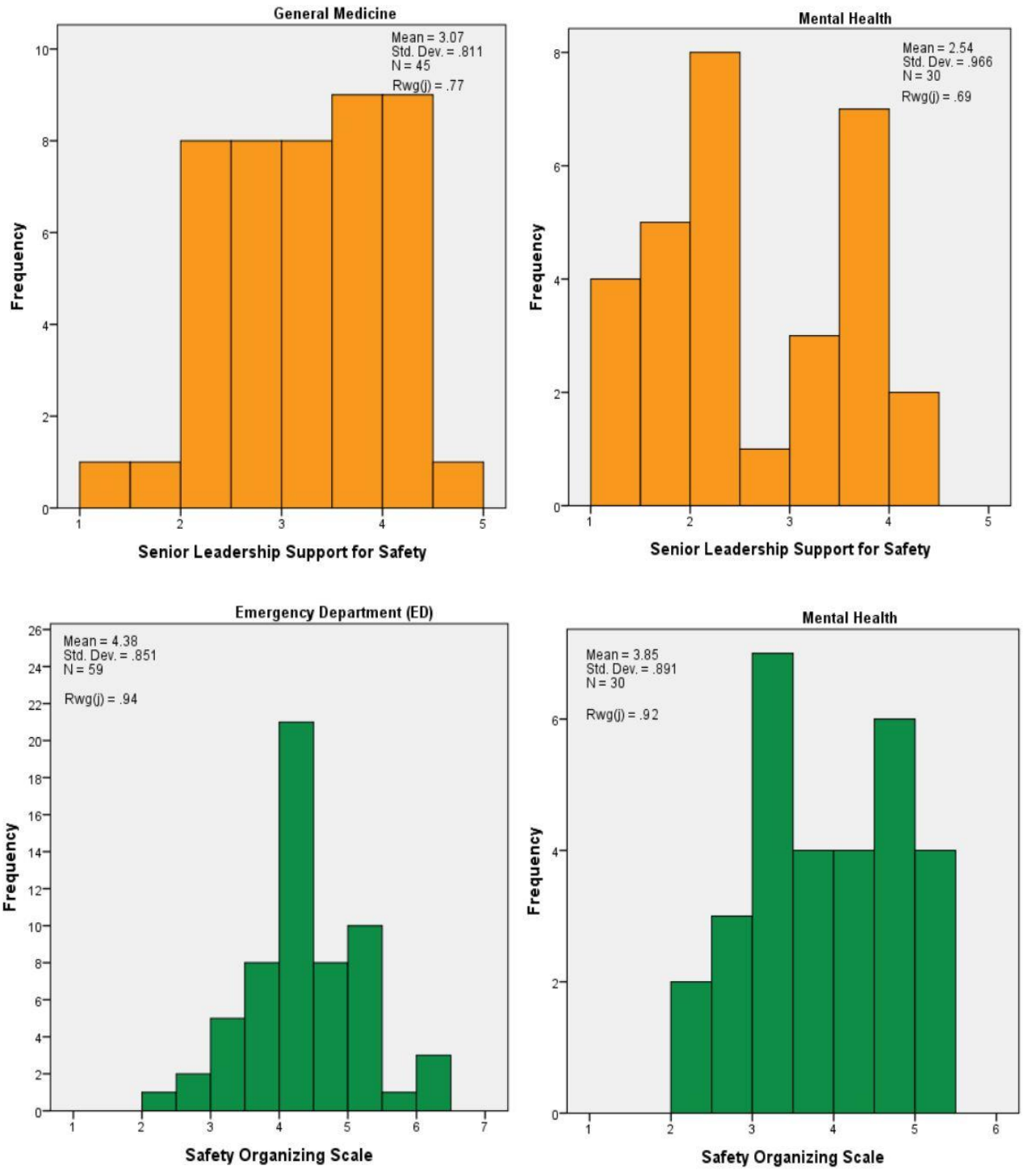

Figure 3.1: Illustrative Examples of Climate Shape Differences

Qualitative Interview Findings

During the final qualitative analyses, one interview from ICU and one from ED were excluded as these interviewees did not met the study's inclusion criteria (see table 3.9).

Table 3.9: Total Number of Interviews per Clinical Unit.

	Conducted	Excluded	Reason for Exclusion
Intensive Care Unit	6	1	The interview conducted with the unit's nurse educator was excluded as it was deemed to be a leadership position
General Medicine	5	0	
Emergency Department	5	1	The interview conducted with an AHP was excluded as the participant had worked at ED for < 2 months at the time of the interview
Mental Health	5	0	

Before the start of data analysis, an initial coding system was primarily developed from the theory (i.e., Enabling, Enacting, and Elaborating Safety Culture Framework) and contained two levels (i.e., domain and theme). Subsequently, most of the concepts at the sub-theme level were developed from the data during the coding process of interview transcripts (see table 3.10).

Table 3.10: Coding Scheme (*Note: Bolded Categories were developed from theory; non-bolded categories were developed from the data*)	
Domain – **Safety Climate**	
Themes	*Sub-themes*
Perceptions of senior leadership support for safety	Relational competency (e.g., visibility)
	Communication with the frontline staff
	Policy making
Perceptions of supervisory leadership support for safety	Manager-staff safety related communication (e.g., nurse manager's feedback to reported errors)
	Relational competency (e.g., approachability)
Domain – **Teamwork Climate**	
Perceptions of teamwork climate within a unit	Inter-professional teamwork climate
	Intra-professional teamwork climate
	Tenure
	Nurse-patient ratio / staffing level
Perceptions of teamwork climate across unit boundaries	Inter-professional teamwork climate
	Intra-professional teamwork climate
Domain – **Mindful Organizing**	
Principles of Anticipation	**Preoccupation with failure**
Principles of Containment	**Commitment to resilience**
	Deference to expertise

The qualitative analyses revealed the importance of leadership, teamwork climate, and mindful organizing to safety outcomes – corroborating the survey results while also providing a more nuanced understanding of these concepts. The patterns or themes that emerged from this analysis are discussed in-depth below:

Safety Climate

Perceptions of senior leadership support for safety

The interviewees held negative perceptions of senior leadership support for safety on the four participating clinical units. More specifically, the data analyses revealed that the interviewees perceived that the senior leaders (a) primarily visit a clinical unit in case of a catastrophic safety event, (b) seldom communicate their vision about the hospital/unit clearly to the frontline clinical staff and (c) don't include frontline clinical staff in policy making discussions.

The interviewees believed that senior leaders rarely visit the frontlines and when they do, it is usually in response to a catastrophic safety event. For example, ED's nurse 2, commented:

> *I heard they came down, I was not there that day but…….I know they did come down because……staff got assaulted by patients and they did come down and had briefings and things like that after that situation happened…….I have worked here for 12 or 13 years; I don't think I have ever met any of the senior management in this hospital or had a chance to discuss anything with them so I feel they could probably come around a lot more down to emerg, especially when we constantly have bed crises…….and we are kind of like the frontline of the hospital*.

Similarly, poor visibility of senior leaders at the frontlines is highlighted by the following excerpt taken from an interview with an allied health professional (AHP 1) on the general medicine unit:

> *The trouble, I think from the corporate ladder, the highest that I ever see is the manager on this unit, so I don't even know who else to talk to. Occasionally I see the director as of lately because accreditation is coming but the manager is the top that I would even see, I don't see anyone higher up in that team to discuss anything with. So, they don't have that big of a presence on this floor.*

Similarly, mental health's nurse 1, while supporting the assertion that senior leaders are primarily seen on the floor in case of a catastrophic safety event, also pointed out that the senior leaders need to communicate their vision for the unit/hospital to the staff much more clearly as shown by the following quote:

> *I can think of twice, in my time here when the senior leaders been involved, in both times it was extremely violent incident. So, they were very serious events but other than that, no, not really. The director is not involved; they will come down and say there is a plan for expansion in ER, there is a plan for expansion of west 3 to increase the bed flow. We don't really know what is going on, it's a plan but we don't know what is happening so I don't really get a lot of input from upper management levels.*

In addition to clearly communicating their vision to the frontlines, the senior leadership must also demonstrate that they have taken the concerns of the frontline clinical staff into consideration while making decisions as the following quote taken from an interview with general medicine's nurse 1 illustrates:

> *There is a lot of, I find horizontal conversations happening but not a lot of top down communication. So, a lot of the feelings from nurses is that senior management have no idea about what is going-on on the floor so a lot of people feel that way because we don't hear the background, we don't hear what they are talking*

> *about, we just see the very end result and they just say hey we are doing this. A lot of people on the floor don't feel that like they are taking into account what we are saying because we don't hear all the discussions that they are having in senior management meetings.*

The mental health's nurse 3 went even further and suggested the need for the frontline clinical staff to be included on committees creating hospital wide policies as highlighted by the following excerpt:

> *A lot of the policies like the code white, the over sensing, it's with input from the other stakeholders in the facility. So, it would be director from physical facilities, director from HR, director from child and adolescent, director from the medicine program that will all sit down and try to come up with ways to make the unit safe. But as they are trying to make the unit safe, or the patients safe, they're not asking for the staff to comment or participate in those meetings where they created it…….unless you have frontline staff that are in those areas that are most effected by that policy, you're never going to create a safe policy because you cannot sit in an office and not practice and not deal with the day to day ins and outs of the physical unit and know that that policy is an appropriate policy to implement*.

Perceptions of supervisory leadership support for safety

There were positive perceptions of supervisory leadership support for safety at ED, ICU, and the general medicine unit. The staff at these clinical units saw their nurse manager as someone who (a) is approachable, (b) values staff expertise, (c) listens to staff concerns and (d) take those concerns into consideration while making decisions. For example, ED's nurse 1 commented:

> *Our manager is really good, we had a change in our manager a couple of years ago, and it has changed the whole department I would say. Our manager is really good like when that incident happened, when that nurse got attacked, she had meetings after meetings with the staff to see what we needed…….she is really good at coming out on the floor, having daily huddles to check*

> *things, to see what's going on, updates us what's going on manager side of things and checking in to see what is working and what is not working on the floor and that's usually done once a day, 'a huddle' she calls it*.

Similarly, ED's nurse 2 highlighted her positive perceptions of the nurse manager while describing an incident concerning a homeless patient as follows:

> *I really like my manager, she is really approachable, to be honest. I feel comfortable with her, I feel like I can go to her, like the other day we had a patient and I felt like there was a lot of buck passing in his care. He was a homeless man, he couldn't go back to the shelter, he needed a nursing home, they refused to admit him to the hospital so he was down in our emerg department for five days which seems a little inappropriate to me and then there were issues like getting his meds from the pharmacy because they only send those for admitted patients and the kitchen wouldn't send him a warm meal because they only send warm meals for admitted patients. I went to the nurse manager and complained, passed on all my concerns about the patient. She was quite open to my concerns and how to fix what was happening…….my manager did call the food service and talked to their supervisor and talked to the pharmacy and kind of said, this is the situation and you need to appropriately change polices for this patient*.

On the same note, ICU's nurse 3 pointed out that the nurse manager disseminates safety related information to staff on a regular basis and takes prompt action to alleviate safety concerns whenever possible as evident through the following excerpt:

> *There is a huddle board that gets done, patient huddle board, for the most part it gets done on daily basis and there the nurse manager discusses what could be safety issues…….and you feel free to bring up anything you want to in-front of the group, so more suction equipment, sometimes that might be a safety issue. Now, ICU nurse manager have ordered some extra suction equipment so that we can have enough for patients in every room*.

A similar picture emerged at the general medicine unit as shown by the following excerpt from an interview with general medicine's nurse 1:

> *Our manager is being very good at asking for feedback, 'what are your ideas, what do you think we can do', and she is actually pretty good at just making posts, she has this envelope where you can just put ideas in and every couple of weeks, she would write a response and post it at the nursing station……our manager is very approachable.*

However, perceptions of interviewees on supervisory leadership differed across these three units (i.e., ED, ICU, and general medicine) when it came to provision of timely feedback to reported errors. At ED, there was a consensus among the interviewees that they receive timely feedback to reported errors from unit management. For example, ED's nurse 2 commented on the quick response from the nurse manager to a reported medication error, "*I think that happened in the middle of the night and my manager typically comes in at 7am and my shift ends at 7:30am and she came and talked to me about it before I left. So, I think, whenever I have submitted an incident report I have always heard back from management*". Similarly, ED's nurse 3 mentioned, "*I have submitted unsafe work forms before, when I felt that there were too many patients, they were too sick and we didn't have time for our breaks……..and then our manager did come to me and say I got this, I just want to let you know that I have received this, we are working on it so she followed up*".

In contrast, some of the interviewees from ICU and the general medicine unit expressed that feedback to reported medical errors is sometimes missing from the unit management. This lack of feedback occurred for minor events that caused no patient harm – this being a concern especially for patient falls at the general medicine unit. For example, general medicine's nurse 2 mentioned that feedback for reported patient falls is usually missing "*unless it's something that has really affected the patient then yes we do receive feedback. They ask about the situation and it depends how far the management wants to go with it but usually we don't hear anything.*

I think they use it mainly for statistics but I don't know because I never ever had anybody follow up with me on someone that has fallen." Similarly, general medicine's AHP 1 commented that "*falls happen pretty regularly……so manager doesn't come around if someone has a fall unless it is a catastrophic event…….I think they need to be providing more feedback about falls……that might inspire people to take those next steps to prevent or decrease the number of falls*".

There were negative perceptions of supervisory leadership support for safety at the adult in-patient mental health unit. The manager was seen by the nursing staff as someone who micro-manages the day-to-day functioning of the unit and seldom rely on the expertise of the frontline clinical staff while making decisions. Furthermore, a common concern was that the unit management doesn't communicate effectively with the frontline clinical staff often resulting in a lack of timely feedback for reported errors even when those reported errors were considered as catastrophic events by the clinical staff. For instance, mental health's nurse 1 described an incident of a patient's admission order being changed from the locked side to the open side of the unit by the manager without consulting the frontline clinical staff:

> *A person was admitted to our open side, when he came up, the patient looked agitated with pacing, looked a little bit difficult to engage, wasn't really saying a lot, making poor eye contact, looked like he was quite irritated…….so what he did was he got up and went to the room next to him where two females were and he was standing in the door way blocking their exit from the room…….when I asked him to leave……he escalated quite quickly to the point of agitation and possible violence. So, I called the doctor on call, who gave me the order to transfer him to the lock side of the unit……but this patient was admitted to the lock side already, somehow that has changed to the open side……..our manager was downstairs……..had talked to the patient and it seemed like through that conversation decided that he be okay for the open side when in fact he really wasn't. We*

> *weren't told about it up here and the charge nurse on the floor wasn't aware about it either…….my manager who is downstairs for five minutes then in a meeting and all over the hospital, is not the person to make those communication calls……on the other side, the [ED] mental health nurse and the charge nurse up here should be communicating as to the status of the patient, the history, how they are presenting down in the emerg and to me that makes the most sense for the flow and then the charge nurse would communicate that among the rest of us……so the overall effect on staff, they don't feel valued, they don't feel listened to, their assessments are worthless, doesn't really matter what I say or do because it's going to happen anyway*.

Similarly, mental health's nurse 4 vividly described the lack of timely debrief by the unit management in response to an extremely violent safety incident:

> *They were running around here like chickens with their heads cut off, they didn't know what they were doing. They needed to sit and talk to the people involved, that was a pretty big event…….it took me two and a half months to debrief with the people who were involved……why were we not debriefing about it Monday morning, bring the staff in who were involved, make sure they are well mentally, make sure they are ok physically, pay them overtime and let's talk, not two and half months later…….the morale on this unit and the safety concerns on this unit are awful because of our manager. If I can get out of here and go someplace comfortable……I be gone because this place is an accident waiting to happen, it really is*.

However, an outlier emerged at the adult in-patient mental health unit – in contrast to her peers, mental health's nurse 3 held overall positive views of the supervisory leadership support for safety and suggested that some of the frontline clinical staff do not communicate their concerns to the unit management effectively as evident through the following excerpt:

> *I personally feel that management is working and doing as much as they can to keep the staff and the patients safe. They are open to our ideas; they really do try to help when we say to the management that the unit is really unpredictable……..they allow us to call extra staff if we think we need more staff……they usually listen to me, I feel that they listen for the most part to the*

> *staff and their needs……I have even heard management say, 'we have done this this this and this, so what is it that we can do', and it's like, 'well fix it', there is not really a suggestion there from the staff so I am not sure what they are expecting*.

Teamwork Climate

The data analyses revealed that interviewees differentiated between quality of teamwork climate within a clinical unit and across unit boundaries. Furthermore, distinction was made by the interviewees between inter-professional and intra-professional teamwork climate as discussed in-detail below.

Perceptions of teamwork climate within a unit

Intra-professional teamwork climate

There were positive perceptions of intra-professional teamwork climate (e.g., nurse to nurse or physio to physio) on all 4 clinical units. For example, general medicine's nurse 2 commented, "*I think as nurses we work very well as a team because we understand that it needs to be done as a team because that is the best way that the patient gets taken care of and the best way they feel heard and feel at ease being here*". Similarly, mental health's nurse 4, while discussing teamwork climate, remarked that nurses rely on "*good communication with each other…….at unit level. For us nurses, I think we are pretty cohesive. Some of us, we have to lead some of the newer staff……so you need to take the lead, that's what you do but the communication beyond unit level, it's crap, it's atrocious*".

On the same note, AHP 1 from ICU described the working relationship with her counterpart as honest and collaborative:

> *The unit has two……[of us in my professional field] to take care of patients…….one of the things nice about that is you always have somebody else that is looking at your work and we have a very honest relationship and we wouldn't hesitant to say, 'you miss*

> *that' or 'I would have done that' or 'what do you think I could have done better?' So, there are two heads all the time looking at something and ensuring that we are operating hopefully at the best level that we can*.

Inter-professional teamwork climate

The data analyses revealed that many of the interviewees from adult in-patient mental health, general medicine, and ED either believed that the quality of inter-professional teamwork climate needed further improvement or overtly described negative perceptions of inter-professional teamwork climate. This pattern was especially salient for the nurse-physician communication at general medicine and ED, whereby staff were of the view that certain physicians don't communicate effectively with the nursing team and in doing so jeopardize safety of the patients. For example, a unit clerk from ED commented that "*the physicians, some of them, especially the newer younger ones don't appreciate how much knowledge some of the nurses, the more senior nurses have and aren't as interested in taking some sage advice from someone who has been there and done that, that sort of thing*".

Similarly, ED's nurse 3 commented on a lack of good physician-nurse communication during resuscitation events:

> *I do feel that sometimes there is a lack of……communication from the physician team and that they don't communicate what their plan of care is with the nursing staff…….I find it really helpful when physician say, 'ok we have this patient in here, they are this old, they have these comorbidities, I feel that this is a cardiac arrest related to BP and we are going to continue the resuscitation, we are going to get pulse check in two minutes'. When the physician speaks about what they are thinking, it just provides a whole lot of clarity for the team and we are not pulling in different directions. Often times the nurses, we are talking to each other, we are planning ahead which is good……but I feel that the physicians need to take the lead*.

Furthermore, her comment also highlighted that the quality of nurse to nurse communication during resuscitation is usually good even if communication from the physician team is lacking.

On the same note, data analyses revealed that the quality of communication between nurses and allied health staff can be further improved exemplified by the following excerpts taken from interviews with a nurse and an allied health professional. The general medicine's nurse 3 commented:

> *I think with [AHPs]……sometimes there is lack of communication. I mean, nurses kind of stick together, we all work together, we see each other all the time so we are like little groups. I mean we try to communicate but sometimes you are so stuck on doing like fifty million things for your patients that you don't really have time to go and talk to physio……about something that maybe is important but not that important. You are always prioritizing your time, like if I have a patient who cannot breathe, I am not going to be like 'hold on for a second, I am just going to talk to physio for that person who could be a falls risk' or whatever*.

The general medicine's AHP 1 acknowledged that the nurses are often pressed for time but emphasized the need to improve the flow of information to the allied health staff as they are only here "*from Monday to Friday……and if someone have fallen during the weekend or fallen over night…….it is not charted consistently in any certain place, sometimes people have written on the chart, sometimes it is written in one area of the online charting, sometimes in another area and sometimes not at all. So, it is not communicated well to us*".

The nursing staff on the mental health unit needed to work along side police officers from time to time in order to provide care for the mental health patients, however, the interviewees commonly held negative perceptions of nurse-police teamwork climate. For example, mental health's nurse 3 commented:

> *The boxed room……where we [keep] anybody that is in custody……does not have a bathroom. So, those police officers, if [the patient] gets up, they just let him walk through the unit. Well, there is a reason that you're here to watch that fellow because he's been a danger and you've charged him……and most often when they're here, it's because it's an assault charge. So, if [a patient] is assaultive, and you've charged him……why are you letting him walk a hundred fifty feet to a bathroom by themselves in a general area without coming to the nursing staff and saying, 'you know, he wants to go to the bathroom'.*

Similarly, mental health's nurse 4 described her negative perceptions of police response to an extremely violent safety incident on the unit:

> *When the police got here, the police were awful because they said, 'well it's part of your job, it is part of your job', well it's not part of our job. I have only twice been assaulted in my nursing career so it is not part of my job; it's not an everyday event. I don't go to work to get beat up…….so, keep in mind, you got security guards who can't take this [patient] down, now the police are involved, he is shackled to a bed and restrained to a bed. We have to take him out of the restraints to let him use the bathroom because this guy is getting sicker and sicker, you cannot tie someone to the bed that long. He is filthy, he smells, the whole nine yards……you cannot keep someone tied up to a bed like that for days on end, that is what [the police] were doing.*

However, at both ED and the mental health unit, an outlier case emerged in regards to the quality of inter-professional teamwork climate on the unit. In both of these cases, the nurse interviewees held positive perceptions of nurse-physician teamwork climate in contrast to their peers. The ED's nurse 2 commented:

> *I have worked in every department in this hospital and I think emerg actually have the best communication within all the different professions because the nurses and the doctors work so close together in the emerg, you have to be able to have a good communication and you have to be able to speak to the doctor and he has to be able to trust the nurses*.

Similarly, mental health's nurse 2 commented that the communication between physicians and nurses is "*exceptionally good on this unit……we spend a lot of time talking about the patients so I think they respect what feedback you have to give because you do have this more of a communication piece as opposed to physical caring for people on mental health so it is a little bit different that way, you work with the doctors in that way differently than another unit that focuses more on the physical aspects of the patients*". Interestingly, both of these nurses had a long tenure – The ED nurse had worked for 7 years and the mental health nurse for 26 years on their respective units at the time of the interview.

On the other hand, consensus existed among the interviewees from ICU that clinical staff belonging to various professions worked well with each other on the unit. For example, ICU's nurse 3 commented, "*I definitely think that there is good communication and there is a good working relationship among the staff in ICU. I think everybody is very supportive, I think it adds patient safety for sure like everybody seems to look out for one another"*. On the same note, AHP 1 from ICU labelled the inter-professional teamwork climate on the unit as "excellent" and commented:

> *I couldn't do what I do without [my team] because.....I very rarely touch patients so.....I look at the patient, I sometimes look at their feet, look at their skin, whatever, but I will go through the chart, I will talk to the doctor, talk to the nurse, talk to the pharmacist and create my care plan based on all the information and then my care plan goes to the team and then the team implements it, the nurse and the pharmacist primarily or the physician if they have to put a tube in because I don't deliver feeds, I don't hang IVs.....so, the fact that I have a team is crucial, I couldn't care for people without them because I need all their input and then I need them to implement the plan that I develop based on everyone's input.*

The role of tenure

The qualitative analyses also revealed that the presence of newer or inexperienced staff can compromise the quality of teamwork climate on a clinical unit. For example, ED's nurse 2 commented:

> *When you get a lot of newer nurses who don't know the doctors, the doctors don't know the nurses, there always is a bit of an adjustment period where you need to learn about each other, learn how to speak to each other and learn to trust each other……we also use a lot of agency staff here because when people call in sick, you have to have somebody to look after these patient so then we have somebody here for 12 hours, they never been here before, they are not invested in the hospital or the place, they don't know the doctors, they don't know the staff and then….it is a bit difficult for them and for the doctors and the staff for an hour or two with the communication*.

The following excerpt taken from the interview with general medicine's nurse 2 paints a similar picture with regards to tenure and its associated influence on quality of teamwork climate:

> *It is harder for newer staff members coming on to this unit, they don't know people; they don't know who they can talk to so I being here for four years I know who I can talk to and how to get things done that I need get done and I know if I have concerns whom to talk to but a new staff member I think will probably have a hard time with that because they don't know anybody so they don't know who they can talk to which would then be a patient safety concern because they are trying to manage everything on their own and you cannot do that on the floor*.

On the same note, mental health's nurse 3 while discussing the relationship between staff tenure and communication commented that when on a given shift "*you've got 3 staff members that are recent to nursing in general and you have 1 or 2 that are new to mental health…….the communication skills are not going to be there because the ones that are fresh*

and new to the unit are unconfident and uncomfortable in bringing to light something because they don't know how it's going to be interpreted".

The role of patient-nurse ratio

A key finding that emerged from the semi-structured interviews was that staff had much better perceptions of teamwork climate at ICU compared to the other three participating units. The ICU's nurse 3 who had previously worked at the general medicine unit implied that nurse-patient ratio may explain the differences in perceptions of teamwork climate between clinical units as shown by the following excerpt:

> "*Medicine [unit] is where I worked for years previously before coming here and you see differences of people working together on these units. Sometimes up on the medicine unit, where there is a higher ratio of patients and very minimal staff, it was hard to support one another. People got tired and it was just different; the physicality of the job was much heavier…….here you have a unit of about 10 beds which is far better than a unit of 35 beds up there with only 7 to 8 staff on days. Here you just have more people if you need to grab people, which is what it should be*.

Indeed, the general medicine's AHP 1 commented that over-worked nursing staff sometimes ignore her treatment recommendations and put the safety of patients at risk:

> *Sometimes people feel rushed and over worked. So, one of my roles is to assess a patient's mobility and then we have our own communication notes that go above…….the bed but sometimes what I found that if I am recommending that a patient use a mechanical lift or two people to transfer, sometimes the team is, 'oh I am too busy to get that, I will just throw them back into the bed' essentially, not in those words, but it is easier to muscle through things sometimes than to do it in actual recommended safe manner since there is no time for people to go get it, bring it back, hook it all up so that is a component……I think if you have more staff on the floor to support these heavy care need patients then there be more eyes on people, more help to actually mobilize patients so that would reduce the risk of people falling out of bed*.

Perceptions of teamwork climate across clinical boundaries

The quality of teamwork climate across unit boundaries was only brought up in the context of intra-hospital patient transfers – primarily patient transfers from ED – and the process was described as "poor" by the clinical staff. For example, ICU's nurse 2 discussed the difficulty she experienced trying to communicate with physicians from another unit concerning a patient who had experienced a medical error:

> *We had a patient that…….was given a……very large dose of medication at an hourly rate through a miscalculation……she was a patient that was what we call bed space from another unit……..[so] another service supposed to care for this patient and there was no physician that would readily take responsibility for this patient……I had to end up finally going to several layers of physicians and finally……to chief of medicine and she was the one who finally took patient care on that*.

The teamwork climate across clinical unit boundaries was especially an area of concern for interviewees from the adult in-patient mental health unit. They felt that clinical staff from ED lacked understanding about the complexity of treating mental health patients and were prone to provide incomplete information during patient transfers. For instance, mental health's nurse 4 commented:

> *You got staff downstairs who have no clue what we do up here……..they don't get it nor do they want to get it, everything revolves around the emergency room, you cannot assess somebody in a 20-minute period and decide what you want to do with them, it takes some time. They are constantly pushing, pushing, pushing and then when you call them to try to get information, the left hand doesn't know the right, like if I call for a report from an ED nurse, they don't even know who their patients are, they don't know the mental health act, they don't know anything about mental health*.

Similarly, mental health's nurse 5 vividly described an incident where she received insufficient information from ED during a patient's transfer:

> *I was taking in an admission for patient from down in the emergency department…….it was a regular ED nurse who had this patient and she gave me a report, it was pretty brief. She didn't say very much, she told me that 'he is calm and cooperative, nothing is wrong with him'……and after I hung up with her, I realized that I didn't get a very good report so I tried to call back down for another report, nobody answered. So, I had to page my manager, she called down to the emergency to talk to their manager but in the process of this all happening, the patient arrived [up here] on the unit while I was waiting to get a better report*.

There was only one instance where an interviewee from the emergency department talked about her perceptions of teamwork climate between staff from ED and mental health unit. The ED's nurse 1 mentioned that the use of psychiatric emergency nurses on ED has improved the quality of communication between the two units as shown by the following quote:

> *The psychiatric emergency nurse are actually mental health unit nurses that work down here……..they worked up on the mental health, they know what goes on that floor, they know what goes on the emerg so they are kind of back and forth between. Usually a pen nurse is assigned to those four mental health beds here plus an ER nurse, so the ER nurse will do all the blood work, ECGs, kind of more medical things and the pen nurse will look after more psychiatric issues……this is kind of recent, the last couple of years we don't have that pen nurse there so that kind of really help with the communication with the mental health floor*.

Mindful Organizing

The semi-structured interview questions and associated probes didn't directly solicit information about the 5 processes of mindful organizing. However, data analyses revealed the

presence of three of these processes while the interviewees were discussing their perceptions of teamwork climate and leadership support for safety.

Principles of Anticipation

Preoccupation with Failure

Data analyses revealed two specific themes concerning preoccupation with failure: (a) identification and reporting of errors by frontline clinical staff and (b) nurse manager's feedback to those reported errors. There was a consensus among the interviewees from all participating units that the frontline clinical staff are good at identifying and reporting near misses and medical errors irrespective of patient harm. For example, ED's nurse 2 commented:

> *Our jobs require us to be completely 100% accountable for all errors so if you notice that something has happened, you need to tell the appropriate people. Like I once……gave the wrong medication to the wrong patient, realized it as soon as they have popped it in their mouth and swallowed it, 'oh god this is the wrong person' and I have to go and tell the doctor that I have given this person this medication and go from there.*

Similarly, general medicine's nurse 2 mentioned that the nursing staff "*report any incidents that happen to patients……..even if it was a near miss, even if they have fallen and we saw them fall, it was a witness thing, we still fill out an incident report. If they fall and nothing is wrong with them you still fill out the incident report, if they fall and got a skin tear or have a laceration on their head we fill it out and it's not just for falls either*".

On the same note, ICU's nurse 1 mentioned that the nursing staff report all sorts of errors to the online incident reporting system irrespective of the extent of patient harm, "*whether it would be……a needle stick, a fall, anything, we report it……even if somebody has a pressure wound……we report it.*" Similarly, mental health's nurse 2 described the multi-

layered reporting process that the nursing staff engage in when a patient falls on the unit floor as follows:

> *The manager…….is made aware; the charge nurse is made aware; the doctor, the following day as long as it is nothing that you have to attend to right away, as long as it is not a bad fall……..unless it is something they break that needs immediate attention and couldn't wait till the following day then you would have to make those constant decisions*.

There were differences across the four clinical units regarding staff perceptions of nurse manager's feedback to reported errors as evident through the quotations provided above in the section pertaining to supervisory leadership support for safety. At ED, the interviewees believed that the nurse manager provides timely feedback to all types of reported errors or incidents. At ICU and general medicine unit, the interviewees perceived a lack of feedback to reported minor safety events – errors or incidents that didn't cause patient harm – from the nurse manager. At mental health unit, the interviewees perceived that the feedback from unit management is often missing for reported minor safety events and sometimes delayed for serious safety events.

Principles of Containment

Commitment to Resilience

The interviews revealed that on occasions the frontline clinical staff found themselves faced with unexpected events (e.g., a patient fall or administration of a wrong medicine) but in almost all such cases they were able to successfully manage the unexpected event in real time. This pattern was observed on all four participating clinical units. For example, ED's nurse 2 took swift action when she realized that she had administered wrong drug to a patient:

> *I once had a patient, because it's crazy in the fast-track zone and you have you know forty patients at once in there, and I gave the wrong medication to the wrong patient, realized it as soon as they have popped it in their mouth and swallowed it, 'oh god this is the wrong person' and I have to go and tell the doctor that I have given this person this medication and go from there, monitor the patient. It turned out to be quite fine, it was like giving the wrong patient Tylenol but still it could potentially cause damage to the patient if they have allergy to Tylenol or that kind of thing*.

Similarly, general medicine's nurse 3 highlighted the nursing staff commitment to resilience when she described her team's quick response to a patient fall:

> *It was shift change, we were going to go home and the patient in [one of the rooms] was found on the floor……..so, we all rushed in there, of-course somebody said 'I need help in here' because they found him on the floor, we all rushed in there and we all helped, you know two nurses would grab one side and two another side, then we picked him up and we put him back in bed and we took his vitals to make sure that he is ok……make sure there is nothing broken……..make sure that there are no major injuries…….then we have procedures, we have to do incident report, we have to call the doctor and tell the charge nurse to inform them about the fall*.

On the same note, the nursing staff commitment to resilience was evident when it was discovered that a patient has received a drug overdose – ICU's nurse 2 vividly described the drug overdose event:

> *We had a patient that……..was given a……very large dose of medication at an hourly rate through a miscalculation…….she was a 42-year-old woman…….she had heparin running 150 cc per hour, it was horrific amount of heparin…….I was getting report as a charge nurse and then I just got up and said like 'we need to stop, I have to go deal with this' as the nurse was coming out of the room and saying 'what is happening this is running at 100 [cc per hour]'……..and so then the two of us start phoning the physicians, and of-course stop the heparin drip immediately and I said to the primary nurse, 'don't touch her, don't remove any lines, she is not allowed to get out of bed, like don't let her do anything until this just has to wear off'. She just has to metabolize*

> *the drug…… and I had to end up going to several layers of physicians and I finally had to go to chief of medicine and she was the one who finally took patient care on that*.

Similarly, mental health's nurse 5 described an incident where a psychotic patient was initially misdiagnosed at the emergency department before being transferred to the open or less secured side of the mental health unit and then how the nursing team had to manage the unexpected situation in real time to move the patient to the closed or more secured side of the unit:

> *I…….sat down and talked to him and within couple of minutes of talking to him I realized that he was horribly psychotic, he was having delusions that there were people watching him on the cameras; he thought the TV was watching him. He was found about ten minutes later after I went to the nursing station to try to contact my manager…….to get him move over to the closed side of the unit, he was found in…….a female patient's room and he was just standing at the end of her bed, staring at her and this is a patient who has had sexual abuse in the past so that deters her recovery when she is trying to get better……we went to go get the psychotic patient out of her room and then he was trying to get out of the doors, he first was pulling on the patio door and then he went to the exit door and he was pulling on those trying to get out…….I was speaking with him, another nurse……..went on the nursing station and started getting medication ready while couple of us were still talking to the patient, trying to convince him to come over willingly to the closed side without having to put hands on him or call a code white and another nurse went to check on the medication and got that ready and an injection, just in case he wouldn't take the pill. Once we had him over there, the other nurse came with medication and it kind of just fell together that way*.

The role of education or training

A consensus emerged across all participating clinical units that the capabilities for resilience can be improved by providing the frontline clinical staff more educational and/or training opportunities. For example, ED's nurse 3 commented that her clinical team's response

to emergency codes (e.g., code blue, code white etc.) can be improved through simulation training:

> *I feel that we will benefit from having practice codes and I read some literature where hospital and emergency teams who go through repetitive practice arrest situations, perform far better and the communication is far better…….for example, running through practice code blue would really enhance our team work, our communication in a code environment……the unit management should be given permission from upper management to have in house education days, mandatory for staff and we are provided with the time off. Or have it on our scheduled days and then get coverage so that we can be away from the department.*

Similarly, ICU's nurse 3 commented on the need for more education and training for the frontline clinical staff:

> *I think there could be more education and more training. So, we got some new monitors in here a few months ago, and it seems that they drop the monitors off, the bedside monitors, and they left. So, definitely some more training on things like the monitors, even some review topics like human dynamics or ventilators or current studies on……ventilator-associated pneumonia……..would be nice.*

On the same note, general medicine's nurse 2 mentioned that lack of in-house educational opportunities can put patients at risk, "*We have some high-risk medications, where people are not doing the lines properly, like a heparin line with a rescue line……so that is a danger to the patient so we tell our educators that we need more education on these things so that everybody is on the same page and we don't get any follow up*." Similarly, mental health's nurse 3 commented that a lack of crisis prevention intervention training can jeopardize a clinical team's ability to manage and bounce back from a safety incident:

> *If you're not trained to interpret the little bits of what's going on, or to intervene, because you don't have crisis prevention intervention training……how is that safe for the patient? How is*

> *that safe for the unit?.....even if you communicate with your [colleagues], okay you need to watch patient H because he's irritable, didn't sleep, is refusing medications and you let whether it's the personal support worker, or the float nurse, whether it's the agency nurse……know that……you can communicate all you want but if they do not have that training, they're not going to understand.*

Deference to Expertise

Two specific patterns emerged regarding deference to expertise during analyses of the semi-structured interviews. First, interviewees from ED and the general medicine unit believed that some of the physicians don't defer to nurse's expertise during a bed-side crisis, thereby risking the safety of patients. For instance, the following excerpt from the interview with ED's nurse 3 highlighted how a lack of deference to nurse's expertise can compromise patient safety:

> *I had a patient who was having difficulty breathing and going into congestive heart failure or symptoms of what looked like congested heart failure……it was at night time and this physician often leaves early and I have interactions with him before where I have questioned his orders and he has been quite rude to me. So, I called him and I asked if I can give the patient some medicine to help with her breathing and also get a chest X-ray. He was quite rude on the phone, didn't finished listening to my request and then hung up on me……this is also the physician who ordered a blood thinner for a patient of mine with a basal skull fracture and I refused to give. I called him several times to clarify orders, I called to see if I can give him something for pain, he said 'yes', then I called back to clarify, 'are you sure you want me to give him heparin, he got a skull fracture' and he said 'yes give the heparin and make sure you think next time before you call me' and then hung up.*

Similarly, general medicine's nurse 2 commented that, "*some physicians probably……think that they know the patient better than we do……which is not fair because we spend 12 hours a day with them, they spend may be 20 minutes……it is not beneficial to the*

patient in the long run when they don't listen to us when we got a concern, it may be a gut feeling but there is a genuine concern".

A second pattern regarding deference to expertise emerged at the mental health unit where the interviewees were of the view that the unit management don't defer to the expertise of the frontline clinical staff during a bed side crisis, thereby putting the safety of staff and patients at risk. For instance, mental health's nurse 4 talked about her frustration when the unit management ignored the frontline clinical staff recommendation to move a patient that instigated an extremely violent incident to a stand-alone psychiatric hospital:

> *Our management team…….they did not listen to the staff, I have done this job for a lot of years, I came from a psychiatric mental health centre, they have every violent offender there, I said that he needs to be transferred there now, nobody listened……the management had no idea how to handle this, it was like they were wading through and learning as they were going. Listen to the staff who tell you, the guy got to go, send him to jail, we all said forensic, he's got to go, it's [an extremely violent] incident, call the police…….so, they put staff repeatedly at risk as well as all the other patients just for one guy who should have been the hell out of here, like quickly*.

It is important to note here that the topic of deference to expertise during a crisis situation was not brought up by any of interviewees from ICU.

In summary, the qualitative data analyses showed that the interviewees perceived a lack of support for safety from senior leaders at all participating clinical units. The interviewees were of the view that the hospital's senior leaders need to be more visible at the frontlines, communicate their vision about the hospital much more clearly and involve frontline clinical staff in policy making discussions.

The interviewees from ED, ICU, and the general medicine unit held positive perceptions of supervisory leadership support for safety – the only exception being the perception of a lack of manager's feedback to minor events or near misses at ICU and the general medicine unit. In contrast, at the adult in-patient mental health unit, two distinct groups emerged that held strongly opposing views on supervisory leadership support for safety. On the one hand, the majority of interviewees had negative perceptions of nurse manager's support for safety while on the other an outlier held positive views on supervisory leadership support for safety. In general, the frontline clinical staff preferred participative or supportive nurse managers, who are approachable, value staff expertise, provide timely feedback and take staff concerns into consideration while making decisions compared to directive nurse managers who micro-manage and seldom rely on the expertise or opinions of the frontline clinical staff while making decisions.

The data analyses revealed that the staff perceptions of teamwork climate are strongly influenced by profession and unit boundaries. Within unit boundaries, the interviewees held positive perceptions of intra-professional teamwork climate on all participating clinical units, whereas, staff perceptions of inter-professional teamwork climate were primarily negative on 3 out of 4 clinical units – ICU being the exception where interviewees believed that clinicians belonging to different professions worked well as a team on the unit. Lastly, interviewees from the participating units suggested that the presence of newer or inexperienced staff as well as high patient to nurse ratio can compromise the quality of teamwork climate on a clinical unit.

The interview questions and associated probes solicited information on within unit teamwork climate, however, some interviewees from mental health and ED talked about the

quality of teamwork climate between these two specific units – those from mental health described it as poor while those from ED believed that it has improved significantly over the past few years.

Similarly, the semi-structured interviews did not directly solicit information about mindful organizing. However, data analyses revealed themes pertaining to three out of five processes of mindful organizing – preoccupation with failure, commitment to resilience, and deference to expertise. First, the interviewees believed that frontline clinical staff report near misses and errors irrespective of patient harm but feedback from a nurse manager is not always forthcoming or timely. Second, there were numerous examples in the interviews of frontline clinical staff commitment to resilience on all four clinical units. Furthermore, it was suggested by interviewees that staff capabilities of resilience can be improved by providing frontline clinical staff more on-site educational and training opportunities. Third, the interviewees suggested that patient safety is jeopardized whenever a physician or a nurse manager does not defer to the expertise of the frontline nursing staff during a bedside crisis.

Chapter 4: Discussion

Safety Climate

The survey results partially supported hypothesis 1a as staff perceptions of senior leadership support for safety were shown to be positively and significantly associated with overall patient safety perceptions and overall patient safety grade. These survey results were corroborated by the qualitative findings as interviewees highlighted the importance of supportive senior leaders to safety outcomes at the frontlines.

Much of the empirical research in healthcare settings has focused on safety behaviours of senior leaders that can improve employees' climate perceptions such as leadership styles (e.g., Yun, Faraj, & Sims, 2005), executive safety walk-rounds (e.g., Frankel et al., 2008; Thomas et al., 2005), adopt-a-work unit (e.g., Pronovost et al., 2004), and frontline safety forums (e.g., Tucker et al., 2008). In contrast, empirical research that has tried to directly examine the relationship between employees' perceptions of senior leadership and safety outcomes is lacking – see Mardon et al., (2010) for an exception. However, the positive impact of supportive senior leaders on patient and staff outcomes can be inferred from empirical research – e.g., employees' positive perceptions of executive leaders are significantly associated with higher nurse job satisfaction (Cummings et al., 2010) while higher nurse job satisfaction has been associated with significantly lower patient mortality rates (Aiken et al., 2002) and nurse turnover intention (Hayes et al., 2012).

The survey results found that the association between perceptions of senior leadership support for safety and self-reported turnover intention was non-significant. The turnover theory suggests that an employee's decision to leave his/her department or organization is primarily influenced by that employee's immediate work characteristics (Galletta, Portoghese,

Battistelli, & Leiter, 2012) – implying that distal organization level characteristics such as senior leadership support for safety may have limited impact on a clinician's turnover intention when compared with more immediate unit level characteristics. Indeed, empirical studies in healthcare settings have shown that employees' turnover intentions are primarily influenced by individual level (e.g., age, tenure) and unit level (e.g., workload, staffing, supportive unit supervisor) characteristics (e.g., Galletta, Portoghese, Penna, Battistelli, & Saiani, 2011; Hayes et al., 2012).

The survey results did not support hypothesis 1b as the relationships between staff perceptions of supervisory leadership support for safety and the three self-reported safety outcomes were shown to be non-significant. However, interviewees across all participating clinical units emphasized the importance of supportive frontline managers to staff and patient safety outcomes. In addition, both interviewee participants and survey respondents, on average, held more positive perceptions of supervisory leadership support for safety compared to senior leadership support for safety (see table 3.9 – supervisory leadership's mean = 3.61 and senior leadership's mean = 3.01).

Study data showed some inconsistency between qualitative findings and quantitative results on supervisory leadership support for safety. However, it is also important to note here that the survey solicited staff perceptions of manager's proactive safety behaviours (e.g., *my supervisor/manager says a good word when he/she sees a job done according to established patient safety procedures*) while the questions/probes for the interviews were reactive – i.e., solicited staff perceptions of a manger's safety related actions in response to a safety incident – perhaps causing the survey and interview to capture different aspects of the same

phenomenon. Furthermore, the survey items for supervisory leadership focused on only two aspects of a manager or supervisor's role: (a) encouragement of clinical staff to follow established patient safety procedures and (b) taking into consideration staff suggestions for improving patient safety. However, the qualitative findings suggested that the clinical staff perceived the safety related responsibilities of a supervisor in much broader terms – for example, the ability of a supervisor to provide timely feedback regarding reported errors was seen by interviewees as a central aspect of supervisory leadership support for safety. There is in fact ample empirical evidence in the healthcare literature for the positive effect of supportive supervisors or frontline leaders on patient and staff safety outcomes. For example, nursing staff perceptions of supportive managers have been associated with significantly lower patient mortality, medication errors, patient falls, patient infection rates, and nursing turn-over in hospital settings (Capuano, Bokovoy, Hitchings, & Houser, 2005; Houser, 2003; Wong, Cummings, & Ducharme, 2013). Future examinations of supervisory leadership for safety would benefit from broader operationalizations of supervisory leadership for safety than the measure used in the current study.

Mindful Organizing

Hypothesis 2 was not supported by the survey results as the associations between safety organizing scale (SOS) and the three outcome variables was found to be non-significant. In comparison to the current study, all previous empirical research on SOS had utilized larger sample which increases the likelihood of detecting significant associations among variables (Kerlinger & Lee, 2000). Furthermore, the current study contained a relatively large number of variables – unlike the past empirical studies on SOS – potentially limiting the amount of unique

variance accounted for by SOS in the hierarchical regression analyses. In addition, the qualitative findings of the current study show that senior and supervisory leaders primarily rewarded staff for compliance with established safety protocols and rarely for extra-role safety behaviours suggesting that perhaps many of the frontline clinicians were either unaware of or did not appreciate the importance of extra-role safety behaviours that underpin the safety organizing scale. In other words, high reliability theory and the components of mindful organizing may not yet be part of frontline providers' lexicon to the extent that leadership support for safety is.

The semi-structured interview questions and associated probes did not directly solicit information about mindful organizing; however, data analyses revealed the presence of some interesting themes associated with processes of mindfulness. First, it emerged that on 3 out of 4 clinical units, the management rarely responded strongly to weak signals of failures, that is, near misses or safety events causing no patient harm, rarely elicited feedback from unit management. The importance of managerial response to safety failures is increasingly supported in the literature. In a theoretical paper, Kaplan and Fastman (2003) pointed out that compared to adverse events resulting in patient harm, near misses and no-patient harm incidents provide greater opportunities for organizational learning and systems' improvement as such events occur more frequently, contain richer information content for failure/learning analyses, and permit examination of organizational capabilities to prevent incidents from escalating into patient harm adverse events – consequently, error reporting systems must be able to capture near misses and no-patient harm events while administration's feedback needs to be timely to motivate clinicians to report such events. Indeed, empirical evidence showing

that timely and appropriate feedback for reported errors is an integral part of an effective incident reporting system has started to emerge. For example, Benn et al. (2009) conducted semi-structured interviews with safety management experts from high risk industries (e.g., civil aviation, offshore production, healthcare, and energy) to glean knowledge about the characteristics of effective safety feedback for incident reporting. Their thematic analyses suggested that following an incident report, it is crucial to immediately start a dialogue with the original reporter to assure the employee that the report will be acted upon. Moreover, the safety feedback must be continuous, that is, all employees including the original reporter must be kept apprised of event analysis results and any solutions implemented to alleviate the problem. Karsh et al. (2006) used a focus group design to elicit perceptions of family physicians, nurses, and clinical assistants on a variety of topics related to the design and implementation of a medical error reporting system – e.g., purposes and format of a reporting system, barriers and motivators for error reporting. The inductive analysis of the focus groups revealed that participants perceived the presence of instantaneous and continuous feedback as a key motivator for error reporting. Similarly, a cross sectional survey study carried out in six Australian hospitals showed that perceived lack of feedback was the most frequently cited barrier to error reporting by both doctors and nurses (Evans et al., 2006).

Second, on 3 out of 4 clinical units, interviewees felt that some of the informal (i.e., physicians) and formal leaders (i.e., managers) ignore the expertise of bedside nurses during crisis situations, thereby putting patients at risk. This is consistent with previous research in which nurses perceived that their opinions/concerns are not always taken into account by physicians during patient care decision making. For example, a cross-sectional survey study,

with a sample of 114 nurses and 33 physicians, found that collaborative patient care decision making was the least frequently used physician behaviour at an acute care hospital (Nair, Fitzpatrick, McNulty, Click, & Glembocki, 2012). Similarly, Niekerk and Martin (2002) conducted a survey study to elicit views of 1,015 registered nurses on ethical and professional conflicts experienced by them during the provision of pain treatments. The results suggested that physicians often inadequately consult nurses while designing pain treatment plans for patients. In addition, nurses who felt physicians adequately rely on their pain management advice were significantly less likely to experience conflict with physicians compared to those who felt physicians ignore their advice. This is important because research in healthcare settings has also shown that collegial or collaborative nurse-physician relationships – characterized by physicians valuing the unique and overlapping expertise of nurses – are significantly associated with positive patient (e.g., lower mortality rates, decreased length of stay) and staff (e.g., decreased turnover intention) outcomes (e.g., Baggs et al., 1999; Bogaert, Meulemans, Clarke, Vermeyen, & Heyning, 2009; Knaus, Draper, Wagner, & Zimmerman, 1986; Schmalenberg & Kramer, 2009). Similarly, empirical research suggests that high quality or positive nurse-manager relationships are significantly associated with positive nurse (e.g., lower turnover intention) and patient (e.g., lower incidence of falls, nosocomial infections, and medication errors) outcomes (Galletta, Portoghese, Battistelli, & Leiter, 2012; Germain and Cummings, 2010; Laschinger and Leiter, 2006).

Third, consensus emerged in regards to the importance of providing hospital based continuous safety training or education to the frontline clinical staff in order to improve their capabilities to manage and bounce back from unexpected events. Indeed, empirical research

suggests that on-site (e.g., hospital, nursing home) staff training or education can significantly improve clinicians' performance or competence. For example, in the clinical realm a prospective randomized cohort study found that low dose (i.e., 5-minute training session) high frequency (i.e., 4 training sessions in 6 months) in-hospital cardiopulmonary resuscitation (CPR) training significantly improves the CPR performance of pediatric nurses and physicians (Sutton et al., 2011). The study participants were 2.9 times more likely to perform excellent CPR on a pediatric manikin after they have successfully completed 3 training sessions while CPR performance of no-training cohort did not improve. An observational cohort study was conducted at a large tertiary care hospital in Chicago to determine the impact of simulation-based education on the incidence of catheter related bloodstream infections (Barsuk, Cohen, Feinglass, McGaghie, & Wayne, 2009). During the study, ninety-two residents at a medical intensive care unit completed simulation-based training on how to properly insert a central venous line. It was found that ICU patients had a significantly lower incidence of central line infections per 1000 catheter-days after the implementation of the educational intervention. Similarly, a number of other empirical studies have suggested that staff competence and/or quality of patient care improves when frontline clinical staff are provided on-site education/training on a wide variety of topics including communication (Rollnick, Kinnersley, & Butler, 2002), minimal access laparoscopic surgery (Seymour et al., 2002), cancer risk assessment (Blazer et al., 2005), and emergency airway management (Mayo et al., 2004).

Teamwork Climate

Hypothesis 3 was supported by the survey results as teamwork climate was shown to be significantly associated with the three self-reported safety outcomes (i.e., overall perceptions of

patient safety, overall patient safety grade, and turnover intention). These results are consistent with past empirical research that has shown staff perceptions of teamwork climate significantly impact patient (e.g., adverse events) and staff (e.g., burnout) safety outcomes (e.g., Bowers, Nijman, Simpson, & Jones, 2011; Buist et al., 2002; Mardon et al., 2010; Mazzocco et al., 2009).

The survey results found that the perceived quality of teamwork climate was especially important for self-reported turnover intention – every 1 point increase in teamwork climate resulted in a 1 point decrease in turnover intention. Moreover, nurse survey respondents reported higher turnover intentions compared to allied health professionals. Interestingly, past empirical research has suggested that nurses are more likely to report high turnover intention when they perceived low quality of teamwork climate (Hayes et al., 2012) while turnover intention in turn is significantly associated with actual leaving behaviours (Bluedorn, 1982; Schwepker, 2001). Consequently, when taken together, it can be argued that healthcare organizations may be able reduce nurses' turnover by focusing their efforts on improving the quality of teamwork climate.

The qualitative findings corroborated the survey results as interviewees perceived positive teamwork climate within a unit as critical for patient and staff safety outcomes. In addition, the qualitative findings revealed that the clinical staff distinguished the quality of teamwork climate across professional and unit boundaries. In general, the interviewees held positive perceptions of intra-professional and negative perceptions of inter-professional teamwork climate on a clinical unit, this being consistent with past empirical research. For example, Creswick, Westbrook, & Braithwaite (2009) carried out a cross-sectional survey study

to examine problem-solving, advice-seeking, and socializing networks of staff at an Australian emergency department. The study found the majority of work-related collaboration on the unit occurred within professional boundaries, i.e., ED clinicians including physicians, nurses and allied health staff primarily sought help from and provided assistance to peers in their own profession. Similarly, a qualitative study was conducted to examine the impact of professional boundaries on quality of teamwork climate at a forensic mental health unit located in London, United Kingdom (Shaw, Heyman, Reynolds, Davies, & Godin, 2007). Data were collected through (a) direct observations of inter-professional teamwork behaviors and (b) semi-structured interviews with psychiatrics, nurses, allied health staff (i.e., psychologists, occupational therapists, and social workers), and patients. It was found that high quality inter-professional collaboration rarely emerged on the unit primarily as a consequence of power/status inequalities among the professionals – psychiatrists residing at the top and nurses at the bottom of the power/status hierarchy. The psychiatrists interacted with other clinicians in a manner that solidified bio-medical dominance and marginalized other patient care perspectives leading to only 'tokenistic' collaboration between psychiatrists and other clinical staff. However, on rare occasions, high quality collaboration emerged between nurses and allied health professionals when they equally shared the responsibility for patient care decisions.

Interestingly, the qualitative findings of the current study revealed that the nurses were especially concerned about the quality of nurse-police teamwork climate on the adult in-patient mental health unit. The working relationship between nursing staff and police officers has rarely been empirically studied in the healthcare literature. Furthermore, it has primarily been

examined from the nurses' perspective on preventing workplace violence. The empirical research on workplace violence suggests that nurses feel safe in the presence of police officers but at the same time they perceive that police officers are inadequately trained/educated on healthcare issues and institutional policies often fail to clearly outline the responsibilities of police officers while they are stationed on a clinical unit (e.g., Catlette, 2005; May & Grubbs, 2002) – these same factors were also implicated by the interviewees in the current study as potential causes of poor nurse-police teamwork climate at the adult in-patient mental health unit.

Moreover, the qualitative findings indicated that higher tenure and higher staffing levels are beneficial for teamwork climate and safety outcomes on a clinical unit. Indeed, empirical research suggests that a higher nurse-patient ratio or nurse staffing level is significantly associated with lower medication errors and patient's length of stay (Paquet, Courcy, Lavoie-Tremblay, Gagnon, & Maillet, 2013), lower odds of hospital related adverse events including in-patient mortality, nosocomial bloodstream infection, hospital acquired pneumonia (Kane, Shamliyan, Mueller, Duval, & Wilt, 2007), lower odds of nursing burnout and job dissatisfaction (Aiken, Clarke, Sloane, Sochalski, & Silber, 2002), and better nursing teamwork climate (Kalisch & Lee, 2011). Similarly, higher nurse tenure or years of experience on a clinical unit is significantly associated with lower incidence of patient infections – i.e., pneumonia, pressure ulcers, and urinary tract infections (Uchida-Nakakoji, Stone, Schmitt, & Phibbs, 2015), decreased probability of nurses' needlestick injuries (Clarke, Rockett, Sloane, & Aiken, 2002), lower patient's residual length of stay – i.e., actual length of stay minus expected length of stay (Bartel, Beaulieu, Phibbs, & Stone, 2014) and better nurse-physician collaboration (Niekerk &

Martin, 2002). Interestingly, the survey results showing that clinical staff in the ICU had significantly higher tenure and held more positive perceptions of safety outcomes compared to the other three participating units are consistent with the qualitative findings on tenure. Furthermore, informal conversations with nurse managers and formal interviews with study participants revealed that the ICU nurse-patient ratio was much higher compared to the other three clinical units – e.g., under normal working conditions, each ICU nurse took care of a single patient while each ED nurse was responsible for the care of at least 4 patients. This qualitative finding on nurse-patient ratio provides a potential explanation for the significant association of ICU and two of the three self-reported safety outcomes.

Finally, the qualitative findings also revealed that the nursing staff held overwhelmingly negative perceptions of the quality of teamwork climate across unit boundaries when it came to intra-hospital patient transfers. Much of the empirical research on patient handoffs or patient transfers has focused on inter-shift handoffs within the same department and inter-hospital patient transfers (Ong & Coiera, 2011). However, scarce empirical research on intra-hospital patient transfer suggests that poor collaboration/teamwork among clinicians involved in the transfer process can often lead to medical errors and associated patient harm. For example, Horwitz et al., (2009) surveyed all medical staff – e.g., physicians, nurses, and physician assistants – responsible for patient transfers from the emergency department to an in-patient medicine unit at a large US teaching hospital. Twenty-nine percent of the survey respondents reported that poor quality of patient transfers from ED to a medicine unit resulted in medical errors (e.g., diagnostic, treatment) causing a patient to experience a near miss or an adverse event. Similarly, a retrospective review of 7525 incident reports submitted by 93 ICUs

to an Australian incident monitoring system between 1993 and 1999 identified 176 intra-hospital patient transfer incidents (Beckmann, Gillies, Berenholtz, Wu, & Pronovost, 2004). Of these 176 reported incidents, 55 resulted in serious patient harm (e.g., prolonged hospital stay, physical injury, or death). A six-month prospective observational study at an Australian teaching hospital examined the quality of patient transfers from in-patient wards to radiology (Ong & Coiera, 2010). No incidents that caused patient harm were observed, however, patients experienced treatment delays and an average of 4 errors per transfer. Some of the key factors implicated for the poor quality of intra-hospital patient transfers in the empirical literature include omitted or inaccurate patient information, overcrowding, professional conflicts, and contrasting patient care expectations or approaches (e.g., Apker, Mallak, & Gibson, 2007; Beckmann et al., 2004; Horwitz et al., 2009; Ong & Coiera, 2010) – these factors were also identified by the interviewees in the current study as potential sources of poor teamwork climate across unit boundaries.

Linking Back to Study's Conceptual Framework

According to the enabling, enacting, and elaborating safety culture framework, external (e.g., accreditation) and internal (e.g., leader behaviours) forces shape safety climate perceptions of frontline staff by prioritizing or subordinating safety over other organizational goals. This in turn motivates or discourages, the frontline staff to participate in safety enhancing behaviours – e.g., teamwork and mindful organizing – capable of improving safety outcomes on the frontlines. The results of the current mixed methods cross-sectional study lend support to this framework as both safety climate and teamwork climate were shown to significantly impact safety outcomes. In addition, the results suggest a potential avenue of refinement to

the framework in terms of accounting for both safety climate and teamwork climate's boundary conditions. More specifically, the current study's results found that the frontline clinical staff distinguished between safety priorities of supervisory and senior leaders leading to the emergence of two concurrent safety climate perceptions. Similarly, the frontline clinical staff highlighted that the quality of teamwork climate were effected by profession and clinical unit boundaries.

Caution should be exercised while describing mindful organizing as an enacting process based on the results of the current study – the survey found a non-significant relationship between SOS and safety outcomes while the interviews did not directly solicit information on mindful organizing. However, interviewees indirectly acknowledged the importance of certain processes of mindful organizing (i.e., preoccupation with failure, commitment to resilience, and deference to expertise) to safety outcomes, warranting further research to explore this association. Finally, interviewees suggested that adequate staffing levels and on-site training/education enhances the quality of teamwork climate and mindful organizing respectively – lending support to the conceptual model's assertion that human resource practices are an enabling force that motivates/discourages frontline staff to enact safety enhancing practices (see figure 1.1).

Climate Profile

The R_{WG} values based on a slightly skewed null distribution revealed that there was lack of agreement among survey respondents on senior leadership support for safety at all four participating clinical units (R_{WG} range = 0.08 – 0.49). Similarly, there was lack of agreement on supervisory leadership support for safety at three out of four clinical units (R_{WG} range = 0.11 –

0.46), ICU being the exception (R_{WG} = 0.68). In contrast, the perceptions of clinical staff on teamwork climate were strongly aligned at three out of four clinical units (R_{WG} range = 0.74 – 0.88), the adult in-patient mental health unit being the exception where there was considerable variability or lack of agreement on teamwork climate (R_{WG} = 0.19). The R_{WG} results for teamwork climate were corroborated to a certain extent by the qualitative findings as an outlier emerged on the adult in-patient mental health unit that held overwhelmingly different teamwork climate compared to her peers.

Overall, it can be argued that weak climates persisted at the adult in-patient mental health unit. Moreover, the histograms representing climates at the mental health unit were consistently bimodal in nature, indicating the presence of two distinct subgroups that perceived the quality of safety on the unit quite differently (see Appendix 8). There were instances of bimodal climate shapes emerging on other clinical units but for the most part the histograms representing climate shapes at other units were normally distributed.

These findings lend support to previous research suggesting that relegation of climate strength as a mere statistical hurdle to justify aggregation of individual level climate data to team/unit level has resulted in an incomplete understanding of the safety climate construct (Ginsburg & Oore, 2015; Singer & Vogus 2013a). The use of holistic climate profiles (i.e., levels, strengths, & shapes of climates) would also help healthcare organizations implement safety improvement initiatives tailored to the needs of a particular clinical unit. For example, it may be necessary to hold a series of focus groups on a clinical unit that has moderate level of safety climate, weak safety climate strength, and a bimodal safety climate shape to fully understand the safety perceptions of distinct subgroups before implementing a safety improvement

intervention. On the other hand, an intervention that clarifies safety procedures, norms, and behaviours may benefit a clinical unit with a moderate level of safety climate, weak safety climate strength, and rectangular climate shape.

Limitations and Future Research

The current mixed methods study was cross-sectional and therefore causal associations between predictor and outcome variables cannot be established (Mathieu & Taylor, 2006). It is difficult to conduct experimental studies in healthcare settings but healthcare research would benefit from more longitudinal quantitative, qualitative, and mixed methods studies (Galletta, Portoghese, Battistelli, & Leiter, 2012; Wong, Cummings, & Ducharme, 2013). Also, the current study utilized self-reported measures that are subject to social desirability biases (Foley, Manuel, & Vitolins, 2005; Podsakoff & Organ, 1986). However, assuring survey participants anonymity and interviewees full confidentiality, as was done in the current study, can minimize socially desirable responding (Randall & Fernandes, 1991).

In the healthcare arena, much of the empirical research on safety and quality has primarily focused on understanding the perceptions of nurses and to a lesser extent those of physicians while largely ignoring the perspectives of other healthcare professionals. In order to address this literature gap, the current study solicited safety perceptions of allied health professionals and unit clerics, in addition to frontline nurses. However, qualitative data analyses revealed that other clinical (e.g., physicians, nurse-managers) and non-clinical (e.g., police) professionals were seen by study's participants as indispensable partners for enhancing staff and patient safety outcomes, warranting the need for future research to simultaneously examine the safety perceptions of a much wider variety of healthcare professionals.

In the current study, quantitative data analyses were completed before the start of qualitative data analyses and the researcher responsible for both sets of analyses could not be blinded to the clinical units during qualitative analyses thereby creating the possibility of researcher bias in the interpretation of the qualitative data. Furthermore, it became apparent during qualitative data collection and analyses that short semi-structured interviews were not ideal for soliciting staff perceptions of mindful organizing – perhaps because hospital staff are not aware of processes of mindful organizing to the same extent as they are of more commonly discussed safety areas such as communication, teamwork, and leadership. Consequently, it is recommended that future studies utilize observations or focus groups to capture greater social context and thereby gain a better understanding of mindful organizing at the frontlines.

An important finding of the qualitative data analyses was that clinical staff differentiated between inter and intra professional teamwork climate. However, interviewees in the current study predominantly consisted of nurses and it is recommended that future qualitative/mixed methods studies utilize sampling techniques that are able to capture the perceptions of a larger number of non-nursing hospital staff in order to validate the current study's findings on inter and intra professional teamwork climate.

The current study utilized convenience and snowball sampling procedures to collect survey data from four clinical units at a single large community hospital, limiting the ability to generalize the study's findings to other types of clinical units (e.g., surgery or pediatrics) and hospitals (e.g., small community or teaching). Finally, the sample size for semi-structured interviews was small, especially for non-nursing professionals – e.g., only 1 clerical staff was interviewed – and therefore caution should be exercised while interpreting the qualitative

findings. Consequently, it is recommended that future mixed methods research test the validity of the current study's inferences by utilizing a larger multi-site sample.

Implications for Practice

The current study's results suggest that the frontline clinicians prefer relationship-oriented leaders over task-oriented leaders at both supervisory and senior leadership roles. The relational practices – e.g., providing vision, support, and constructive feedback – of formal healthcare leaders are associated with better staff and patient outcomes (e.g., Laschinger and Leiter, 2006; Wong, Cummings, & Ducharme, 2013). Therefore, it is important for healthcare institutions to recruit and retain individuals possessing relational competencies into leadership roles at all levels of an organization. Moreover, healthcare leaders must prioritize safety over efficiency and be cognizant of the limitations of certain performance indicators – e.g., average length of stay, average cost per discharge – as such indices tend to put emphasis on efficiency.

The current health care delivery systems are under increasing pressure to simultaneously contain costs and preserve quality of care, necessitating higher levels of inter and intra professional collaboration or teamwork. At the same time, empirical research suggests that clinicians belonging to different professions – e.g., physicians, nurses – hold different perspectives on and expectations from collaborative or teamwork behaviours at the frontlines (Copnell et al., 2004). Therefore, healthcare organizations must provide on-site inter-professional collaborative workshops on topics that can strengthen working relationships such as conflict management, inter-professional respect, negotiation skills, and stress management (Nair, Fitzpatrick, McNulty, Click, & Glembocki, 2012).

Furthermore, the frontline clinicians would benefit from on-site clinical training and presence of adequate staffing resources so that they are able to provide high quality care to their patients (e.g., Kane, Shamliyan, Mueller, Duval, & Wilt, 2007; Sutton et al., 2011). Moreover, it can be argued that the presence of relational leaders, collaborative work environments, adequate staffing levels, and on-site professional development/educational opportunities will help retain longer-tenured frontline clinical staff, potentially improving safety outcomes at a clinical unit (e.g., Clarke, Rockett, Sloane, & Aiken, 2002; Uchida-Nakakoji, Stone, Schmitt, & Phibbs, 2015).

In general, the study participants from the adult in-patient mental health unit held poorer perceptions of domain specific climates and safety outcomes compared to staff on the other participating clinical units. Indeed, the past empirical research has shown that staff perceptions of climate differ between clinical units (Singer et al., 2009a) while clinical areas such as mental health and long-term care have been noted for resource scarcity, quality issues, and inadequate staff training (Armstrong et al., 2009). The results of the current study, along with previous empirical research, suggest that healthcare managers/leaders must devote more attention and perhaps resources to improving patient and staff safety on mental health units.

Finally, a healthcare organization trying to improve patient and staff safety can and should generate a climate profile (i.e., climate's level, strength, and pattern) to get a more nuanced understanding of any given domain specific climate (e.g., safety climate, communication climate, work-ownership climate). The use of information gleaned from holistic climate profiles should allow the design of tailored safety improvement strategies that are more likely to be successful in changing practice at the frontlines (Ginsburg & Oore, 2015).

Conclusion

The "*To Err is Human*" (Institute of Medicine, 2000) and "*Crossing the Quality Chasm*" (Institute of Medicine, 2001) reports highlighted acute quality and safety deficiencies in the healthcare delivery systems and in doing so energized the scientific community and healthcare professionals to design, evaluate, and implement safety improvement strategies at the frontlines. Indeed, implementation of standardized clinical interventions such as hand hygiene guidelines (Goldmann et al., 2009), and surgical checklists (World Health Organization, 2008) have reduced occurrence of medical errors and associated patient harm. Moreover, there is increasing empirical evidence of the indispensable impact of contextual factors (e.g., communication, teamwork, safety climate) on quality of care and safety outcomes (e.g., Bosk, Dixon-Woods, Goeschel, & Pronovost, 2009; Bowers, Nijman, Simpson, & Jones, 2011; Niekerk and Martin, 2002), however, certain literature gaps still remain including an over-reliance on quantitative research (Woodward et al., 2010), imprecise conceptualization of constructs – e.g., safety climate (Zohar, 2008), lack of empirical research rooted in theory (Singer & Vogus, 2013a), and limited empirical evidence of the beneficial impact of certain contextual factors (e.g., mindful organizing) on safety outcomes etc. The results of the current mixed methods study suggest that safety climate, teamwork climate, and mindful organizing demonstrably impact frontline clinical staff perceptions of safety outcomes, thereby addressing some apparent gaps in the organizational safety literature. The current study, together with future research will broaden our understanding of how context-specific factors influence safety outcomes, and ideally help improve delivery of patient care at the frontlines.

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Appendix 1: Interview Guide

Face-sheet

Date of Interview:

Time of Interview:

Location of Interview:

Written Consent Obtained:

Extra notes:

Interview Guide

1) Can you tell me about what you do here? For how long have you worked at this unit?

2) Can you think about the last patient safety incident you were involved in? Can you briefly describe what happened?

- Potential probes:
    - Is this a typical type of safety issue at your unit?

3) So, what was the outcome of this incident and in your view what factors contributed to this outcome?

- Potential probes:
    - a) What about:
        - Leaders?
        - Teamwork & communication?
        - Feeling safe while reporting errors?
        - Utilization of staff expertise?

4) Is there anything else we have not discussed yet that you believe is important for delivering safe care at your work place?

Post Interview Comment Sheet

Description of the setting and the participant:

Emotional tone of the interview:

Any particular difficulties encountered during the interview:

My feelings during and about the experience:

Personal insights and reflections:

Extra notes:

Appendix 2: Survey Instrument

Patient Safety Survey

1. On which patient care unit you spend the most time? Unit name: _____

2. For how long have you been working on this unit?

- ❒ 6-24 months
- ❒ 2-5 years
- ❒ > 5 years

3. Safety Climate

We are looking for your perceptions and opinions of these safety issues. While thinking about your unit, indicate the extent to which you agree or disagree with each of the following statement.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
a) Senior management has a clear picture of the risk associated with patient care	❒	❒	❒	❒	❒	❒
b) Patient safety decisions are made at the proper level by the most qualified people	❒	❒	❒	❒	❒	❒
c) Senior management provides a climate that promotes patient safety	❒	❒	❒	❒	❒	❒
d) Senior management considers patient safety when program changes are discussed	❒	❒	❒	❒	❒	❒
e) My supervisor/manager says a good word when he/she sees a job done according to established patient safety procedures	❒	❒	❒	❒	❒	❒
f) My supervisor/manager seriously considers staff suggestions for improving patient safety	❒	❒	❒	❒	❒	❒

4. Safety Behaviours

Please think about the unit where you work most when responding to the following statements.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
a) It is easy for personnel in this unit to ask questions when there is something that they do not understand.	❒	❒	❒	❒	❒	❒
b) I have the support I need from other personnel to care for patients.	❒	❒	❒	❒	❒	❒
c) Team input is well received in this unit.	❒	❒	❒	❒	❒	❒
d) In this unit, it is difficult to Speak Up if I perceive a problem with patient care.	❒	❒	❒	❒	❒	❒
e) Disagreements in this unit are resolved appropriately (i.e., not *who* is right, but *what* is best for the patient).	❒	❒	❒	❒	❒	❒
f) The physicians and nurses and other team members here work together as a well-coordinated team.	❒	❒	❒	❒	❒	❒

	Not at all	To a very limited extent	To a limited extent	To a moderate extent	To a conside rable extent	To a great extent	To a very great extent
g) We have a good "map" of each other's talents and skills	❒	❒	❒	❒	❒	❒	❒
h) We talk about mistakes and ways to learn from them	❒	❒	❒	❒	❒	❒	❒
i) We discuss our unique skills with each other so we know who on the unit has relevant specialized skills and knowledge	❒	❒	❒	❒	❒	❒	❒
j) We discuss alternatives as to how to go about our normal work activities	❒	❒	❒	❒	❒	❒	❒
k) When giving report to an oncoming nurse/staff, we usually discuss what to look out for	❒	❒	❒	❒	❒	❒	❒
l) When attempting to resolve a problem, we take advantage of the unique skills of our colleagues	❒	❒	❒	❒	❒	❒	❒
m) We spend time identifying activities we do not want to go wrong	❒	❒	❒	❒	❒	❒	❒
n) When errors happen, we discuss how we could have prevented them	❒	❒	❒	❒	❒	❒	❒
o) When a patient crisis occurs, we rapidly pool our collective expertise to attempt to resolve it	❒	❒	❒	❒	❒	❒	❒

5. Safety Outcomes

Please think about the unit where you work most when responding to the following statements.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a) Patient safety is never sacrificed to get more work done	❒	❒	❒	❒	❒
b) Our procedures and systems are good at preventing errors from happening	❒	❒	❒	❒	❒
c) It is just by chance that more serious mistakes don't happen around here	❒	❒	❒	❒	❒
d) We have patient safety problems in this unit	❒	❒	❒	❒	❒

	Strongly Disagree	Disagree	Somewh at Disagree	Neutral	Somewh at Agree	Agree	Strongly Agree
e) There is a good chance that I will leave this job in the next year or so	❒	❒	❒	❒	❒	❒	❒
f) I frequently think of quitting this job	❒	❒	❒	❒	❒	❒	❒
g) I will probably look for a new job in the next year	❒	❒	❒	❒	❒	❒	❒

h) Please give your work area/unit in this hospital an overall grade on patient safety.

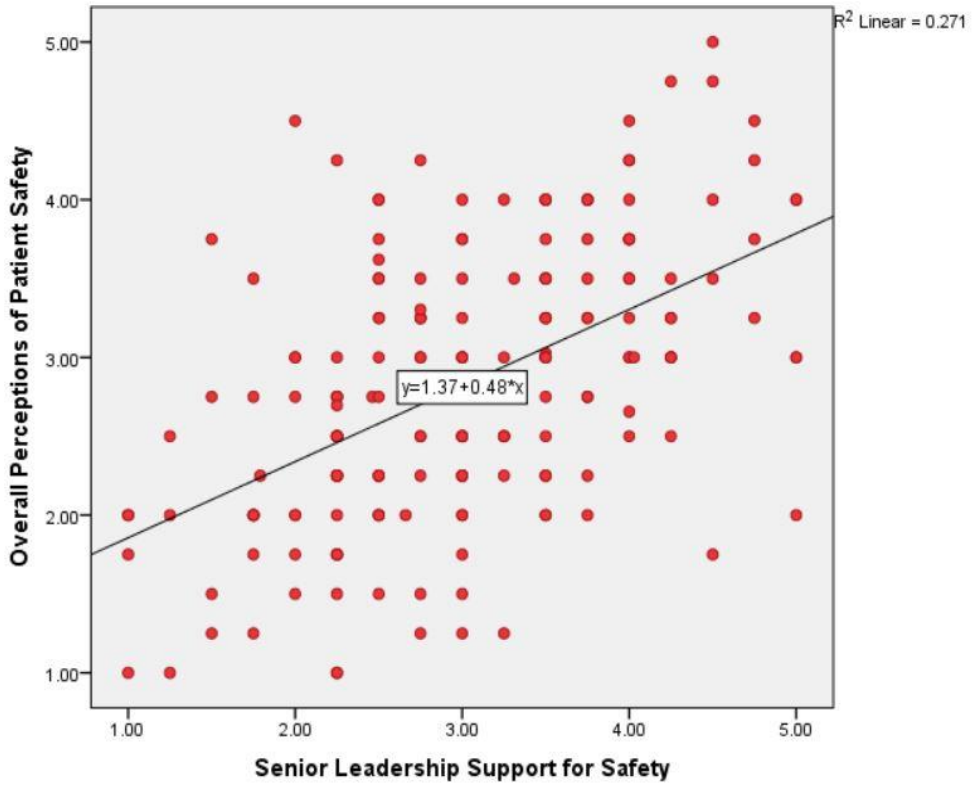
☐	☐	☐	☐	☐
A	**B**	**C**	**D**	**E**
Excellent	Very Good	Acceptable	Poor	Failing

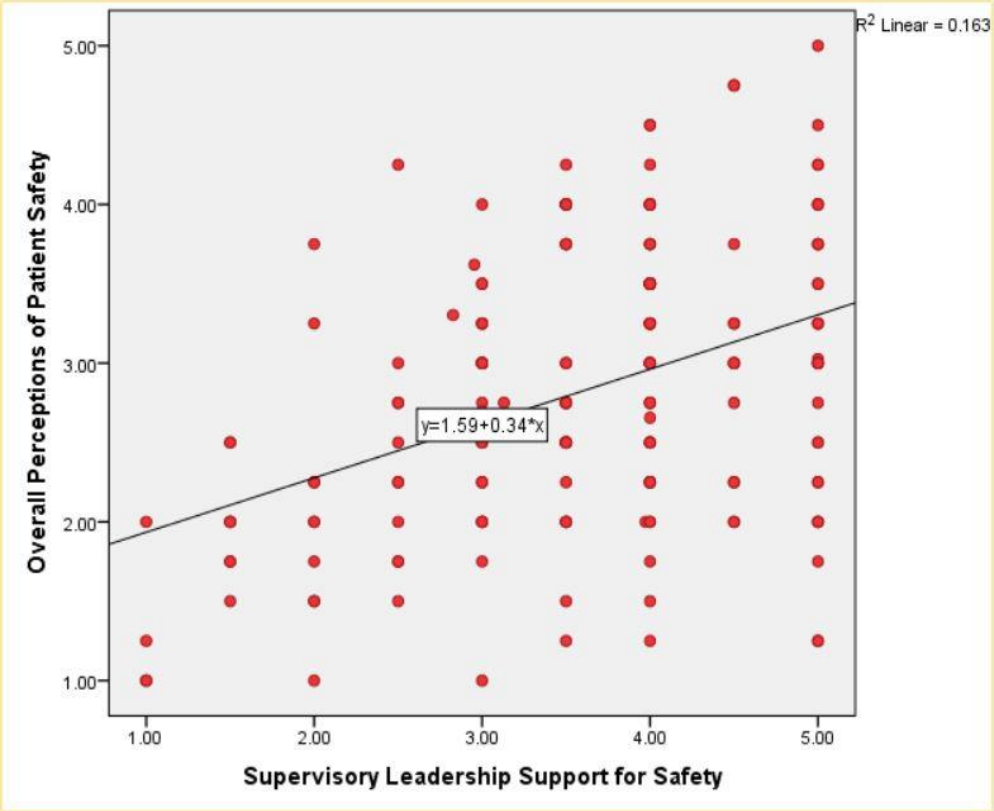
5. Demographic Information:

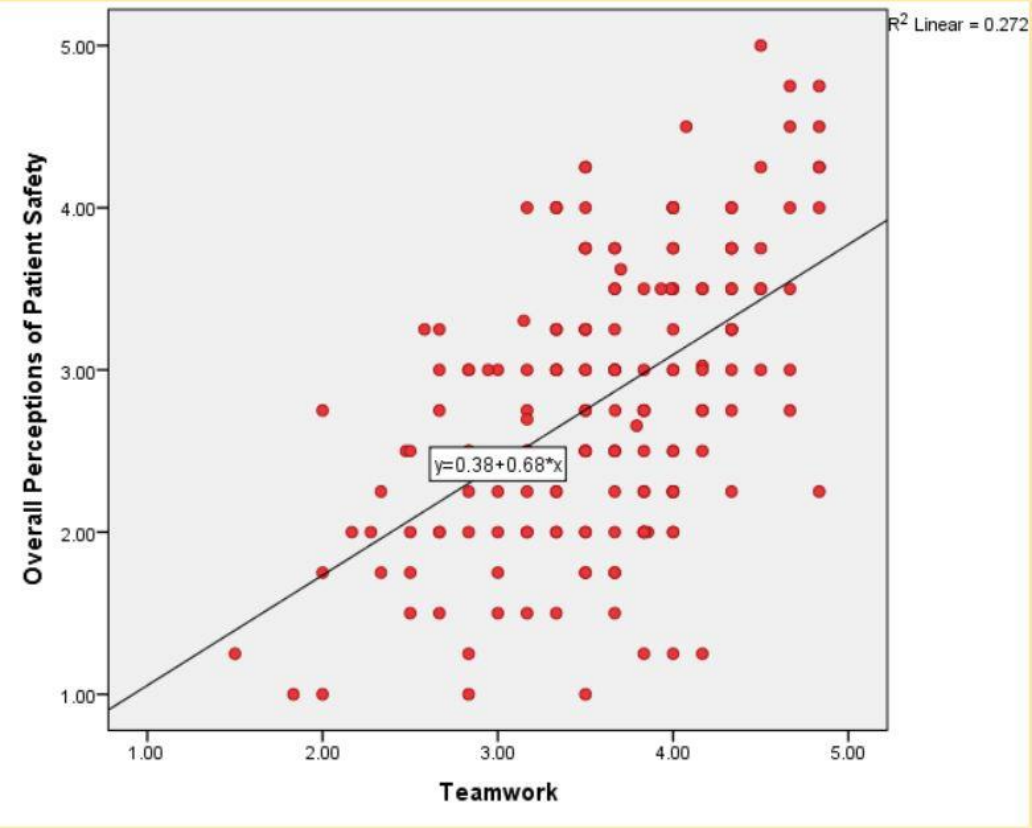
a) Age:	**b) Gender:**	**c) Profession:**
❒ ≤30	❒Female	❒ Registered Practical Nurse (RPN)
❒ 31-40	❒ Male	❒ Registered Nurse (RN)
❒ 41-50		❒ Nurse Practitioner (NP)
❒ 51-60		❒ Allied Health Professional (AHP)
❒ > 60		❒ Clerical Staff
		❒ Other: _____

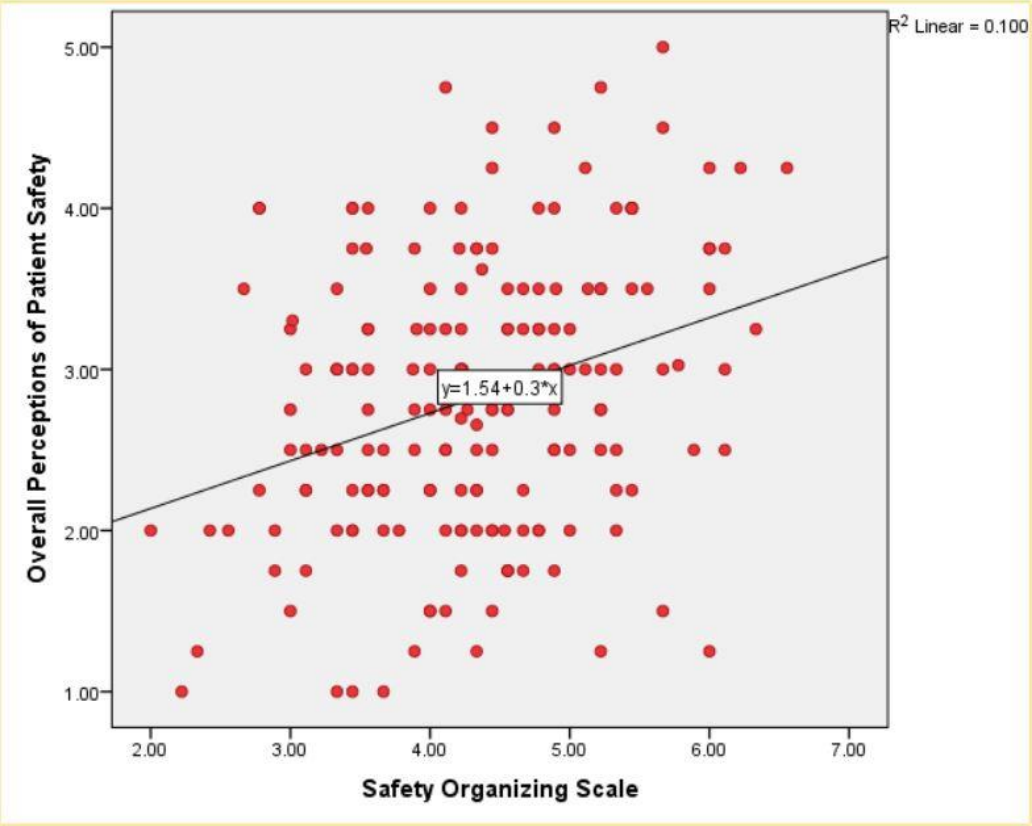
– Thank you for completing this questionnaire –

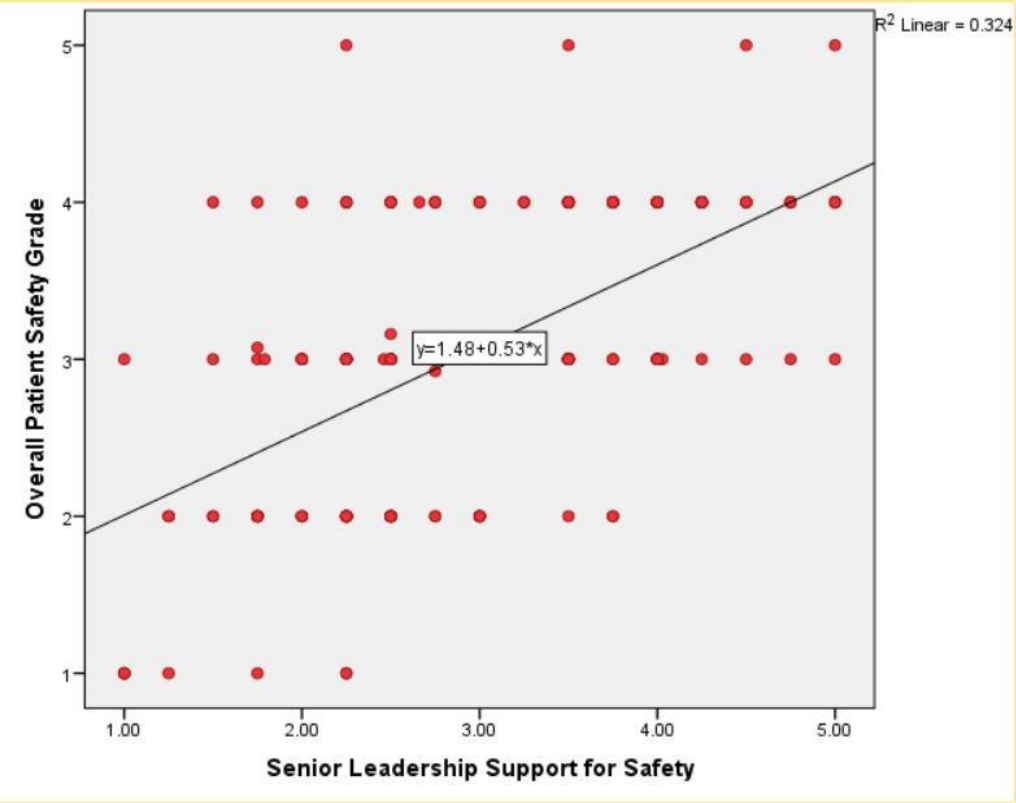
Appendix 3: Bivariate Scatter Plots

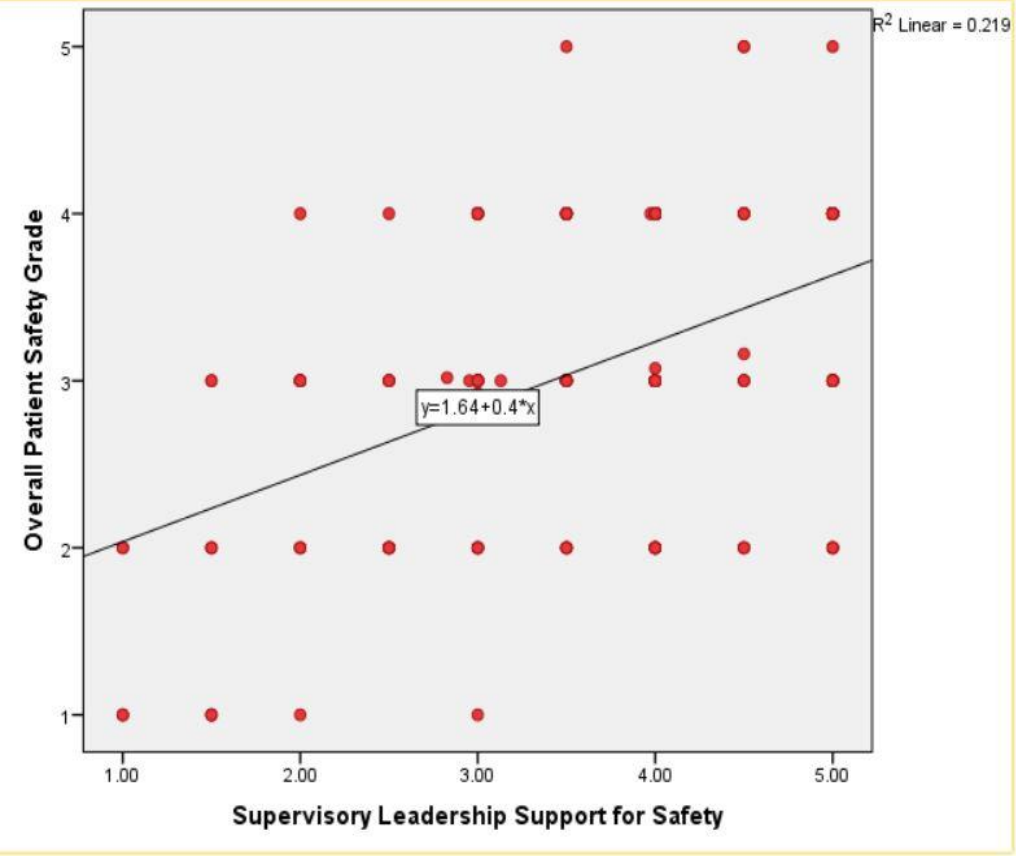


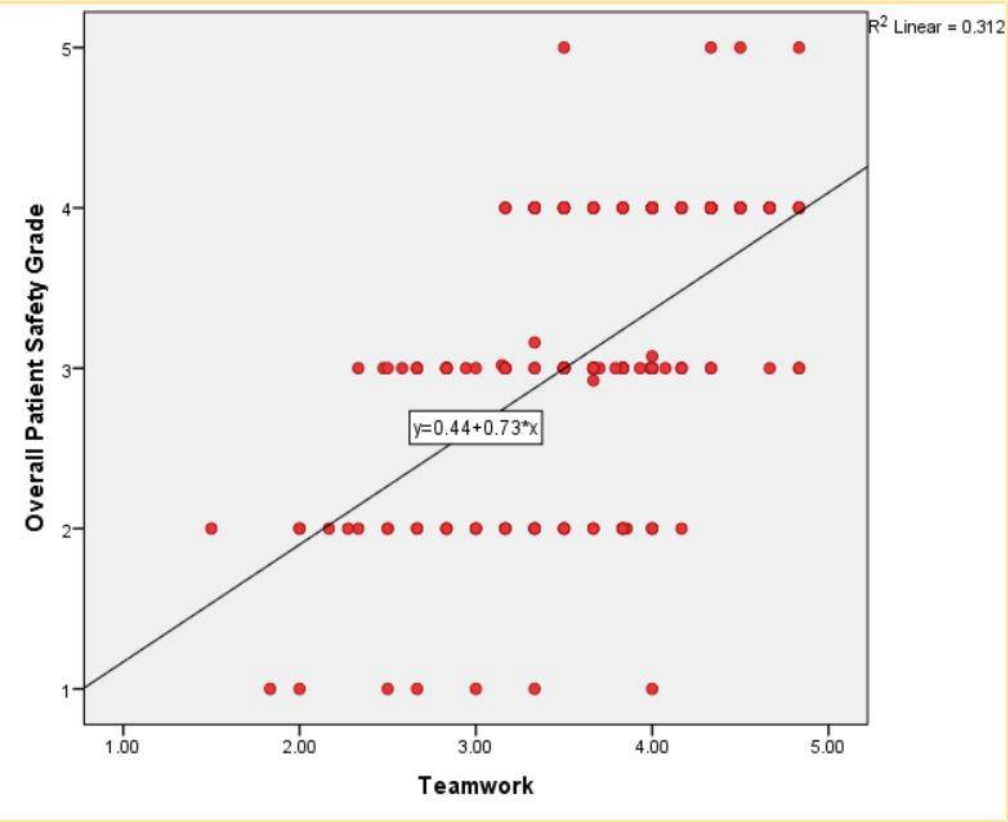


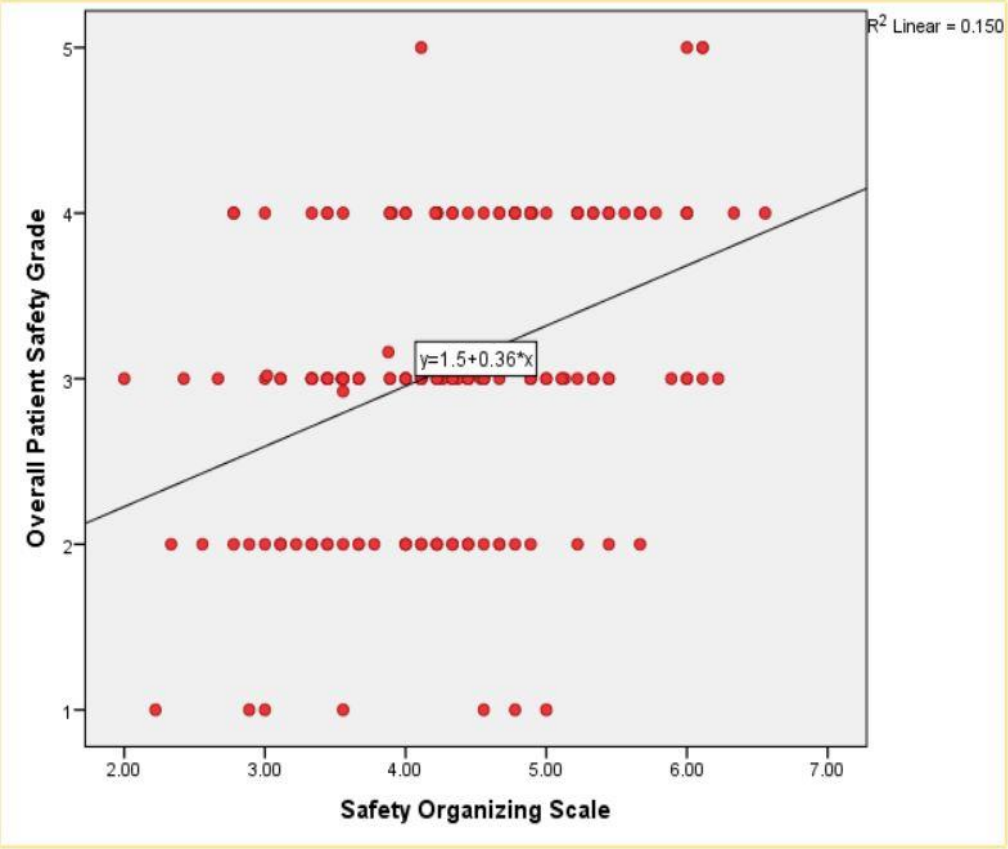

R² Linear = 0.272
Overall Perceptions of Patient Safety
5.00
4.00
3.00
2.00
1.00
y=0.38+0.68*x
1.00
2.00
3.00
4.00
5.00
Teamwork

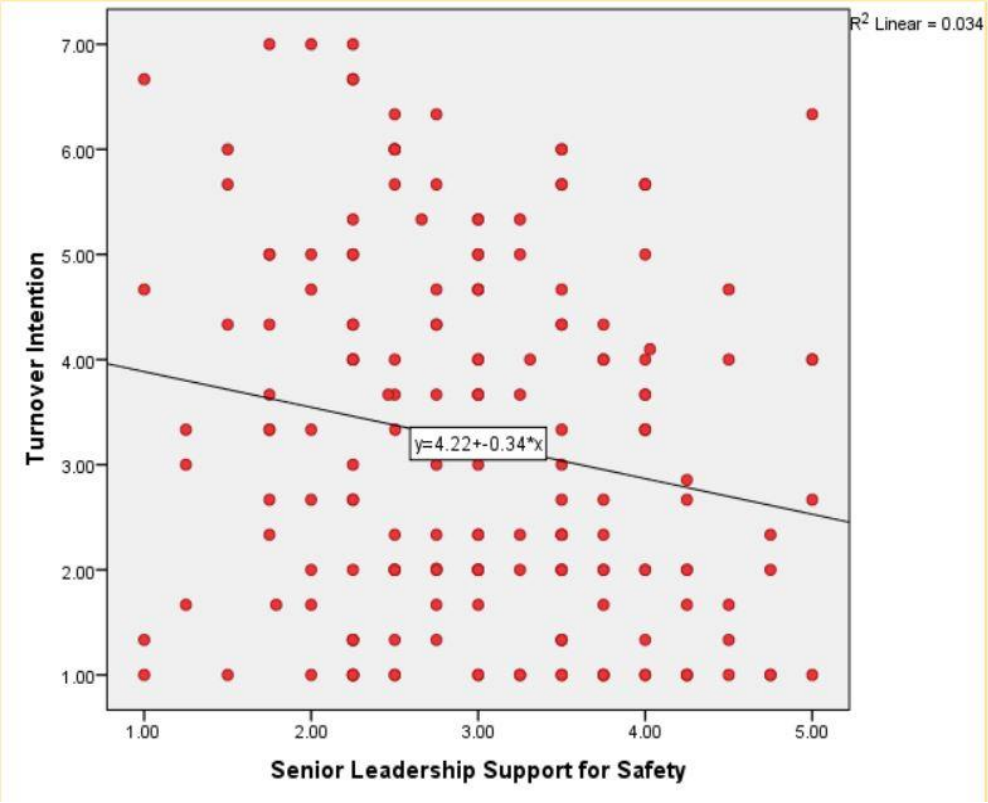

R² Linear = 0.100
Overall Perceptions of Patient Safety
5.00
4.00
3.00
2.00
1.00
y=1.54+0.3*x
2.00
3.00
4.00
5.00
6.00
7.00
Safety Organizing Scale

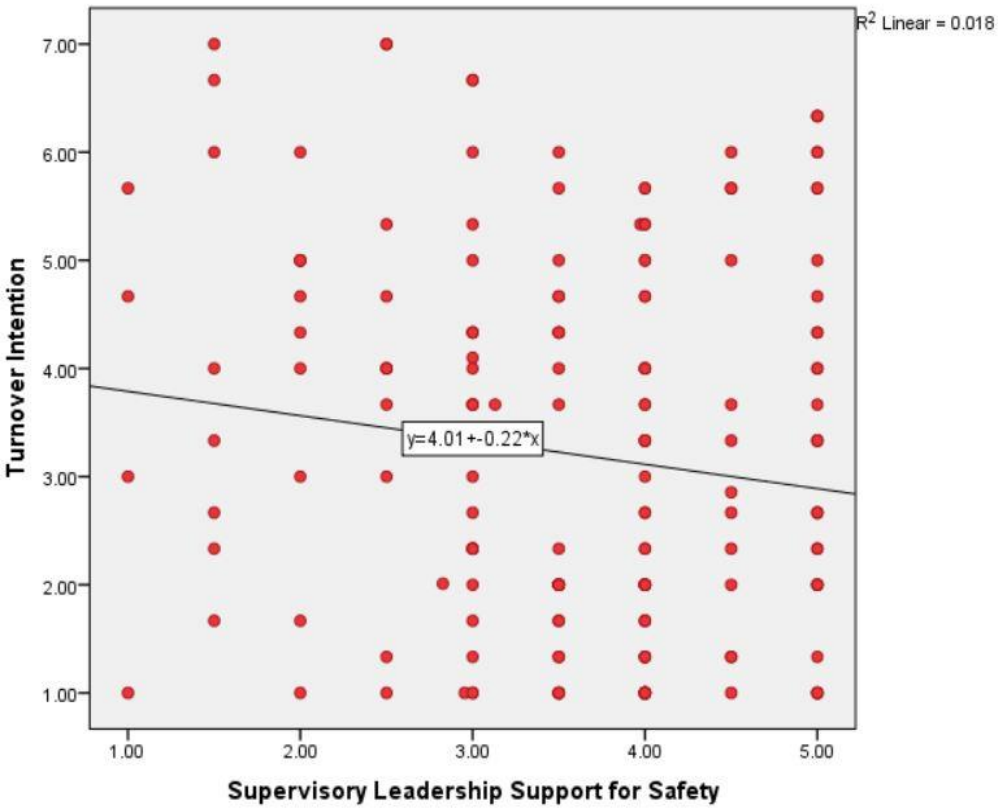

R2 Linear = 0.324
y=1.48+0.53*x
Overall Patient Safety Grade
Senior Leadership Support for Safety
1
2
3
4
5
1.00
2.00
3.00
4.00
5.00

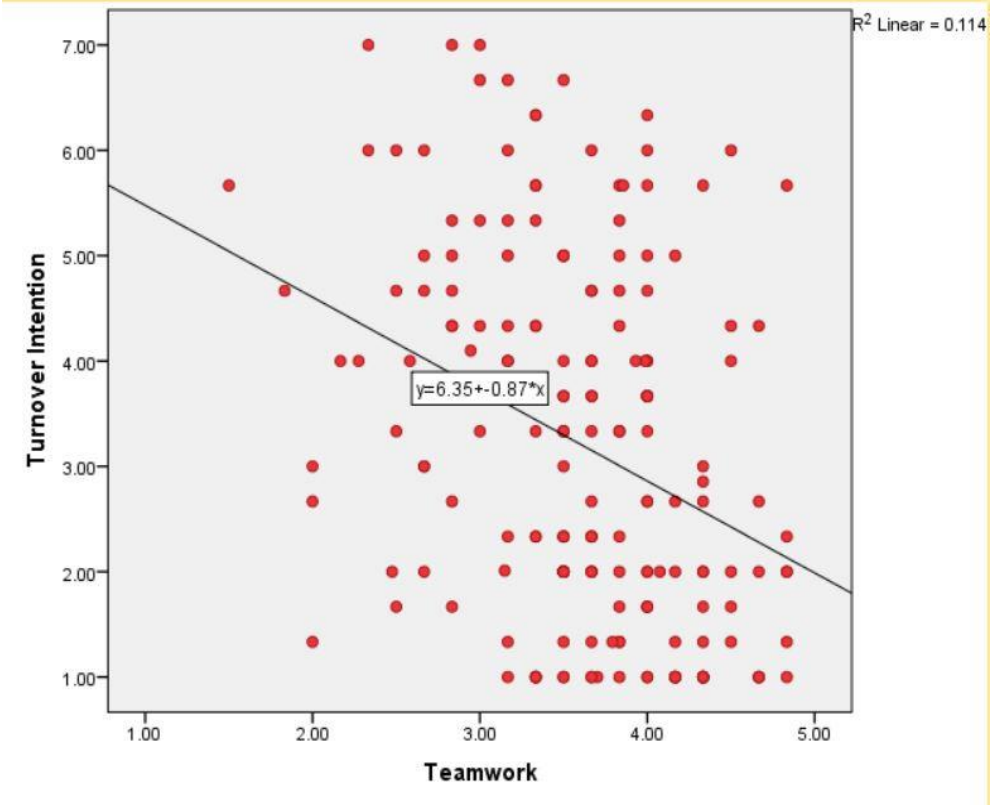

R2 Linear = 0.219
y=1.64+0.4*x
Overall Patient Safety Grade
Supervisory Leadership Support for Safety
1
2
3
4
5
1.00
2.00
3.00
4.00
5.00

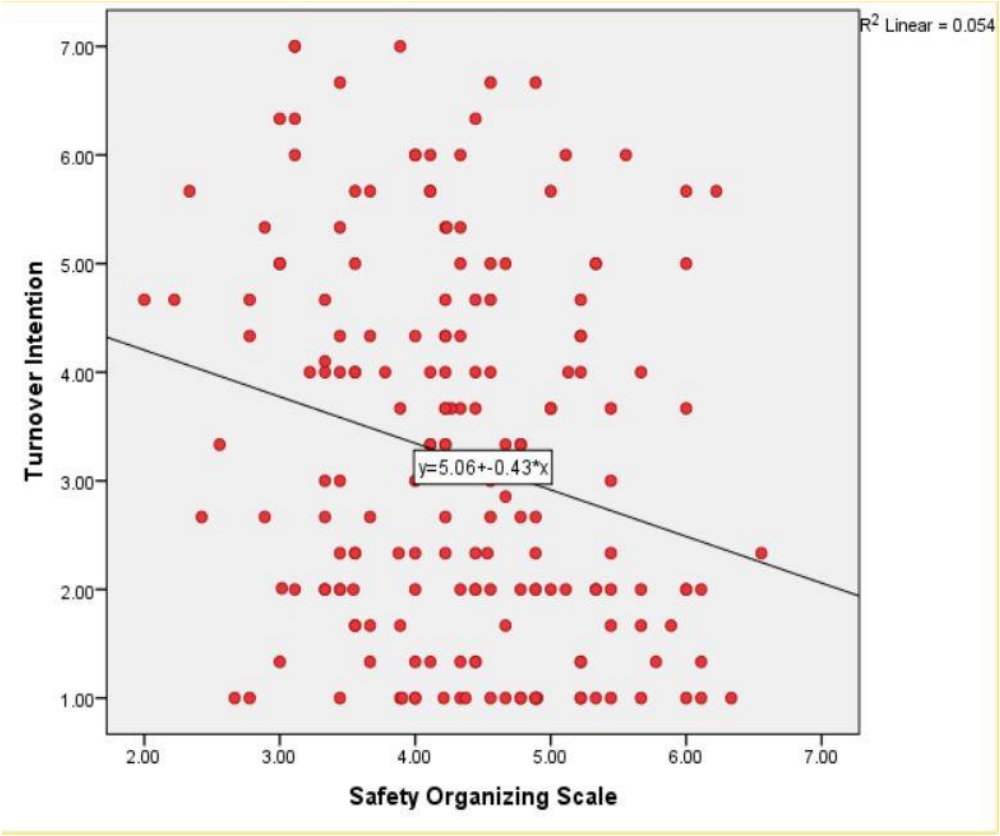

R² Linear = 0.312
Overall Patient Safety Grade
y=0.44+0.73*x
Teamwork
1
2
3
4
5
1.00
2.00
3.00
4.00
5.00


R² Linear = 0.150
Overall Patient Safety Grade
y=1.5+0.36*x
Safety Organizing Scale
1
2
3
4
5
2.00
3.00
4.00
5.00
6.00
7.00


R² Linear = 0.034
Turnover Intention
7.00
6.00
5.00
4.00
3.00
2.00
1.00
y=4.22+-0.34*x
1.00
2.00
3.00
4.00
5.00
Senior Leadership Support for Safety

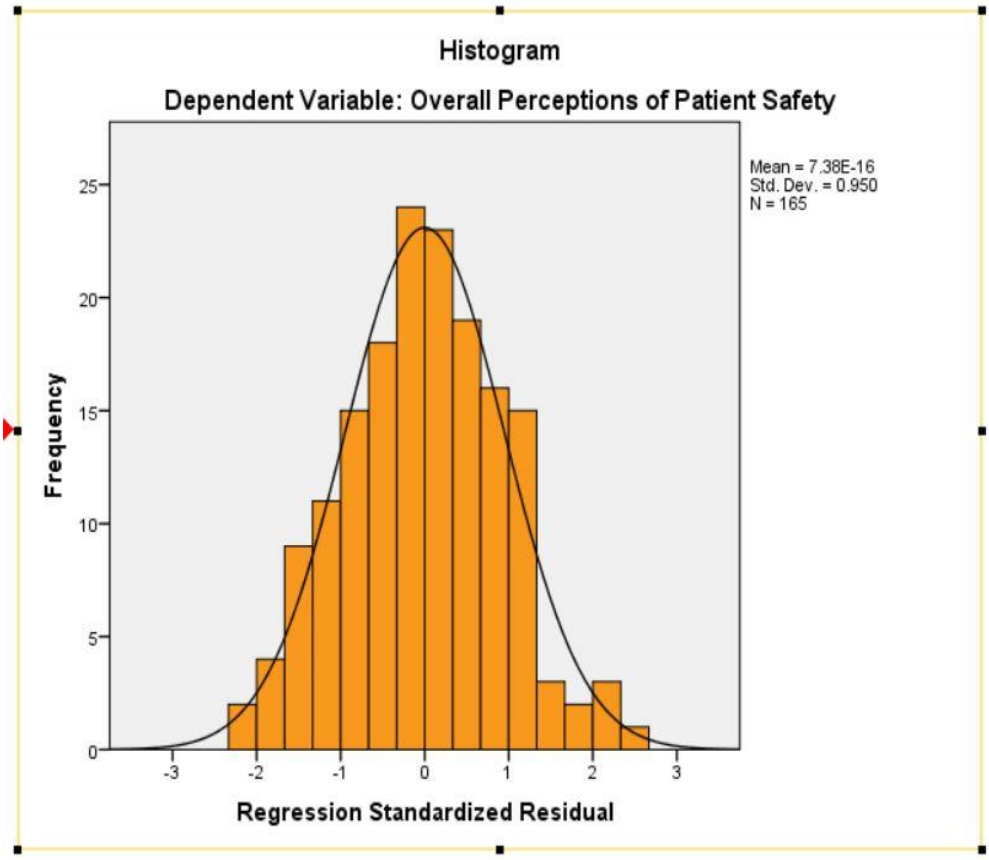

R² Linear = 0.018
Turnover Intention
7.00
6.00
5.00
4.00
3.00
2.00
1.00
y=4.01+-0.22*x
1.00
2.00
3.00
4.00
5.00
Supervisory Leadership Support for Safety

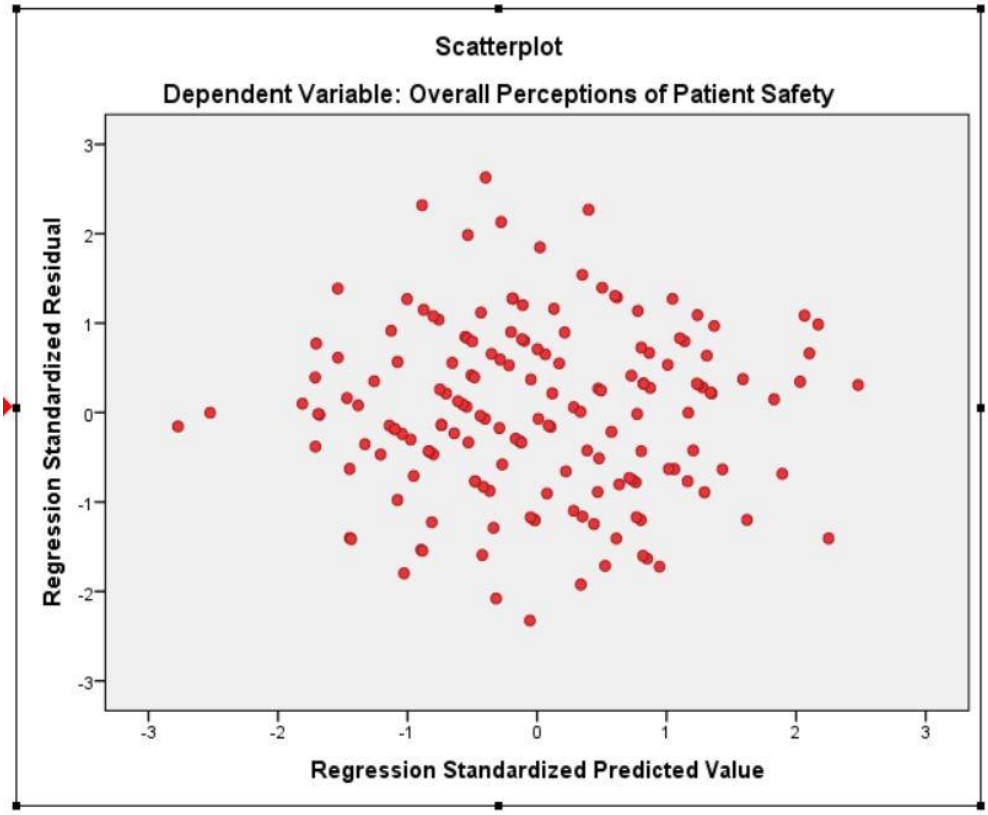

R² Linear = 0.114
Turnover Intention
Teamwork
y=6.35+-0.87*x
7.00
6.00
5.00
4.00
3.00
2.00
1.00
1.00
2.00
3.00
4.00
5.00

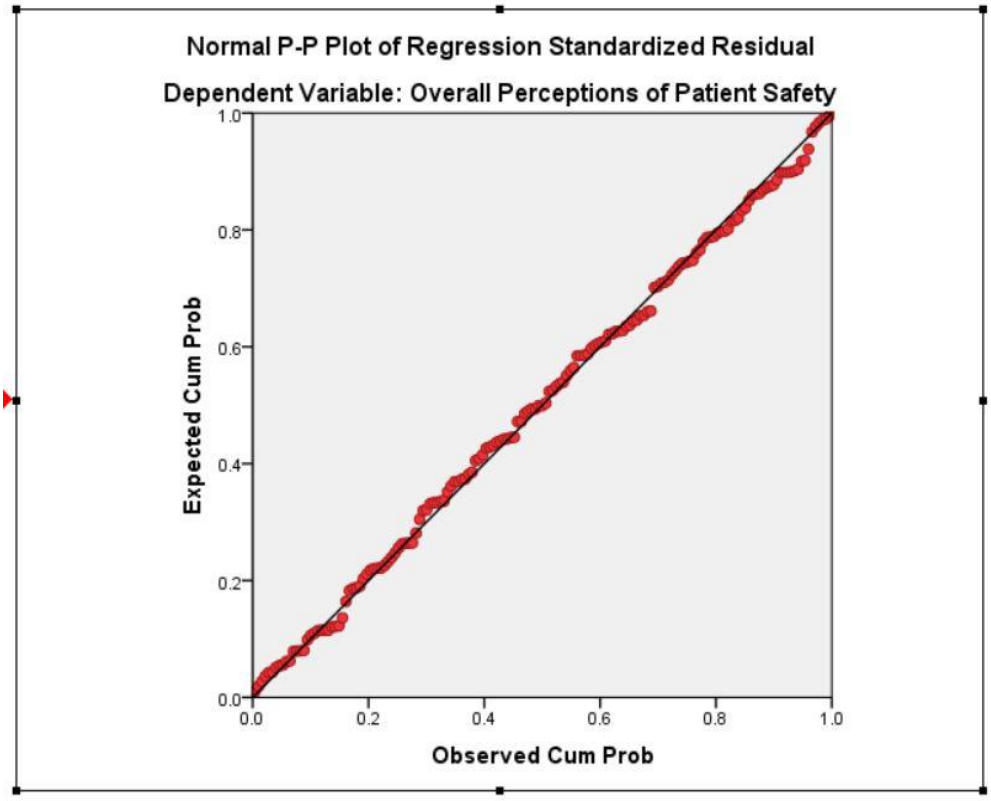

R² Linear = 0.054
Turnover Intention
Safety Organizing Scale
y=5.06+-0.43*x
7.00
6.00
5.00
4.00
3.00
2.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00

Appendix 4: Residual Scatter Plots & P-P Plots

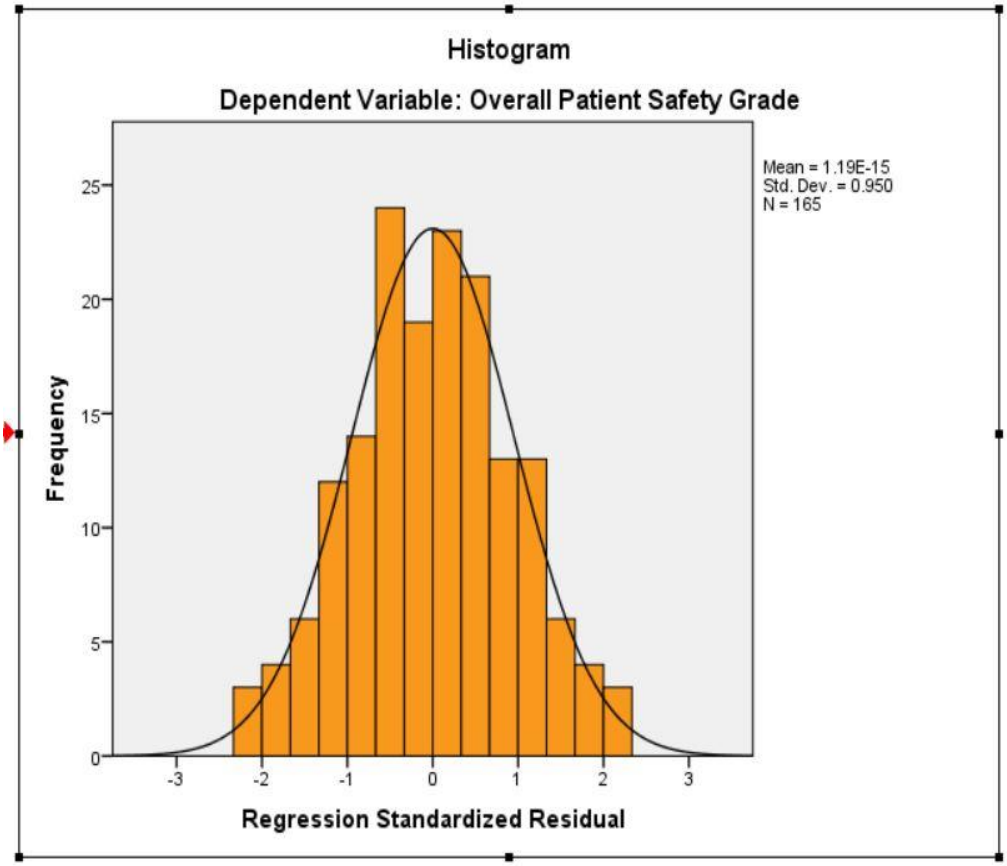
First Hierarchical Regression Analysis – *Predictors:* **ICU, ED, Mental Health, Tenure 2-5 years, Tenure > 5 years, Age ≤ 30 years, Age 31-40 years, Age 41-50 years, Female, RPN, RN, AHP, Senior leadership support for safety, supervisory leadership support for safety, teamwork, SOS.** *Outcome:* **Overall Perceptions of PS**

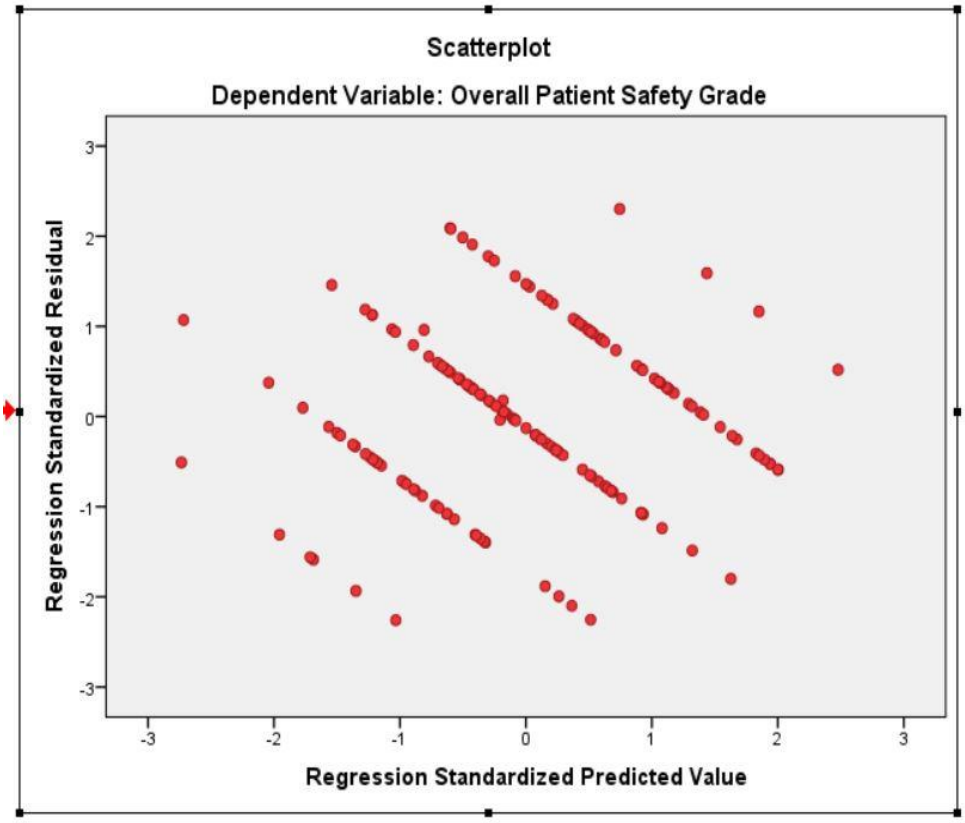


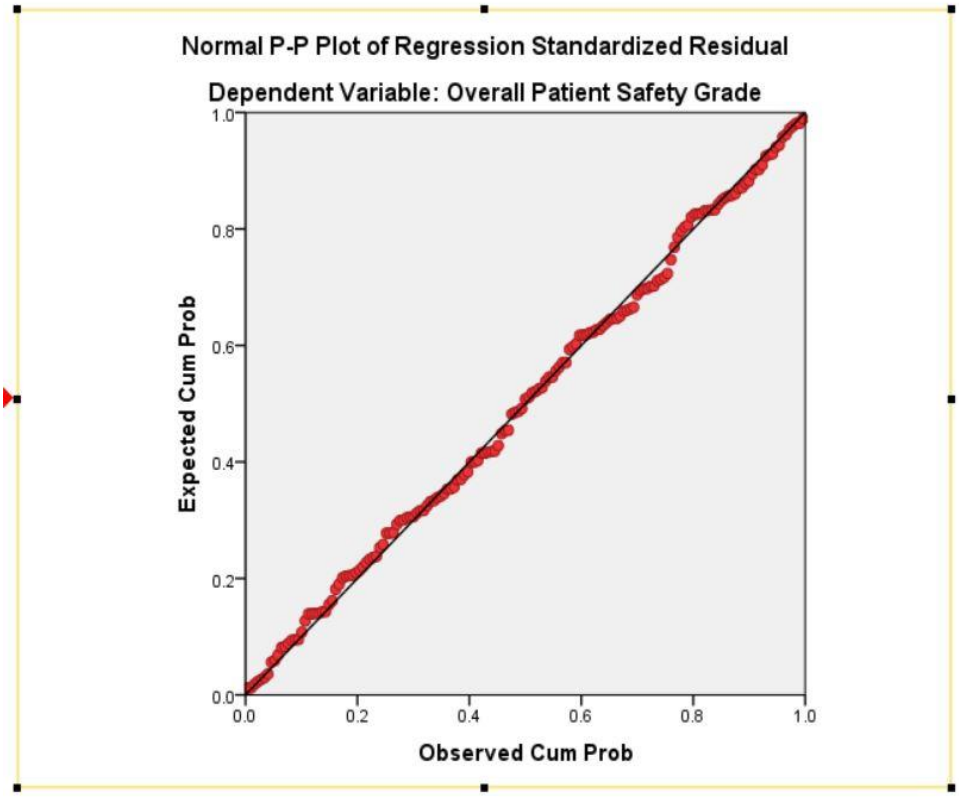

Scatterplot
Dependent Variable: Overall Perceptions of Patient Safety
Regression Standardized Residual
Regression Standardized Predicted Value
3
2
1
0
-1
-2
-3


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Overall Perceptions of Patient Safety
Expected Cum Prob
Observed Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0

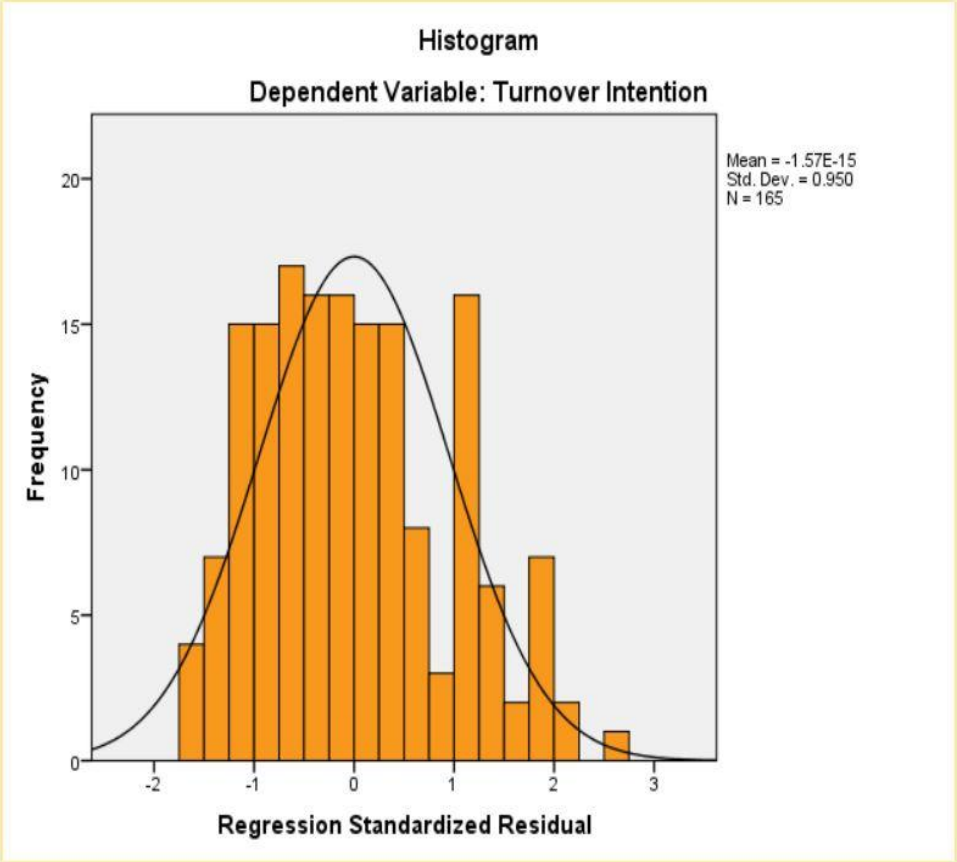
Second Hierarchical Regression Analysis – *Predictors:* **ICU, ED, Mental Health, Tenure 2-5 years, Tenure > 5 years, Age ≤ 30 years, Age 31-40 years, Age 41-50 years, Female, RPN, RN, AHP, Senior leadership support for safety, supervisory leadership support for safety, teamwork, SOS.** *Outcome:* **Overall PS Grade**

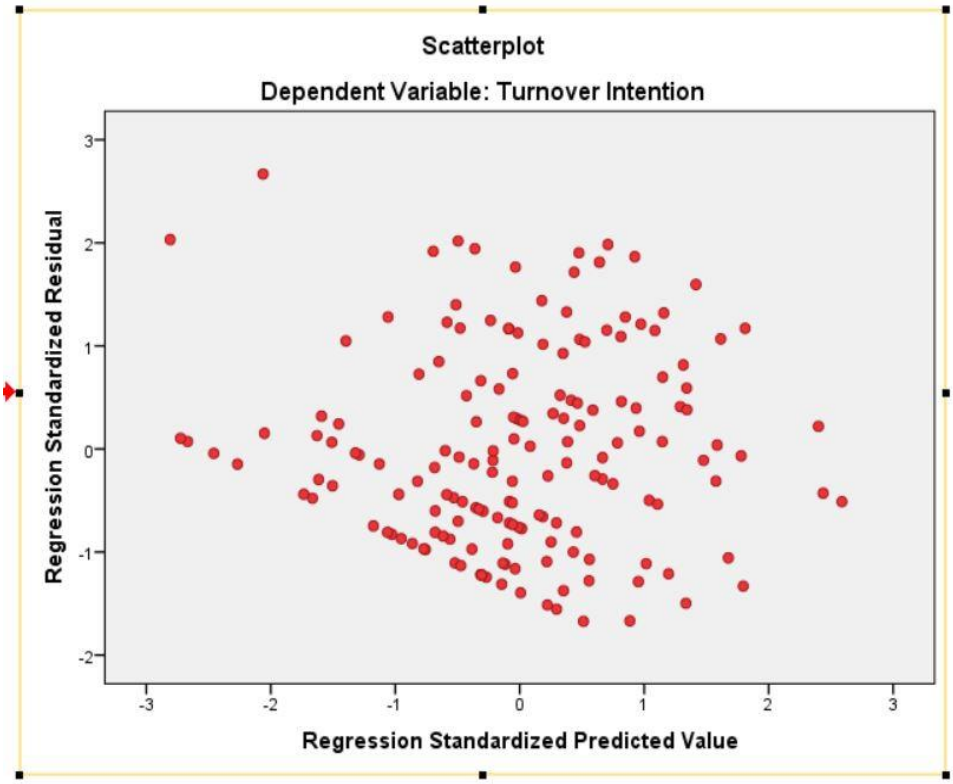


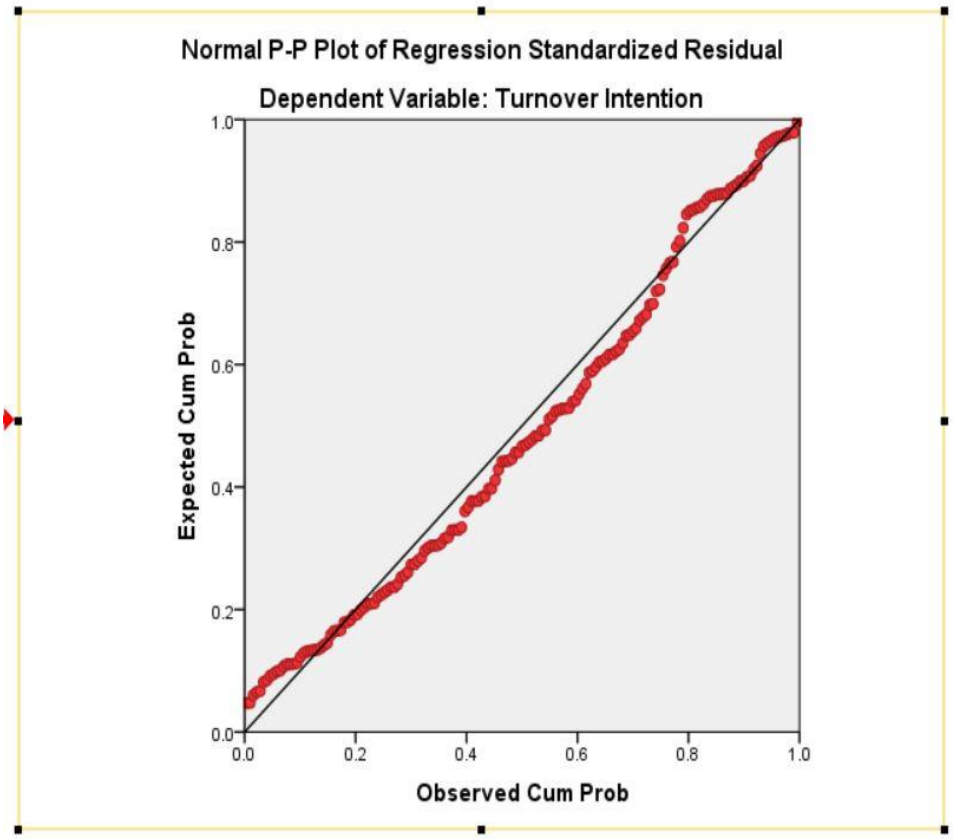

Scatterplot
Dependent Variable: Overall Patient Safety Grade
Regression Standardized Residual
Regression Standardized Predicted Value
3
2
1
0
-1
-2
-3


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Overall Patient Safety Grade
Expected Cum Prob
Observed Cum Prob
0.0
0.2
0.4
0.6
0.8
1.0

Third Hierarchical Regression Analysis – *Predictors:* **ICU, ED, Mental Health, Tenure 2-5 years, Tenure > 5 years, Age ≤ 30 years, Age 31-40 years, Age 41-50 years, Female, RPN, RN, AHP, Senior leadership support for safety, supervisory leadership support for safety, teamwork, SOS.** *Outcome:* **Turnover Intention**




Scatterplot
Dependent Variable: Turnover Intention
Regression Standardized Residual
Regression Standardized Predicted Value
3
2
1
0
-1
-2
-3
-2
-1
0
1
2
3


Normal P-P Plot of Regression Standardized Residual
Dependent Variable: Turnover Intention
Expected Cum Prob
Observed Cum Prob
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.2
0.4
0.6
0.8
1.0

Appendix 5: Skewness Calculations

Table: Skewness Values

		Overall Perceptions of Patient Safety	Overall Patient Safety Grade	Turnover Intention
N	Valid	183	183	183
	Missing	0	0	0
Skewness		.053	-.303	.396
Std. Error of Skewness		.180	.180	.180

Overall perceptions of patient safety = .053 < 2 x .180 = .360

Overall patient safety grade = .303 < 2 x .180 = .360

Hence, both of these dependent variables were normally distributed.

Turnover intention = .396 > 2 x .180 = .360

Hence, turnover intention was found to be slightly skewed.

Appendix 6: Chi-square & K-W tests for Demographic Variables

Table: Chi-square tests for gender by clinical unit

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	1.209[a]	3	.751	.777		
Likelihood Ratio	1.186	3	.756	.777		
Fisher's Exact Test	1.204			.798		
Linear-by-Linear Association	1.090[b]	1	.296	.326	.180	.058
N of Valid Cases	180					

a. 3 cells (37.5%) have expected count less than 5. The minimum expected count is 2.67.

b. The standardized statistic is -1.044.

Table: Chi-square tests for profession by clinical unit

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	11.610[a]	6	.071	.067		
Likelihood Ratio	11.787	6	.067	.096		
Fisher's Exact Test	10.086			.100		
Linear-by-Linear Association	.031[b]	1	.860	.904	.453	.047
N of Valid Cases	178					

a. 7 cells (58.3%) have expected count less than 5. The minimum expected count is 2.20.

b. The standardized statistic is .177.

Table: Kruskal-Wallis ANOVA for tenure

	Tenure
Chi-Square	16.096
df	3
Asymp. Sig.	.001

a. Kruskal Wallis Test

b. Grouping Variable: Clinical Unit

Table: Kruskal-Wallis ANOVA for age

	Age
Chi-Square	14.105
df	3
Asymp. Sig.	.003

a. Kruskal Wallis Test

b. Grouping Variable: Clinical Unit

Appendix 7: Hierarchical Regression Analyses without Missing Data Imputations

Table: Results of First Hierarchical Regression Analysis (DV = Overall Perceptions of PS)

	Model 1, β	Model 2, β	Model 3, β
Block 1 – Socio-Demographic Dummy Variables			
ICU	.815***	.751***	.585**
ED	.049	.016	-.040
Mental Health	-.596**	-.364	-.373*
Tenure (2-5 Years)	-.080	.022	.116
Tenure (> 5 Years)	-.444*	-.282	-.186
Age (≤ 30 Years)	-.186	-.056	-.114
Age (31-40 Years)	-.174	-.089	-.111
Age (41-50 Years)	-.097	-.076	-.079
Female	-.305	-.132	-.102
RPN	.139	.338	.265
RN	-.184	.107	.077
AHP	-.069	.009	.125
Block 2 – Leadership Support for Safety			
Senior Leadership		.411***	.343***
Supervisory Leadership		.013	-.096
Block 3 – Frontline Clinical Staff Behaviours			
Teamwork			.409***
SOS			.036
Total R^2 (adjusted)	.203***	.380***	.444***
Change in R^2	.262***	.172***	.065***

***p < .001, **p < .01, *p < .05. (N = 164). Reference groups: General Medicine, Tenure (6-24 months), Age (≥ 51 years), Male, and Clerical Staff.

Table: Results of Second Hierarchical Regression Analysis (DV = Overall PS Grade)

	Model 1, β	Model 2, β	Model 3, β
Block 1 – Socio-Demographic Dummy Variables			
ICU	.895***	.811***	.665***
ED	.327	.279	.223
Mental Health	-.493*	-.203	-.202
Tenure (2-5 Years)	-.261	-.193	-.065
Tenure (> 5 Years)	-.333	-.148	-.055
Age (≤ 30 Years)	.028	.213	.158
Age (31-40 Years)	.012	.128	.110
Age (41-50 Years)	.346	.407*	.389*
Female	-.297	-.044	-.008
RPN	.182	.422	.350
RN	-.053	.292	.271
AHP	-.159	-.122	.005
Block 2 – Leadership Support for Safety			
Senior Leadership		.488***	.428***
Supervisory Leadership		.033	-.066
Block 3 – Frontline Clinical Staff Behaviours			
Teamwork			.320**
SOS			.085
Total R^2 (adjusted)	.195***	.444***	.493***
Change in R^2	.255***	.237***	.052***

***p < .001, **p < .01, *p < .05. (N = 161). Reference groups: General Medicine, Tenure (6-24 months), Age (≥ 51 years), Male, and Clerical Staff.

Table: Results of Third Hierarchical Regression Analysis (DV = Turnover Intention)

	Model 1, β	Model 2, β	Model 3, β
Block 1 – Socio-Demographic Dummy Variables			
ICU	-.812	-.766	-.345
ED	-.599	-.571	-.438
Mental Health	.518	.382	.332
Tenure (2-5 Years)	-.030	-.063	-.446
Tenure (> 5 Years)	.530	.428	.154
Age (≤ 30 Years)	-.037	-.090	.074
Age (31-40 Years)	.196	.163	.220
Age (41-50 Years)	.299	.299	.375
Female	.063	-.042	-.129
RPN	-.676	-.815	-.618
RN	-.230	-.409	-.327
AHP	-1.511*	-1.559*	-1.929**
Block 2 – Leadership Support for Safety			
Senior Leadership		-.246	-.059
Supervisory Leadership		.001	.283
Block 3 – Frontline Clinical Staff Behaviours			
Teamwork			-.972***
SOS			-.237
Total R^2 (adjusted)	.038	.040	.155***
Change in R^2	.109	.014	.116***

***p < .001, **p < .01, *p < .05. (N = 162). Reference groups: General Medicine, Tenure (6-24 months), Age (≥ 51 years), Male, and Clerical Staff.

Appendix 8: Climate Profile Histograms

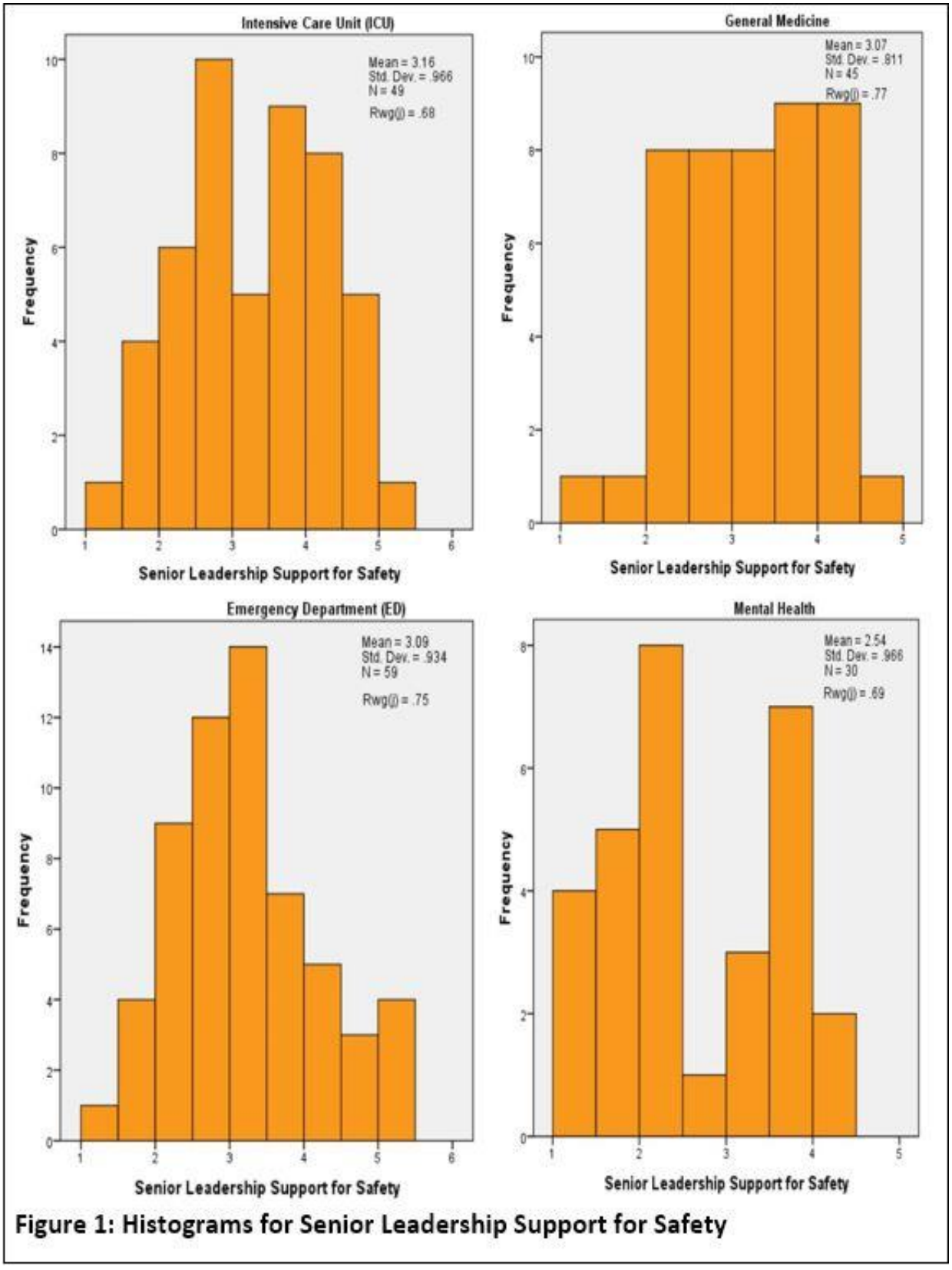


Figure 1: Histograms for Senior Leadership Support for Safety

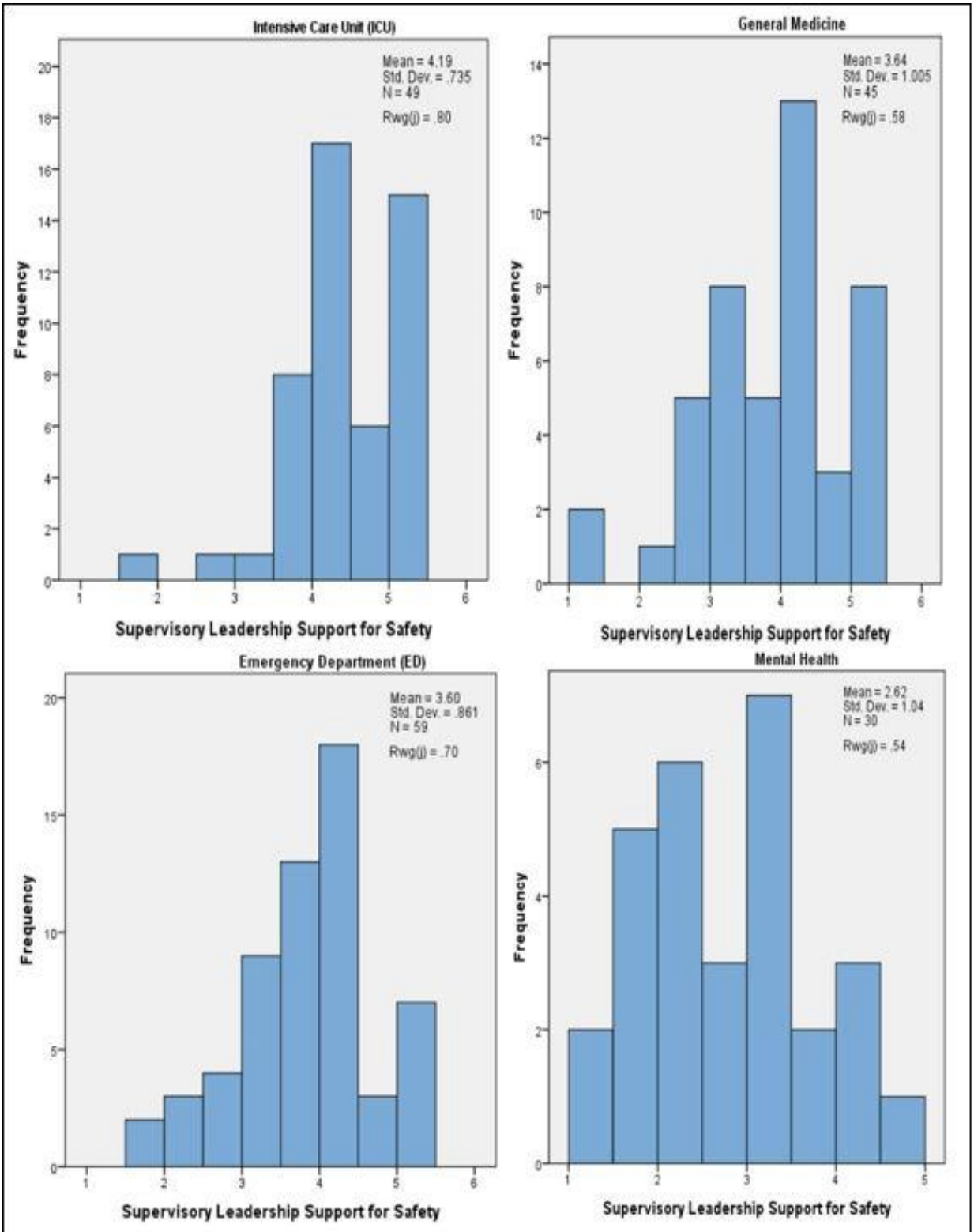


Figure 2: Histograms for Supervisory Leadership Support for Safety

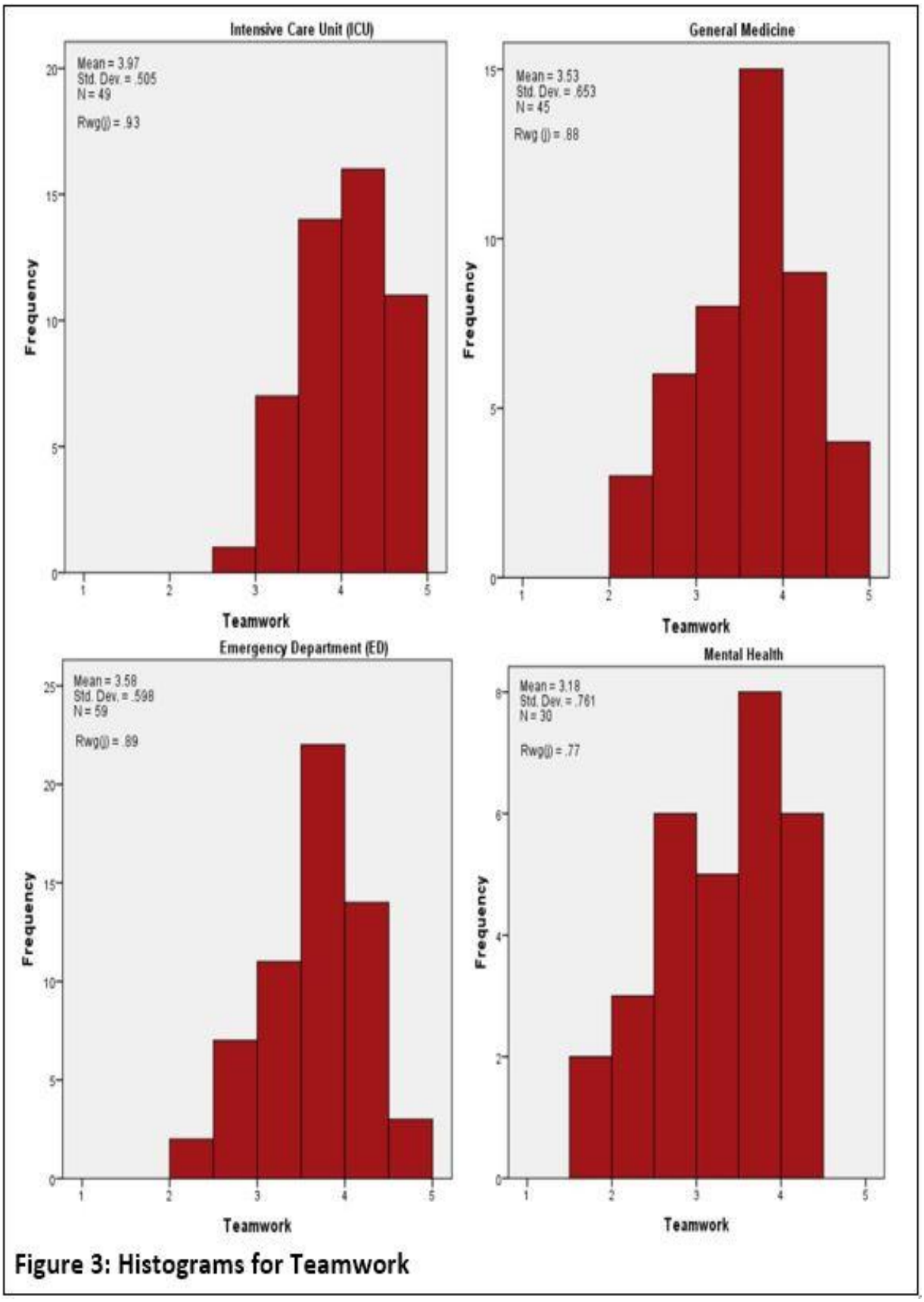


Figure 3: Histograms for Teamwork

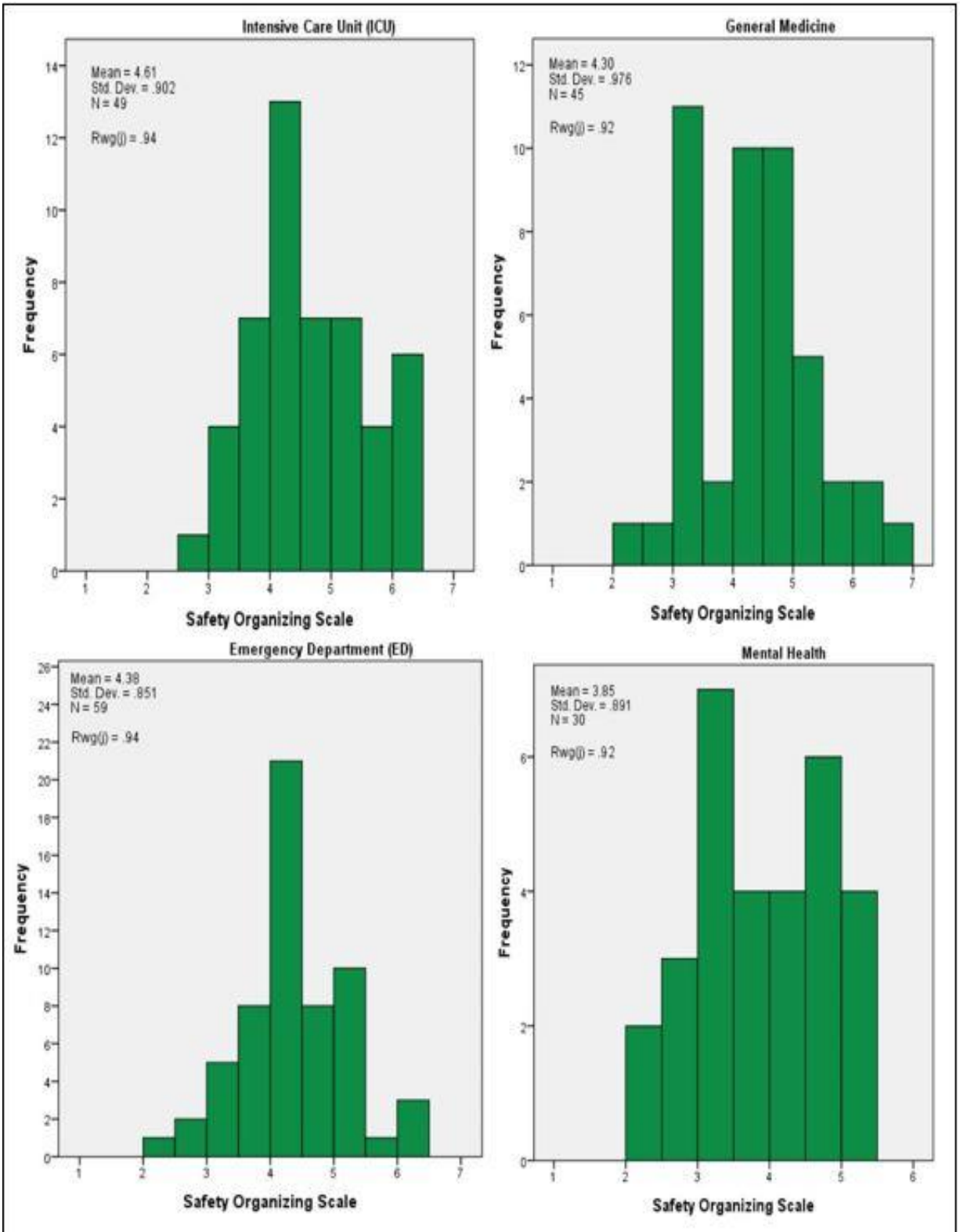


Figure 4: Histograms for Safety Organizing Scale

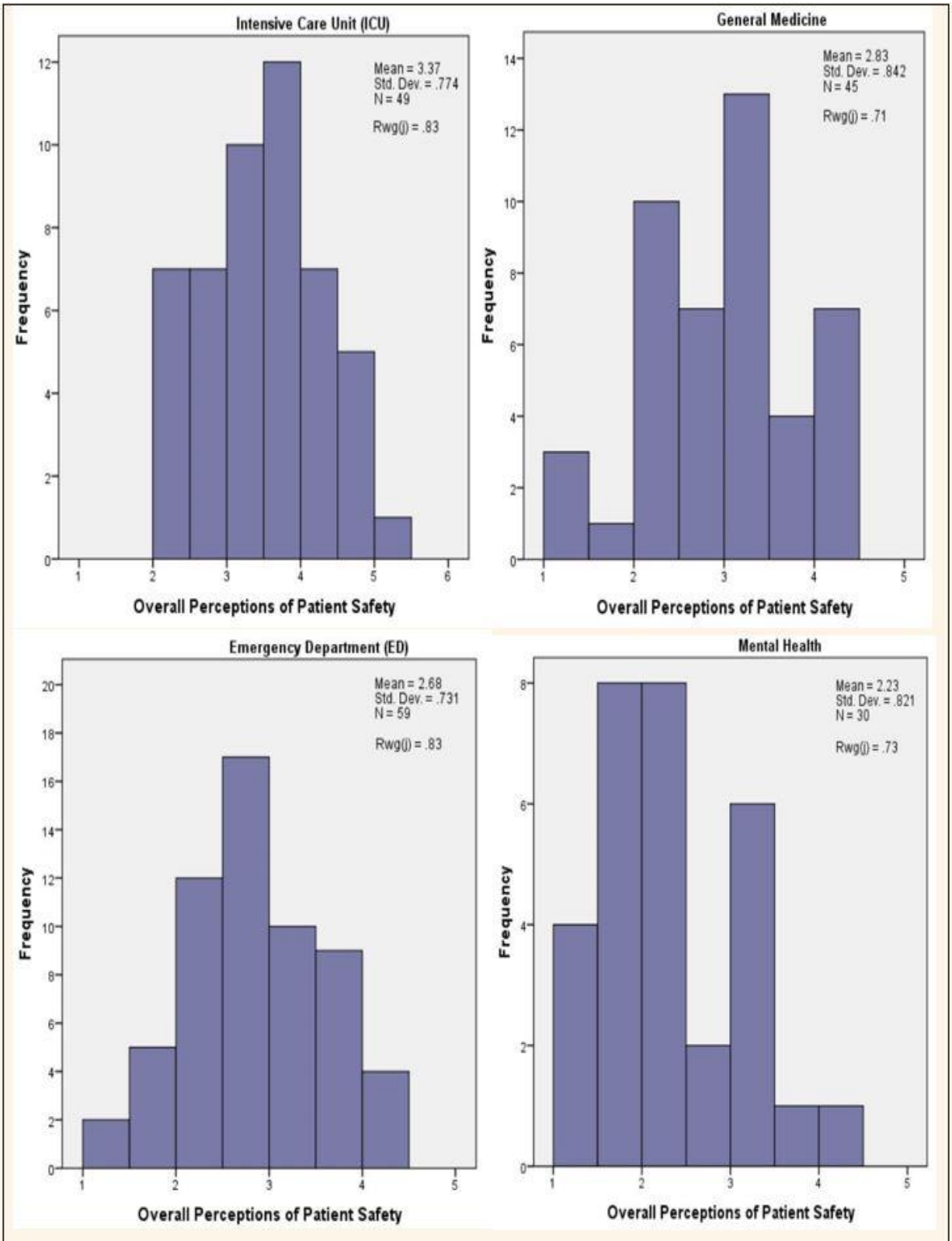


Figure 5: Histograms for Overall Perceptions of Patient Safety

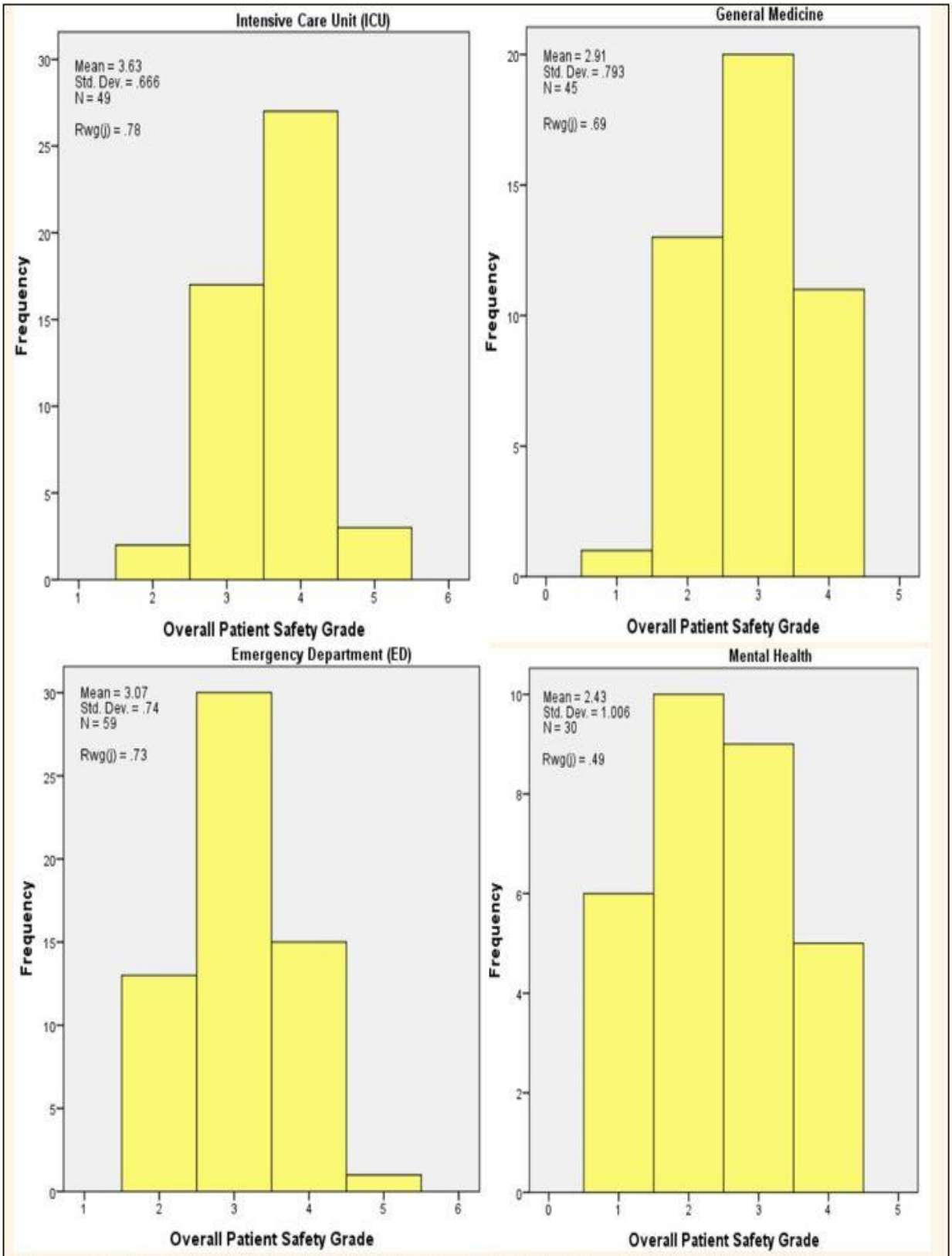


Figure 6: Histograms for Overall Patient Safety Grade