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Keeping Patients Safe: The Relationship Between Patient Safety Climate and Patient Outcomes

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Keeping Patients Safe: The Relationship Between Patient Safety Climate and Patient Outcomes

by

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ABSTRACT

KEEPING PATIENTS SAFE: THE RELATIONSHIP BETWEEN PATIENT SAFETY CLIMATE AND PATIENT OUTCOMES

Roxanne Louise O'Brien

Increasing complexity and use of technology in health care has provided life-saving advances in patient care and also increased risks of medical error. Developing a culture of safety and assessing the safety climate or measurable attitudes of staff, in hospitals has been recommended as approaches to enhancing the safety of hospitalized patients. This study used a cross-sectional, descriptive, model testing design to evaluate the relationship between patient safety climate, patient outcomes, staffing, and hospital performance measures. The sample consisted of multiple patient care units and ancillary departments in 10 hospitals. Secondary databases used in this research included responses to a patient safety attitudes survey, unit level patient falls and hospital acquired pressure ulcers, unit staffing data, and hospital level performance measures. Bivariate correlations, descriptive statistics, ANOVA, and hierarchical linear modeling were used to describe unit and hospital level safety attitudes. Patient safety climate was found to vary significantly across units and among hospitals. There were no relationships found between patient safety climate, falls and hospital acquired pressure ulcers. Higher staffing hours in ICU were a confounder in the analysis of a significant relationship between patient safety climate and nurse staffing. A reduction in the failure rate for the community acquired pneumonia hospital performance measure was associated with staff perception of support from unit managers. Understanding how patient safety climate influences the safety of hospitalized patients is currently evolving. Continuing research in this area is warranted to explore this relationship.

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CHAPTER ONE

STATEMENT OF THE PROBLEM

Patient safety is paramount to the efforts of all health care providers involved in treating, healing, and comforting patients. The phrase *first do no harm* [italics added] is considered a guiding principle in the education of all health care providers. The rapid rise in technology and complexity in health care in the twentieth century has provided life-saving advances in care yet, paradoxically, has also introduced new complexities and increased risk of medical errors. Complications from medical management have become one of the unintended consequences of the increasingly complex health care system in the United States (U.S.) (Small & Barach, 2002).

Documentation of the evidence of preventable injuries in hospitalized patients is not new. Schimmel (1964) published the results of a review of medical errors in a sample of over 1,000 patients admitted to the medical service of a university hospital. Twenty percent of the patients experienced an adverse event related to their hospital care including nosocomial infections, transfusion reactions, and reactions to medications. Ten percent of the sample had prolonged hospital stays secondary to medical errors. In a study to provide accurate information related to patient insurance claims for disabilities incurred during hospitalization, Mills (1978) reported the rate of medical errors from a sample of California hospitals (n = 20,864 patients). The review found that 4.65% of the patients had experienced a “potentially compensable event”, defined as a disability caused by medical management (p. 361).

The Harvard Medical Practice Study I estimated the incidence of adverse events, and the subset of patient injuries due to negligent or substandard care, in hospitals in New York State (Brennan et al., 1991). Discharge records of over 31,000 patients hospitalized in 1984 were reviewed. Adverse events, defined as injures caused by medical management, occurred in 3.7% of the hospitalizations, with 27.6% of those injuries due to negligence. The Harvard Medical Practice Study II, using the same data base, analyzed the causes of the adverse events (Leape et al., 1991). Types of errors included technical error in a procedure (76%), failure to use tests indicated for the condition (50%), failure to take precautions to prevent injury (45%), and inadequate reporting or communication (26%). A 1992 study using similar methods as the Harvard Medical Practice Studies reviewed discharge records of over 15,000 patients in Utah and Colorado (Thomas et al., 2000). In Utah, 32.6% of the adverse events were caused by negligence, and 6.6% of patients died from those events. In Colorado, 27.4% of adverse events were caused by negligence, with a mortality rate of 8.8% in those patients.

In its report, *To Err is Human*: *Building a Safer Health System*, the Institute of Medicine (IOM) estimated that tens of thousands of patients die in hospitals because of the care they received, not their illness (Kohn, Corrigan, & Donaldson, 2000). According to this report, preventable medical errors are one of the leading causes of death in the U.S. Based on hospital admission data from the Harvard Medical Practice Study in 1984 and the Utah and Colorado study in 1992, the rate of patient mortality from medical management was between 2.9% and 3.7%. Extrapolating this injury rate to data from 1997, in which there were 33.6 million hospital admissions, researchers estimate that between 44,000 and 98,000 patients die in U.S. hospital each year because of preventable medical injuries, misdiagnoses, and other medical errors. The national cost of preventable injuries (lost income, cost of care, and disability) is estimated to be between $17 and $29 billion, with medical care costs accounting for approximately half that amount. Nationally, adverse drug events causing injury to patients are estimated costing $2 billion a year (Kohn et al., 2000). These estimates not only illustrate the scope of medical errors but also highlight the need for research into the threats to patient safety in an industry devoted to care and healing.

Patient safety is defined and interpreted by the IOM as “Freedom from accidental injury; (and) ensuring patient safety involves the establishment of operational systems and processes that minimize the likelihood of errors and maximizes the likelihood of intercepting them when they occur” (Kohn et al., 2000, p. 211). The problem confronting the U.S. health care system is to identify, understand, and confront threats to patient safety through all means available. Defenses against threats to patient safety involve a multifaceted approach in the organizational components of (a) leadership and management, (b) workforce, (c) work processes, and (d) organizational culture (Page, 2004). Defenses are created when leaders and managers promote evidence based practice; when the capabilities of the workforce are understood and maximized; when work processes are designed to reduce errors in patient care; and when a culture of safety is created and sustained (Page, 2004). Creating a culture of safety in hospitals requires the institutionalization and legitimization of patient safety as the priority concern for the organization and the interdisciplinary providers of care (McKeon, Oswaks, & Cunningham, 2006).

In the IOM report *Crossing the Quality Chasm: A New Health System for the 21st Century*, the Committee on the Quality of Health Care in America stated that “the biggest challenge to moving toward a safe health system is changing the culture from…blaming individuals for errors to one in which errors are treated as opportunities to improve the system and prevent harm” (Institute of Medicine, 2001, p. 79). Health care organizations, including hospitals, must develop a culture of safety in which the workforce and its patient care services are clearly focused on improving the reliability, quality, and safety of care (Kohn et al., 2000). A culture of safety should include these components: (a) safety as a priority communicated by all levels of leadership; (b) frequent, open, and truthful staff communication by all levels of leadership; and (c) expressed organizational value in learning from errors and mistakes (Singer et al., 2003).

Page (2004) has described a patient safety culture as one that vigilantly monitors for unsafe situations, cultivating attitudes and behaviors that enhance patient safety. The patient safety culture enforces a nonpunitive error-reporting environment, and uses data analysis to understand causes of error. The safety culture is understood to be a "performance shaping factor that guides the many discretionary behaviors of healthcare professionals" in each patient interaction (Nieva & Sorra, 2003, p. ii17). Yet creating a culture of safety in health care organizations, specifically hospitals, has not progressed as rapidly as providers and consumers had anticipated (Brennan, Gawande, Thomas, & Studdert, 2005; Leape & Berwick, 2005; Page, 2004). Currently, a culture exists of "naming, blaming and shaming" that focuses on the individual rather than the systems that contributed to error (Page, 2004, p. 27). The focus has been on "who" was responsible, rather than "what" happened (Bagian, 2006, p. 288). Improving the quality and safety of patient care requires an organizational commitment to a culture of patient safety that maintains vigilance in monitoring for threats to patient safety (Nieva & Sorra, 2003; Scott, Mannion, Davies, & Marshall, 2003).

Staff perceptions and attitudes about patient safety (also called the patient safety climate) of their hospitals and on their work units can influence the care they provide. Research on unit work climate (the measurable attitudes of staff) in human services organizations, which included social workers and nurses, has shown that an organizational climate of support for staff and responsiveness to priorities (such as patient safety) positively affects the quality and effectiveness of services (Hemmelgarn, Glisson, & Dukes, 2001). In clinical units where staff clearly understands that patient safety is a high priority, the anticipated benefits would be reducing or eliminating the beliefs and attitudes that jeopardize patient safety (Singer, Lin, Falwell, Gaba, & Baker, 2009). A better patient safety culture or safety climate would facilitate staff attitudes in adopting safe patient care behaviors more readily and consistently, such as following policies and procedures designed to protect patients, reporting errors in care, and communicating and collaborating with the health care team. The effects of these behaviors can be observed and measured by indicators of quality patient care.

Objective measures of the quality and safety of patient care offers the means to evaluate care processes and identify areas for improvement. For example, performance improvement programs can include educational programs that update staff on unit quality indicators, identify progress to the goals of the unit, and plan strategies to meet those goals as indicated. Linking outcomes to the culture of safety offers opportunities to create benchmarks and the exchange of approaches within and across hospitals that improve patient safety (Singer, Lin et al., 2009).

Although questionnaires have been used to measure and describe hospital patient safety culture and climate, few studies have attempted to link climate to patient outcomes or other indicators of safe, quality patient care (Davenport, Henderson, Mosca, Khuri, & Mentzer, 2007; Thomas, Sexton, & Helmreich, 2003). Research in non-health care industries has demonstrated a link between safety climate and reduced worker injuries, and lost work days (Johnson, 2007; Zohar, 2000, 2002). Health care worker safety research has also shown a relationship between safety climate and staff behaviors, finding that high safety climate scores indicated support of safety practices (Gershon et al., 2007). It is unclear if findings from occupational safety can be applied to patient safety as little is known about what factors contribute to the patient safety climate on hospital units, or how to influence or change the climate.

Safety climate assessments can signal the beginning of the organization's patient safety program by raising awareness of the issue and providing a baseline assessment of the priority of safety (Nieva & Sorra, 2003). From there, patient safety interventions can be monitored for progress or identified for more intensive interventions. Benchmarking between units or between hospitals has been suggested as a potential tool for improving patient safety, but it is unknown if aggregated survey data alone is beneficial in understanding how culture affects patient outcomes (Nieva & Sorra, 2003). Safety culture assessments are also being used as evidence of patient safety activities for regulators and other groups.

The Joint Commission on Accreditation of Healthcare Organizations (TJC), government agencies, and public, not-for-profit agencies are now recommending that hospitals evaluate and improve the patient safety culture of their organization. TJC sets standards for evaluating key areas of organizational performance. TJC also has the authority to survey hospitals for Medicare certification by the Centers for Medicare and Medicaid (CMS). Several standards address patient safety culture under the Hospital Leadership Standards for Accreditation. Leadership Standard LD.03.01.01 states that leaders are to regularly evaluate the culture of safety and quality using valid and reliable tools. Although the time frame for assessing the patient safety culture is not explicit, TJC hospital accreditation surveys evaluate if culture surveys are being done on a timely and regular basis. Under Leadership Standard LD.03.02.01 leaders are to describe how data and information are used to create a culture of safety and quality. Leadership Standard LD.03.03.01 states that leaders must describe how planning supports a culture of safety and quality (The Joint Commission on Accreditation of Healthcare Organizations, 2009). These standards support the assessment and monitoring of patient safety culture in hospitals that are working toward achieving or maintaining accreditation.

The California Department of Public Health (CDPH) established legislation effective January 1, 2009 designed to improve the health and safety of patients and reduce preventable events. Senate Bill SB 158 states that hospitals must establish a patient safety committee and safety plans for their facility. Among other requirements, the plan must include a process for reporting patient safety events and for supporting and encouraging a culture of safety. This state requirement is evaluated for compliance during site visits by examining officials (California Department of Public Health, 2008)

The Committee on the Work Environment for Nurses and Patient Safety, sponsored by the IOM, recommends assessing the culture of safety in health care organizations (Page, 2004). Although not a regulatory requirement, the Committee developed Recommendation 7-1 which states that health care organizations should conduct an "annual, confidential survey of nurses and other health care workers to assess the extent to which a culture of safety exists" (Page, 2004, p. 309). Baseline assessments of the patient safety culture give organizations a way to prioritize safety issues and challenges. The Committee recommends ongoing surveys to monitor the behaviors and attitudes that enable or distract from safety efforts.

The Agency for Healthcare Research and Quality (AHRQ) is the health services research arm of the U.S Department of Health and Human Services. This agency supports research in health care quality, costs, outcomes, and patient safety. According to the

AHRQ, barriers to patient safety include a culture of blame; resistance to change; lack of executive leadership commitment; attitudes and behaviors that cover-up error, and other barriers. The AHRQ recommends that organizations measure their progress in patient safety culture, and the culture should be measured periodically (Clancy, 2006). In an effort to foster patient safety culture assessments the AHRQ has developed survey tools for assessing patient safety, medical errors, and incident reporting in the nursing home, medical office, and hospital settings. The surveys are free to institutions via the AHRQ website (Agency for Healthcare Research and Quality: Patient Safety Culture Surveys, 2008).

Public, not-for-profit agencies have also identified culture as a barrier in improving the quality and safety of patient care. The National Patient Safety Foundation (NPSF), a not-for-profit research and education organization, surveyed physician and nurses to identify patient safety educational and training needs (Van Geest & Cummins, 2003). The results of the survey found that both physicians and nurses felt that the current culture of health care was a culture of tolerance for error, and the historical reaction of health care providers was that errors were not viewed as educational tools to prevent such errors in the future. Both groups felt that health care was designed for efficiency rather than safety, causing a culture of blame and isolation. The NPSF recommendations are to change culture through education on basic patient safety principles (systems issues, complexity of the health care environment, ethics, and using errors as opportunities to learn) for nurses, physicians, and the public.

Assessing the organizational safety culture is also recommended by the Institute for Healthcare Improvement (IHI). The IHI is an independent, not-for-profit organization formed to improve health care in the U.S. and worldwide through research, evidence-based recommendations, and field-based testing of strategies to improve patient care. One of the fundamental principles held by the IHI is that the complexities in today's health care environment demand a systems approach to improving patient care. The IHI recommends that the reliability and safety of patient care be improved by following a series of eight steps, with the first step to address and assess the culture of organization. Hospitals and other health care organizations are advised to use a patient safety survey of their choice to assess the current, baseline state of the organization's patient safety culture (Botwinick, Bisognano, & Haraden, 2006). Surveys should be repeated at six-month intervals until the safety scores reach acceptable levels (defined by the organization) and then monitor the gains by implementing the survey on an annual basis thereafter. Establishing a patient safety culture is threatened by a tradition of seeking out, blaming, and punishing staff; lack of transparency around reporting medical errors, and poor communication (Botwinick et al., 2006). According to the IHI, these conditions jeopardize the safety of patients in all health care settings, especially in the acute care setting.

Assessing patient safety climate is an important step in understanding the patient safety climate in hospitals and can be the mechanism for alerting staff to the priority of safety for the organization. Understanding how the patient safety climate affects the care of patients is the logical next step because connecting indicators of quality patient care with safety climate provides objective information to guide hospital resources and strategies to improve care. Patient safety in the hospital setting is a concern for providers, leaders, and consumers, and a significant gap exists in the health care literature about the relationship between the patient safety climate and objective measures of patient care quality and safety at the unit and hospital levels.

Purpose of the Study

Few research studies have described the relationship between the patient safety culture or climate, patient outcomes, unit staffing, and hospital performance measures. The purpose of this research is to describe the patient safety climate at the unit and hospital levels, evaluate the relationships between the patient safety climate, patient outcomes and staffing, and describe the relationship between the patient safety climate and hospital performance measures. It has been assumed that a positive, or better, safety climate would be associated with fewer adverse events, errors, and better outcomes of care; however, the quantitative evidence for this assumption has been limited (Singer, Lin et al., 2009). Although the literature has reported baseline assessments and descriptive studies of the patient safety climate at the unit and hospital level, few studies have linked climate to quality of care measures.

Significance of the Problem

The high volume of errors estimated to occur in U.S. hospitals has catalyzed health care providers, organizations, policy makers, and consumers to seek solutions to reducing harm to patients. The estimate that between 3% and 4% of patient will die from errors in their care has mobilized providers and organizations to identify how they can implement defenses against threats to patient safety (Page, 2004). Protecting patients from harm involves understanding the system involved in health care delivery and patient safety culture and climate is considered to be a part of that system.

This study contributes to patient safety research by evaluating the relationship between patient safety climate and indicators of safe patient care. The rationale for developing a better understanding between patient safety climate and indicators of quality is based on the perception that enhancing patient safety depends on addressing systemic problems in hospitals. Although advances in technology, in procedures, and in staffing and work processes are an important part of the overall approach to decreasing patient injury, affordable solutions to organizational problems may be limited. Although individual practitioners' decisions and actions affect patient outcomes directly, these decisions are made within the context of the practice environment and the coordination of the health care team (Clarke, 2006a). The state of the science of patient safety is limited in understanding the relationship between patient safety climate and outcomes, due in part to lack of a theoretical framework, clear definitions of patient safety culture and climate, identification of optimal indicators of the quality of patient care, and issues in measuring the climate (Clarke, 2006a; Scott et al., 2003). Although intuition supports a link between the patient safety climate and patient outcomes, further empirical evidence is needed to establish how the climate of the work unit influences patient care in order to guide hospital leaders, providers, and patients themselves in improving patient safety.

Research Question and Hypotheses

The overall research question is: What is the relationship between patient safety climate, patient outcomes, unit staffing, and hospital level performance measures? The specific aims of the study are:

1. To describe the patient safety climate at the unit and hospital level,

2. To describe the relationship between the patient safety climate at the unit level and falls and hospital-acquired pressure ulcers,

3. To describe the relationship between the patient safety climate at the unit level and registered nurse (RN) hours per patient day (RNHPPD), total nursing care hours per patient day (TotNHPPD), and percent of RN only hours of care (%RNH), and

4. To describe the relationship between the hospital level patient safety climate and hospital performance measures.

There are separate hypotheses for Aims 2-4. Aim 1 is descriptive in nature, and therefore no hypothesis is formed. The hypothesis for Aim 2 is that patient safety climate is inversely associated with falls and hospital-acquired pressure ulcers. The hypothesis for Aim 3 is that patient safety climate is positively associated with three unit staffing variables: registered nurse hours of care per patient day, total nursing hours of care per patient day, and the percent of nursing care supplied by RNs. The hypothesis for Aim 4 is that patient safety climate is inversely associated with hospital level performance measures related to three conditions: acute myocardial infarction (AMI), heart failure, and community acquired pneumonia (CAP).

The research involved a secondary analysis of data collected during 2006. The study used a convenience sample of 59 units in 10 community hospitals of a faith-based health system in California and Texas. Data from a survey on patient safety climate was obtained from the administrator of the survey (n = 6697). Patient outcomes, unit staffing data, and hospital level performance measure data for the study were obtained from the health system's quality management office.

The patient safety climate data were based on the results of the Safety Attitudes Questionnaire (SAQ), a valid and reliable tool used to assess the patient safety climate in hospital units and departments (Sexton, Helmreich et al., 2006). The survey uses a Likert scale for scoring (1 = Strongly disagree, 2 = Slightly disagree, 3 = Neutral, 4 = Slightly agree, 5 = Strongly agree). The survey has six subscales, Teamwork Climate, Safety Climate, Perceptions of Management, Job Satisfaction, Stress Recognition, and Working Conditions. The survey included questions regarding both hospital management and unit management. Therefore, the Perceptions of Management subscale was categorized into two subscales: Perceptions of Hospital Management and Perceptions of Unit Management for a total of seven subscales for analysis.

The patient outcome and unit staffing variables are the data collected for the California Outcomes Nursing Coalition (CalNOC) and National Database of Nursing Quality Indicators (NDNQI) databases. These indicators have been identified as valid indicators for measuring nursing care outcomes (Brown, Donaldson, Aydin, & Carlson, 2001; Montalvo, 2007). The patient outcomes variables are falls per 1000 patient days, and hospital acquired pressure ulcers (HAPU) calculated from the pressure ulcer prevalence study done at the time of the SAQ survey. Three unit staffing variables were used: registered nurse (RN) hours of care per patient day, total nursing hours of care per patient day, and the percent of nursing care supplied by RN.

The hospital level performance measures are data gathered as part of the Hospital Quality Alliance (HQA) initiative sponsored by the Centers for Medicare and Medicaid (Centers for Medicare and Medicaid, 2008). The three performance measures are process of care measures that reflect the failure rate of hospital team efforts to provide evidence based care. The indicators are calculated from the number of patients who received selected medications and treatments divided by the number of eligible patients in that diagnostic category. The three performance measures are for patients with the diagnosis of acute myocardial infarction (AMI), heart failure, and community acquired pneumonia (CAP).

Overview of Chapters

This study evaluated the patient safety culture of hospitals units and the relationship between safety climate, staffing and hospital performance measures. The need for further research in this area was discussed in Chapter I by the identification of the volume of patient harm in American hospitals, and need for strategies to reduce threats to patient safety. Chapter I provided the statement of the problem, purpose for the study, significance of the problem, research question, aims and hypotheses. Chapter II presents a comprehensive review of the literature related to safety culture and quality of care indicators, and the conceptual framework for understanding how patient safety climate is influenced by the institutionalization of the values and beliefs, or culture, of the organization. Chapter III describes the research design, sample, data collection methods, and data analysis used to address the research question and aims. Chapter IV presents the research results including hypothesis testing, and Chapter V discusses the findings, limitations, and implications for practice and further research.

CHAPTER TWO

LITERATURE AND CONCEPTUAL FRAMEWORK

This chapter is organized into four sections. First, the concepts of patient safety culture and patient safety climate are discussed and clarified, then defined for this project. Second, the literature review will identify themes in the safety culture and safety climate of industry and health care. Third, the conceptual framework will discuss general concepts of institutional theory and specific concepts of organizational culture and climate theory.

Definitions

The employees of an organization are organized into groups designed to meet the goals of the organization (Schein, 2004). According to Schein, once a group develops some basic assumptions on how a worker should feel and think in order to cope with the workplace's internal and external pressures, a workplace culture emerges. Thus, culture is learned when staff enter the organization (Guldenmund, 2000). The culture serves to constrain, stabilize, and provide structure and meaning for the group members. Stability is established in the groups as workers learn the assumptions and adapt to the culture (Schein). Thus, anxiety is reduced as staff come to understand or even predict the events that occur in the workplace such as staff reduction, change in leadership, or market competition. Culture is multidimensional, is relatively stable, and gives meaning to the work practices of a group; it's the "way we do things around here" (Guldenmund, 2000, p. 225).

Organizational climate is viewed as the expression of the culture of the workplace, and provides staff with a frame of reference that directs behavior (Guldenmund, 2000). Climate describes the perceptions or attitudes workers have of the organization which helps them gauge appropriate behaviors for the workplace (Schneider, 1975). Schein (2004) describes climate as an artifact of culture: the visible, measurable behavior of employees. There are many different types of climates. There can be a customer service climate, an innovation climate, and a safety climate, among others, in an organization (Guldenmund, 2000; Schneider, 1975). Organizational climate is thought to be more tangible and therefore easier to measure and change than the broader concept of the culture of the organization (Clarke, 2006a; Gershon, Stone, Bakken, & Larson, 2004; Provonost et al., 2003). Safety climate is measured with responses, commonly through using a self-administered attitudinal questionnaire or survey (Guldenmund, 2000).

Safety climate reflects the shared perceptions or attitudes of how consistently the priority of safety is supported in the workplace (Zohar, 2002). In some industrial settings, the safety climate is viewed as the underlying cause of industrial accidents (Guldenmund, 2000). Research into health care safety has examined the issues confronting health care workers such as preventing needlestick injuries and reducing on-the-job injuries (Clarke, Sloane, & Aiken, 2002; Gershon et al., 2000; Gershon et al., 2007).The safety climate for staff and patients, however, are different, and managers and hospitals will develop different approaches for education, training and prioritization for safety climate (such as ergonomics for staff, and falls and medication safety for patient) (Zohar, Livne, Tenne-Gazit, Admi, & Donchin, 2007).

The terms organizational culture and organizational climate are often used interchangeably, causing confusion in defining and measuring the concepts (Clarke, 2006a; Gershon et al., 2004; Guldenmund, 2000; Mearns & Flin, 1999). In this research study, the following definitions are used:

1. Organizational culture is defined as the underlying, shared, basic assumptions of the group, creating norms within an organizational (Schein, 2004).

2. Organizational climate is defined as the employees' shared perceptions or attitudes at the work-unit level or organizational level (Blegen, Pepper, & Rosse, 2005; Guldenmund, 2000). Climate is the aggregate of the attitudes employees have about one of the unique climates in the organization such as safety climate or service climate (Guldenmund, 2000; Schneider, 1980).

3. Organizational safety culture is the underlying norms, implied assumptions, and values about safety shared by the employees of the organization (Guldenmund, 2000; Mearns & Flin, 1999).

4. Organizational safety climate is the measurable characteristic of the underlying attitudes toward the priority of safety expressed through the employees' safety behaviors (Mearns & Flin, 1999).

5. The patient safety culture is defined as the underlying assumptions of the priority of patient safety at the hospital and unit levels (Sexton, Helmreich et al., 2006; Zohar et al., 2007).

6. The patient safety climate is defined as the measurable, shared perceptions of work group members regarding the protection of patients from injuries from health care interventions and the environment (Blegen et al., 2005).

Literature Review

The literature review section is organized according to the following themes: (a) industrial safety culture and safety climate, (b) patient safety climate instrument testing, and use of instruments in performance improvement initiatives, and (c) research describing the relationships between patient safety climate measures and indicators of the quality and safety of patient care, (d) research identifying clinical outcomes and nurse staffing as indicators of quality and safety, and (e) research using hospital performance measures as indicators of safe, high quality patient care.

Studies of industrial safety culture and climate span over 25 years and therefore have a longer history than health care safety culture and safety climate studies (Cooper & Phillips, 2004; Guldenmund, 2000; Zohar et al., 2007). Traditionally, worker safety culture and worker safety climate have been studied in industries such as steel manufacturing, oil and gas drilling, and high technology-use industries such as nuclear power plants, chemical processing plants, and the commercial aviation industry (Katz-Navon, Naveh, & Stern, 2005; Reason, 1998). Health care worker safety has also been studied from the framework of how hospital safety culture and safety climate influences workers' behaviors and practices (Flin, 2007; Gershon et al., 2000; Stone et al., 2006; Stone et al., 2007). Industries are interested in studying safety culture as a means of evaluating the relationship between safety and safety performance, such as reducing worker injuries and accidents, and preventing large scale disasters (Cooper & Phillips, 2004; Guldenmund, 2000; Reason, 1998).

Industrial organizational safety culture and climate research suggests that the concepts are multidimensional and complex (Guldenmund, 2000; Mearns & Flin, 1999; Zohar, 2002). The factor structure explaining organizational safety culture and climate is not constant, which suggests that some factor structures may be specific to certain industries or sample populations, or that different instruments may be measuring different safety culture and climate concepts (Cooper & Phillips, 2004; Flin, 2007). This area of research also suggests that there is a relationship between psychological factors (the interactions between people including both staff and management teamwork), behaviors (the job, or the work that is being done), and organizational factors (how organizations are structured, their staffing, departments or divisions, restructuring, and downsizing) in organizational safety culture and climate (Cooper, 2000; Cooper & Phillips, 2004; Zohar, 2002). A limitation in applying this research to hospital patient safety is how outcomes from worker safety culture and climate studies can be transferred to patient safety climate. It is unclear if the concepts for worker safety climate can be applied to patient safety climate, as the patient interacts with the structure of the hospital through the actions of the worker.

Researchers in industrial organizations have varying definitions of organizational culture; and how culture works, and the processes for shaping or changing it, are not fully understood (Cooper, 2000). Guldenmund (2000) discusses organizational culture as an abstract construct, and therefore definitions will vary from author to author. Qualitative methods have been suggested as the method to use when assessing culture (Gershon et al., 2004; Hemmelgarn et al., 2001; Schein, 1990). The ethnographic method has been recommended by Schein (1990) because in-depth descriptions of workplace culture obtained by this method help to build theory.

Industrial climate studies adopt the definition that climate is the term for describing employees' shared perceptions about their common work environment (Griffin & Neal, 2000; Johnson, 2007; Zohar, 1980). Multiple climates exist in an organization, and the term specifically refers to a type of climate, such as a service climate, support climate, climate, or safety climate, among others (Schneider, White, & Paul, 1998). Safety climate is the employees' perception and attitudes regarding the relative importance that management places on safety (Cooper & Phillips, 2004; Johnson, 2007; Zohar, 1980; Zohar & Luria, 2005). Organizational climate is the psychological aspect of culture (Cooper, 2000; Guldenmund, 2000; Neal, Griffin, & Hart, 2000).

Research in industrial and nursing unit settings have common themes. Research findings in industry show that there is a strong association between the influence of management and safety climate, as well as a strong association between improved safety climate and decreased worker injuries (Cooper & Phillips, 2004; Hoffman & Stetzer, 1996; Johnson, 2007; Zohar, 2002). Gershon et al. (2007) evaluated health care worker injuries (blood and body fluid exposure and musculoskeletal muscle injury) and organizational climate. The themes were similar to industrial worker safety research in that (a) perceptions of management support for safety had a significant effect on reducing reports of worker injuries; (b) overall high safety climate scores indicated support of safety practices and programs, encouragement of adherence and compliance with safe practices, and error reporting; and (c) improving safety climate scores was likely to improve occupational health outcomes. In industrial settings, safety climate scores predicted both accidents and microaccidents (minor accidents not resulting in time off from work) in the work area or department (Johnson, 2007; Zohar, 2000, 2002).

Although safety culture and safety climate studies in industry have suggested a relationship between workplace safety culture, safety climate, performance, and worker safety, the role of patient safety culture and patient safety climate in health care has only recently been explored (Huang et al., 2007). Researchers, regulatory agencies and performance improvement organizations are looking to industries with a history of safe work environments to adapt their methods of studying worker safety climate to studying patient safety (Davies, Nutley, & Mannion, 2000; Gaba, Singer, Sinaiko, Bowen, & Ciavarelli, 2003; Kaissi, Johnson, & Kirschbaum, 2003; Sexton, Makary et al., 2006).

Surveying the patient safety climate is recommended before implementing patient safety initiatives aimed at changing the culture of the organization (Kho, Carbone, Lucas, & Cook, 2005; Nieva & Sorra, 2003; Provonost et al., 2003).

This section of the literature review is organized with the three most widely used instruments described first, concluding with an overview of additional tools and a description of their contribution to understanding the assessment of safety climate.

The Agency for Healthcare Research and Quality (AHRQ) developed the Hospital Survey on Patient Safety Culture (HSOPSC) based on examples of existing safety climate instruments and a literature review of areas related to safety management, accident causation, and organizational climate (Sorra & Nieva, 2004a). The extensive online Survey User's Guide for the HSOPSC describes the initial development, psychometrics, and testing of the tool.

The pilot data included over 1400 responses from hospital staff in 21 hospitals (Sorra & Nieva, 2004b). The final instrument is composed of two hospital wide safety climate dimensions, eight unit level safety climate dimensions, and two outcome measure dimensions, along with 2 single item measures: (a) assigning an overall grade (A = Excellent, B = Very Good, C = Acceptable, D = Poor, and F = Failing), and (b) number of patient events reported in the last 12 months, for a total of 12 dimensions and 2 single item measures. Items were scored using a Likert scale (1 = Strongly disagree, 2 = Slightly disagree, 3 = Neutral, 4 = Slightly agree, 5 = Strongly agree). Mean dimension scores were calculated by obtaining the mean of the responses to items in each dimension (Sorra & Nieva, 2004a). Acceptable reliability estimates using Cronbach's alpha range from .50 to .80 and above (Ferketich, 1990; Switzer, Wisniewski, Belle, Dew, & Schultz, 1999). The Cronbach's alpha for each of the dimensions were acceptable, ranging from .63 to

.83. The mean score, standard deviation (*SD*), and Cronbach's alpha for each of the 12 dimensions is shown in Table 1.

Table 1

HSOPSC Dimensions, Number of Items, Mean Scores, Standard Deviation, Cronbach's Alpha Coefficient

Dimension (# of items)	Mean Score (*SD*)	Cronbach's alpha coefficient
Overall perceptions of safety (4)	3.35 (.82)	.74
Frequency of event reporting (3)	3.44 (.95)	.84
Supervisor/Management expectations & actions promoting safety (4)	3.70 (.83)	.75
Organizational learning/continuous improvement (3)	3.73 (.73)	.76
Teamwork within units (4)	3.73 (.83)	.83
Communication openness (3)	3.65 (.75)	.72
Feedback and communication about error (3)	3.51 (.86)	.78
Nonpunitive response to error (3)	3.03 (.94)	.79
Staffing (4)	3.10 (.86)	.63
Hospital management support for patient safety (3)	3.43 (.92)	.83
Teamwork across units (4)	3.29 (.80)	.80
Hospital handoffs and transitions (4)	3.11 (.85)	.80

Note. HSOPSC = Hospital Survey on Patient Safety Culture; *SD* = standard deviation

Peer reviewed articles evaluated how the HSOPSC was used to describe patient safety climate at the unit level (Edwards et al., 2008; Halbesleben, Wakefield, Wakefield, & Cooper, 2008; Moody, Pesut, & Harrington, 2006; Scherer & Fitzpatrick, 2008). Moody et al. administered the HSOPSC to nurses in 6 medical/surgical units to examine relationships between patient safety, nursing care hours per patient day, motivation and decision making style. Halbesleben et al. administered the HSOPSC to nurses in a Veterans Health Administration (VA) hospital, along with a survey assessing degree of burnout. Scherer & Fitzpatrick administered the HSOPSC to the all staff in the perioperative department in a community hospital to describe the level of patient safety climate in the department, and to compare findings between physicians and nurses. Edwards et al. reported results from all staff in the units of two children's hospitals.

Halbesleben et al. (2008) found a relationship between higher burnout scores and staff reporting lower perception of safety on the unit, lower frequency of reporting potential errors, and a lower patient safety grade (grading scheme of A = Excellent through F = Failure) for the unit. Moody et al. (2006) found a positive correlation between supervisor and manager support of actions and expectations promoting safety, and the reporting of medication errors. They also found that when nurses had a higher patient workload (more patients in his or her care) more medication administration errors were reported. Findings on human factors of motivation and communication indicated that these factors also influence willingness to report errors, and the perception of patient safety on the unit. These research studies suggest associations between the human factors of motivation, communication, and burnout on nurses' perceptions of patient safety and reporting behaviors.

Two groups of researchers reported using the HSOPSC to identify areas for improvement in patient safety climate. Scherer & Fitzpatrick (2008) administered the HSOPSC to establish a baseline measure in a perioperative unit. The survey was implemented as part of a performance improvement project in an effort to understand possible reasons for lack of adherence to the Joint Commission patient safety goal of correct site surgery. The survey was targeted to registered nurses (RN, $n = 43$) and physicians (MD, $n = 40$) who had interactions or direct contact with patients. Edwards et al. (2008) administered the HSOPSC to inpatient staff providers in two pediatric hospitals, excluding physicians, to measure baseline perceptions before implementing initiatives aimed at changing overall patient safety hospital culture and unit climate.

Scherer & Fitzpatrick (2008) reported the survey results in the percentage of RN and MD who agreed or disagreed with each item of the survey, and did not report mean scores for the survey dimensions. Significant differences were found between RN and physicians. The majority of physicians (65%) agreed ways to prevent errors were discussed in the unit, yet only 56% of the RN agreed that error prevention was discussed in the unit. A majority of MD (82%) agreed that staff were given feedback about changes made after a patient event had occurred, while only 69% of the nurses agreed. Half the respondents gave their unit a grade of very good to good.

Using findings from the baseline survey, Edwards et al. (2008) targeted improving communication, overall perception of safety, and nonpunitive response to error climate scores over a 12 month period. Significant improvement in organizational learning (improved by 7%), feedback and communication regarding error and nonpunitive response to error (both improved 5%), and frequency of event reporting and teamwork within units (improved 4%) resulted after improvement initiatives were implemented. Although teamwork factor scores fell by 2% and hospital handoffs and transitions fell by 6%, this was felt to be due to challenges with implementing a new electronic pharmacy tracking system. Both of the research teams concluded that the HSOPSC was useful in helping the team target specific areas for improvement, and measure the safety climate at the unit level (Edwards et al., 2008; Scherer & Fitzpatrick, 2008).

The AHRQ recruited hospitals using the HSOPSC tool to participate in creating an ongoing national comparative database starting in 2007 (Agency for Healthcare Research and Quality, 2008). According to the AHRQ, the advantage of the national database is that it can be used for benchmarking performance improvement activities at the hospital and unit level in comparison with similar hospitals. The 2008 database contains data from over 160,000 respondents in 519 hospitals. The average response rate for the hospitals was 54%, with over 300 surveys returned on average. Hospitals using the paper-based survey had a higher response rate (average response rate 60%) than those using the web based survey (average response rate 44%). Those using both methods had an average response rate of 52%.

Thirty three percent of the respondents reported Other as their work unit. The researchers note that this high percentage may have been due to their use of generic unit names, which led many respondents to choose the category Other and write in the name of their specific unit. Ten percent of respondents identified their unit as surgery, 9% as a medical unit, and 9% indicated the option many different units/no specific unit. Seven percent indicated working in an intensive care unit (ICU), 6% in radiology, 5% each in the laboratory and emergency department, 4% each in obstetrics and rehabilitation, 3% each in pediatrics and pharmacy, 2% each in psychiatry and mental health, and 1% in anesthesiology. One third of the responders were registered nurses or Licensed Vocational Nurses (LVN), followed by 22% Other, then technician with 11%. Seventy seven percent had direct contact with patients. The hospitals were predominately non-teaching, non-government owned (76%) representing all geographic regions of the U.S.

Overall, 79% of respondents had a positive response to the domain Teamwork within Units. Respondents answered positively to the items “People support one another in this unit”, “When a lot of work needs to be done quickly, we work together as a team to get the work done”, “In this unit, people treat each other with respect”, and “When one area in this unit gets really busy, others help out”. The item “When a lot of work needs to be done quickly, we work together as a team to get the work done” had the highest positive response rate of 85%. The lowest percent positive response (44%) was to the Non-punitive Response to Error domain which had 3 items: “Staff feel like their mistakes are held against them”, “When an event is reported, it feels like the person is being written up, not the problem”, and “Staff worry that mistakes they make are kept in their personnel file”. Sixty seven percent agreed with the item “Staff worry that mistakes they make are kept in their personnel file”. These results show that a blame and shame culture still exists in health care across the country (Agency for Healthcare Research and Quality, 2008).

Most direct care staff (72%) rated their work units with a Patient Safety Grade of A=Excellent (24%) or B=Very Good (48%) (Agency for Healthcare Research and Quality, 2008). This indicates that although most healthcare providers think their units have a strong patient safety climate, over 25% of them do not agree that the climate supports patient safety. Eighty two percent of administrative or management personnel gave their work unit an A or B patient safety grade, while 67% of Registered Nurses/LVNs graded their unit as A or B. Only 35% of patient care assistants/aides reported a positive response to the domain Non-punitive Response to Error, while 62% of administration/ management staff were positive. Another overall finding of concern was that 52% reported no patient adverse events occurring in their hospital over the last year. Only 53% of respondents with direct patient care responsibilities reported one or more events in the past year, and 32% of those without direct patient care responsibilities reported an adverse event. This finding confirms other studies that have found low overall rates of reporting hospital incidents involving patient care errors (Cullen et al., 1995; Elnitsky, Nichols, & Palmer, 1997; Evans et al., 2006).

The AHRQ 2008 comparative database also reported overall findings by U.S. region. Hospitals in the East South Central states and West North Central states reported the highest composite dimension scores (better safety climate), while hospitals in the Mid-Atlantic/ New England, East North Central, and Pacific states had the lowest composite scores. Hospitals in the Pacific region had the highest percent of respondents who reported at least one event in the last year; the West South Central region had the lowest percent. Hospitals in the Mid Atlantic/New England and Pacific regions scored lowest in giving their workplace an A or B patient safety grade. These results show that all areas of the country have areas of strength and areas for improvement in prioritizing patient safety practices in the unit and at the hospital level (Agency for Healthcare Research and Quality, 2008).

There are some issues to consider in using this comparative database. The hospitals submitting data are a volunteer sample throughout the U.S. and not a statistically selected sample. Each hospital determined their own sampling strategy, which included all staff in some hospitals and only direct care providers in others. Formal training in using the survey was not provided (orientation to the instrument is through the Survey User's Guide which is available on the website). Also, each hospital administered the survey differently. Some sites used the paper survey, others used the web based version, and some hospitals used mixed methods, and if there are effects from different types of survey administration, they were not a part of the analysis.

To summarize, research using the HSOPSC found that most respondents gave their hospital a patient safety grade of Very Good, and managers and supervisors rated their work unit perception of patient safety higher than staff. Teamwork within work units was perceived as positive, although physicians' scores were higher than nurses' scores. Staff members also reported that an overall punitive response to errors exists in hospital work units, which may relate to the low error reporting rate. Research using the HSOPSC with other surveys found that burnout was related to overall safety perception, motivation was related to frequency of error reporting, and communication was related to transitions and handoffs. Consistent findings between the research studies and the national database were low levels of error reporting, perception of a punitive culture when reporting errors, and overall positive response to teamwork within units.

The PSCHO Survey was developed by a team at Stanford University as a part of a patient safety research program sponsored by the AHRQ to be used for personnel in any unit or department of a hospital (Singer et al., 2007). The survey was piloted using a large sample (over 21,000 hospital staff) in 105 hospitals for a 51% response rate in three waves of survey deployment. The survey has nine subscales: three subscales related to the organizational level (management engagement, emphasis on safety, and adequacy of resources available); two subscales at the unit level (safety norms of the unit, recognition and support for safety on the unit); three subscales at the individual level: fear of shame, fear of blame, and learning; and one subscale pertaining to perceptions of incidences of unsafe care (Table 2). Means and standard deviations were reported for the 37 individual items, and not by factor (Singer et al., 2007). The Cronbach's alpha coefficients for the subscales were within acceptable range (.50 to .89), although the Learning subscale had the lowest value Cronbach's alpha (.50).

Table 2

PSCHCO Level, Factors, Number of Items, and Cronbach's Alpha Coefficient

Level	Factors (# of items)	Cronbach's alpha
Organizational level	Senior manager's engagement (7)	.89
	Organizational resources (3)	.67
	Overall emphasis on Safety (3)	.65
Unit level	Unit safety norms (7)	.82
	Unit recognition and support of safety (4)	.74
Individual level	Fear of shame (5)	.58
	Fear of blame (2)	.61
	Learning (3)	.50
Perception of incidences of unsafe care	Provision of unsafe care (3)	.66

Note. PSCHO = Patient Safety Climate in Healthcare Organizations Survey

The PSCHO survey was used to compare responses from naval aviators and health care staff in hospitals participating in the California Patient Safety Consortium (Gaba et al., 2003; Singer et al., 2003). Health care providers and aviators were compared together within the framework of having positions with high responsibility in high stress situations. The researchers reported the results as the percent of problematic responses (perception of the lack of overall safety) rather than percent positive agreement. The sampling strategy in both studies was to sample 100% of senior staff (department heads and above), 100% of physicians, and 10% of other hospital employees (including nurses). Health care providers reported an overall 17.5% problematic response, compared to 5.6% for naval aviation personnel. Fifty five percent of health care staff agreed with the item "Loss of experienced personnel had negatively affected my ability to provide safe care" while only 18 % of naval aviators agreed. Twenty six percent of health care staff and only 7% of naval aviators disagreed with the item "Senior management reacts well to unexpected changes to its plans". Only 2.7% of naval aviators disagreed that senior management provides adequate safety backup to catch possible human errors during patient care activities" while 23.7% of health care workers disagreed. In both naval aviation and hospital sectors, the staff agreed that their organizations were committed to safety.

Singer et al. (2003) reported wide variation in safety climate between hospitals. Overall problematic responses from individual hospitals ranged from 13% to 22%. Comparing responses by position, the researchers found senior management responses were more positive than front line clinicians. For example, 17.5% of clinicians disagreed with the item "Senior management provides a climate that promotes patient safety" compared to 9.4% of management, and 14.3% of clinicians did not agree with the item "Senior management considers patient safety when program changes are discussed" compared to 8.3% of managers.

There are several limitations in the studies (Gaba et al., 2003; Singer et al., 2003). The hospital staff sample, acknowledged to be non-random in both studies, included 100% senior management staff, 100% physicians, and 10% random sample of other hospital employees. The 10% sample was not specifically described, and therefore assumed to be nurses, pharmacists, technologists, or others. Front line staff with direct patient care responsibilities may have been under-represented in the studies. Also, while there may be reasons for comparing aviation personnel to health care personnel due to both groups working in fast paced environments that increase the risk of error, it is unclear how helpful such comparisons are in studying patient safety climate. Although both groups have hierarchical work structures, training and socialization in the military versus health care disciplines are different. In addition, in aviation the focus is on worker safety, and in health care the focus is on patient safety. The intent of survey questions would differ in that worker safety items would inquire about the threat to the staff member, while patient safety questions inquire about threats to a third party, the patient.

Singer, Gaba et al. (2009) used the PSCHO Survey in a random sample 620 hospitals across the U.S. Due to the substantial time commitment and requirement to participate over a three year period, and other issues, only 92 hospitals participated. The authors used the sampling procedure of 100% senior management, 100% physicians, and 10% random sample of other hospital employees. Seventy percent of respondents were female. Twenty percent were physicians and 28.6% nursing staff.

Individual hospitals varied in their perception of patient safety, with problematic responses ranging from 10.9% to 26.6% (Singer, Gaba et al., 2009). Fear of blame among institutions varied most, from 16.1% to 46.8%. The study found differences between work units. Emergency departments (ED) had the highest problematic responses by nurses, followed by medical/surgical wards. In the overall safety climate subscale, ED reported 20.3% problematic responses followed by 18.6% in medical/surgical wards, 18% in surgical services (operating room and post-anesthesia recovery units), and 17.6% in intensive care units (ICU). Nurses were found to have higher perceptions of low patient safety climate than physicians and senior managers, specifically in support of patient safety from unit management. One interesting finding was that 20% of physicians reported a fear of feeling shame, which was higher than for nurses. The authors suggest that traditional expectation about autonomy and sole responsibility for a patient's well-being may be an influencing factor in this finding.

Limitations in this study may include the sampling strategy which could under represent the hospital front line staff (Singer, Gaba et al., 2009). Physicians comprised 20.1% of the sample, and nurses 28.6% (not identified as registered nurses or licensed vocational or practical nurses), with the rest of the sample comprise of managers and other employees. Response rates from individual hospitals ranged from 17% to 100% which could bias the results to those institutions providing the most responses.

The PSCHO survey was administered in 30 Veterans Affairs (VA) hospitals along with a measure of culture called the Z&K survey, which classifies culture into four different types (Hartmann et al., 2009). Hartmann et al. hypothesized that key characteristics of the hospitals would be associated with higher or lower levels of patient safety. Specifically, a higher level of group culture and entrepreneurial culture would be associated with high safety climate, and hierarchical culture and rational culture would be associated with lower levels of safety climate. The hospitals were stratified as other, low, medium, or high performing hospitals based on their performance on the Agency for Healthcare Research and Quality's (AHRQ) Patient Safety Indicators (PSI). The overall response rate was 50%, with individual hospital response rates from 26% to 73%. Responses were approximately 50% female, and 22.7% of the total were nurses.

Hospitals with higher levels of group culture and entrepreneurial culture were associated with higher levels of safety climate (Hartmann et al., 2009). Hospitals with a high hierarchical culture were predictive of a lower level of safety climate. The authors note that a strong group culture may value the respect and camaraderie necessary to bring safety issues into the open. A strong entrepreneurial culture may promote group learning and problem solving. The authors discuss that a balance of cultural styles should be explored further as additional types of cultures may be present in the VA as well as other health care systems. Although no optimal type of culture was recommended as a way to ensure strong safety climate, the authors suggest efforts to reduce high levels of hierarchical culture could benefit the safety culture of a hospital. Limitations to the research included the issue of over-sampling to compensate for non-response, specifically in the physician job group, which traditionally has a lower response rate. Data from hospitals with response rates of less than 40% were included in the study, and this could have biased the results. Another limitation may have been the choice of the Z&K culture classification tool over another tool which could have yielded different results.

Using the data from the Hartmann et al. (2009) study, Kaafarani et al. (2009) extracted data from operating rooms (OR) and post-anesthesia care units (PACU) for analysis at the unit level. One hundred percent of employees in the OR and PACU were sampled in 10 of the original 30 VA hospitals for a response rate of 7.7% (n=324). The researchers did item-by-item comparison between OR/PACU combined units and other work units, finding that OR/PACU unit responders indicated a weaker safety culture. Significant findings included that staff in OR/PACU reported witnessing another staff member deliver unsafe patient care (55.1% vs. 43.2% in other units), perceived less interest in quality of patient care (20.4% vs. 12.5%) and expressed that senior management did not perceive the same level of risk as frontline staff (28.3% vs. 17.1%). Another significant finding was that OR/PACU had less problematic responses to the item “asking for help is a sign of incompetence” 2.18% for OR/PACU vs. 6.24% for other units (Kaafarani et al., 2009, p. 5).

The limitations of this study are that the final sample of 10 hospitals included more high-performing hospitals which may have indicated selection bias. Another issue is that the Other Work Units group included medical, surgical, and non-clinical staff, so no comparisons can be made between OR/PACU services and other specific clinical units. Another bias includes the hierarchical nature of the VA hospitals, all of which were teaching hospitals, and how the relationships between resident and attending surgeons might influence the results.

Two research studies used the PSCHOS in pre and post-interventions evaluation (Cooper et al., 2008; Ginsburg, Norton, Casebeer, & Lewis, 2005). Ginsberg et al. assessed nursing leader's perceptions of patient safety in two Canadian hospitals after a training intervention and found a statistically significant increase in the study group for the Valuing Safety variable after a safety training workshop, from a mean of 3.29 to a mean of 3.49. However, there was no change in the other two safety variables (Fear of Repercussions and Perceived State of Safety). A statistically significant decrease in the Perceived State of Safety (from a mean of 2.80 to 2.71) was found for nurses who did not attend the workshops, although the other safety variables were unchanged.

Cooper et al. (2008) administered questions from the PSCHOS to anesthesia staff personnel in six U.S. hospitals before and after an anesthesia simulation training workshop. Significant differences were found among all six hospital departments in the Safe Workload factor, and in overall Safety Climate for two of the hospitals. Scores for both factors increased after the training. There was no significant change in scores by provider type (attending, resident, fellow, Certified Registered Nurse Anesthetists) after the intervention.

In summary, researchers using the PSCHOS found wide discrepancy between managers and direct patient care providers in perceptions of safety on the unit. Another finding was the variance in responses between hospitals. In the performance improvement studies by Ginsberg et al. (2005) and Cooper et al. (2008), small significant changes in perception of patient safety climate were found. It is unclear if these findings were a result of the sensitivity of the instrument, or from confounding factors such as the influence of earlier training in the anesthesia provider study (Cooper, 2008), and the potential bias of nurse leaders self-selecting into the safety workshop in the study by Ginsberg et al. (2005).

The Safety Attitudes Questionnaire (SAQ) was developed from a background of aviation attitudes surveys (Sexton, Helmreich et al., 2006). An initial report describes the development and pilot testing of the tool in the United Kingdom, New Zealand and the United States, in 203 hospital units with over 10,000 surveys (Sexton, Thomas, Helmreich et al., 2003). Confirmatory factor analysis supported a six factor structure. Cronbach's alpha coefficients ranged from .65 to .83 demonstrating acceptable reliability. The authors converted the Likert scale (1 Strong disagree, 2 Slightly disagree, 3 Neutral, 4 Slightly agree, 5 Strongly agree) to a one hundred point scale for ease of analysis in the published article. The mean scores for inpatient units in the U.S. were calculated as the sum of the items in each factor, noted in Table 3. The range for Cronbach's alpha coefficients for each factor is also noted in Table 3.

Table 3

SAQ Factors, Number of Items, Mean, Standard Deviation, Cronbach's Alpha

Factor (# of items)	Mean Score (*SD*)	Cronbach's alpha
Teamwork Climate (6)	64.3 (16.6)	.62 -.84
Safety Climate (7)	60.5 (16.0)	.62 - .84
Perceptions of Management (4)	38.3 (18.7)	.63 - .74
Job Satisfaction (5)	59.6 (20.5)	.81 - .93
Working Conditions (4)	49.2 (19.5)	.67 -.83
Stress Recognition (4)	74.4 (20.2)	.67 - .76

Note. SAQ = Safety Attitudes Questionnaire; *SD* = standard deviation

Peer reviewed articles describe using the SAQ in specialty units in the United States, including labor and delivery, pediatric cardiac surgery, adult intensive care unit (ICU), a children's hospital, and surgical departments (Bognar et al., 2008; Davenport et al., 2007; Grant, Donaldson, & Larsen, 2006; Huang et al., 2007; Makary et al., 2006;

Sexton, Holzmueller et al., 2006; Sexton, Makary et al., 2006). In two of the studies, registered nurses (RN) had the highest response rate for returning the surveys (Makary et al., 2006; Sexton, Makary et al., 2006) and in three studies, nurses returned the greatest number of surveys (Davenport et al., 2007; Huang et al., 2007; Sexton, Holzmueller et al., 2006). Grant et al. (2006) and Bognar et al. (2008) reported most respondents were female, but did not explicitly state if they were nurses.

Significant differences between RN and physician responses to the Teamwork Climate factor were found in 5 studies (Bognar et al., 2008; Grant et al., 2006; Huang et al., 2007; Sexton, Holzmueller et al., 2006; Sexton, Makary et al., 2006). Physicians consistently reported higher positive responses to perception of teamwork than RN. The study of intensive care units (ICUs) also found physicians had higher percent positive responses than nurses to the Working Conditions, Job Satisfaction and Perception of Management factors, although the study by Grant et al. found that RN reported higher positive responses to the Working Conditions factor. The study by Grant et al. also found the Job Satisfaction factor rated high for all staff, and Perception of Management and Stress Recognition rated low for all staff. Results for the Safety Climate factor showed that RN perceived better unit commitment for safety than physicians in the study by Grant et al. but showed no significant differences between disciplines in the studies by Bogar et al. (2008) and Makary, Sexton, et al. (2006).

Several studies looked at same-type units within hospitals (ICUs, labor and delivery units, surgical departments) and found significant differences in the subscale scores between the units. Bognar et al. (2008) pooled the data from 3 pediatric cardiac units in 3 different hospitals and found significant differences between providers (RN, surgeons, technicians and anesthesiologists). Grant et al (2006) found differences in a children's hospital between inpatient RN and physicians, and surgical department RN and physicians. Huang (2007) evaluated the patient safety climate in four ICU in one tertiary care hospital, finding significant variation in subscale scores between the units and overall higher nurse manager perceptions of the safety of the unit. Sexton, Holzemueller et al. (2006) found that physicians and nurse managers in labor and delivery units perceived teamwork more positively than nurses and obstetrical technicians. Sexton, Makary, et al. (2006) reported on the Teamwork Climate subscale in operating rooms. The authors found variation between hospital operating rooms and a consistent pattern that teamwork was perceived differently according to discipline. Surgeons and anesthesiologists indicated higher satisfaction with physician-nurse teamwork than the nurses reported. Makary et al. (2006) reported on the SAQ safety climate subscale, finding that safety climate varied widely by hospital but not by position indicating that hospitals could claim a "local culture" within their own operating rooms (p. 631).

Several articles describe performance improvement projects using the Safety Attitudes Questionnaire (SAQ), or modifications of the SAQ, to identify baseline assessments of patient safety climate (Grant et al., 2006; Luther et al., 2002; Makary et al., 2006; Rose, Thomas, Tersigni, Sexton, & Pryor, 2006). The common results in these studies were similar to previous research findings, such as physicians reporting higher Teamwork Climate factor scores than nurses; communication and collaboration reported higher for physicians than nurses; low recognition the impact of stress and fatigue on work performance, and management support for safety reported lower for nurses than managers and physicians. The studies share similar positive findings in that job satisfaction was generally high for respondents, and that nurses reported a more positive safety climate than other providers.

In summary, research using the SAQ found that direct patient care staff vary in their perceptions of patient safety climate, both between units and between health care disciplines. Research in the Teamwork Climate factor found the trend of a discrepancy between physicians and RN percent agreement on the quality of teamwork in the unit. Results from the Safety Climate factor found that there is a high level of agreement between disciplines and within units on this factor. Nurses, more than other groups, reported that they did not perceive that managers or supervisors actions supported patient safety. Responses to the Stress Recognition factor showed that most health care personnel did not perceive stressors as factors affecting patient safety. It is unclear if this result is because fatigue and stressful situations are not an issue for health care providers or because they do not recognize the impact of stress on decision making and errors in care. In hospitals using the SAQ for performance improvement activities, the tool helped to identify areas of strengths and weaknesses to be targeted for further evaluation.

Several articles described patient safety climate survey tools that are not as commonly used as the ones discussed previously (Blegen et al., 2005; Hughes, Chang, & Mark, 2009; Kaissi et al., 2003; Sexton, Thomas, & Helmeich, 2000). These tools have added additional insights into issues that influence the perception of patient safety climate. Kaissi et al. (2003) found a high degree of interdepartmental conflict in the emergency, intensive care and surgical departments of four hospitals regarding teamwork. Their research discovered that nursing staff questioned the value and importance of teamwork if it did not increase the efficiencies of the units. Blegen et al. (2005) included a dimension on quality management to a patient safety survey given to nurses in two hospitals, in two time periods. Results found positive and high correlations between quality management and other dimensions of safety. Hughes et al. (2009)

investigated the quality and strength of patient safety climate. Their findings suggest that it is the nurses working together on units that create the normative expectations about acceptable behaviors, such as patient safety, not necessarily the unit managers. The researchers also found that the climate quality was positive for willingness to report errors, but climate strength was limited, meaning that nurses understood the value of reporting errors, but they were concerned with the consequences of reporting. The study also found that nurses in Magnet hospitals were more likely to communicate errors and problem-solve solutions to errors in patient care delivery.

Sexton et al. (2000) merged data from surveys used in a multinational study of operating room, intensive care unit, and flight crew staff. Flight crews were far more likely than surgeons (94% to 55%, respectively) to support non-hierarchical work teams. Although health care staff agreed that discussing errors is important, most reported this is not done due to personal reputation, malpractice concerns, threat of disciplinary action by licensing boards, job security, family and societal expectations that errors would not occur, and other team member's egos and expectations.

Overall, the results from the testing of these patient safety climate instruments has established that differences exist between hospitals, units, and disciplines regarding perceptions of patient safety, and comparisons can be made between different groups. The research showed that there is an overall discrepancy between providers, with physicians showing higher agreement than nurses on the perception of teamwork, communication, and feedback on results from reporting errors. Managers and supervisors were found to consistently rate their perception of the safety of their units higher than the front line staff, although Hughes et al. (2009) found commitment to safety in the nursing unit was the most strongly positive attribute of safety climate on those units. Working conditions, ranging from adequate resources and staffing, influenced how staff perceive patient safety, and overall, staff reported lower perceptions of management and supervisor support for their actions related to patient safety. The research also found consistently low levels of error reporting, as staff perceived a punitive response to reporting, and receiving little feedback about changes made after reporting errors. In the studies reporting perception of the impact of stress, motivation, and burnout on patient safety climate, stress was not perceived as an influencing factor in patient safety perceptions, but motivation and burnout were. Another finding was that training programs can improve patient safety scores.

Additionally, this research theme showed that there are different dimensions to describe patient safety attitudes. The common ones found in these instruments were teamwork, overall safety, perception of management support, and working conditions. Other instruments included factors related to quality improvement, receptiveness to learning, event reporting and workload, among others. One question is whether specific dimensions should be developed for the different units of analysis, such as in the PSCHCO Survey, which has separate dimensions for the overall organization, unit, and individual level. Another issue is whether there is a core set of essential dimensions that should be a part of any instrument measuring patient safety climate. Although common dimensions were found among the instruments reviewed here, the variety of additional dimensions indicates that further research is needed to identify the core dimensions of patient safety climate.

Surveys describing patient safety climate scores may identify areas of staff concerns about patient safety and identify specific areas of improvement to target for improvement, but they do not provide evidence of patient safety outcomes (Colla, Bracken, & Weeks, 2005). Industrial safety climate research has shown a relationship between safety climate and worker injuries which has been used to predict days off from work, and other outcomes. It is unclear if such a relationship exists between patient safety climate and patient injuries. Research in the relationship between patient safety climate and patient outcomes could provide a standardized approach to measuring patient safety climate and patient outcomes (Pronovost & Sexton, 2005). In order to build a culture of safety in hospitals research is needed to understand how and what dimensions of climate link to patient and operational outcomes.

Four articles were found that describe the relationship between patient safety climate scores, patient outcomes, and administrative factors in hospitals serving as indicators of quality and safety (Davenport et al., 2007; Pronovost et al., 2005; Singer, Lin et al., 2009; Zohar et al., 2007). The relationship between administrative measures of length of stay (LOS), nurse turnover, and medication reconciliation was studied by Pronovost et al. (2005). Zohar et al. (2007) used unit observations to assess safety measures of medication safety practices and crash cart readiness practices along with climate. Davenport et al. (2007) used risk adjusted morbidity for surgical patients, and Singer, Lin et al. included 12 patient safety indicators (PSIs) recommended by the AHRQ to evaluate the relationship between patient safety climate and patient outcomes.

Davenport et al. (2007) used the Safety Attitudes Questionnaire (SAQ) to survey providers in the surgical units of VA medical centers. The researchers added a dimension on emotional exhaustion to the survey. Using risk-adjusted mortality and morbidity from the National Surgical Quality Improvement Program (NSQIP), correlations were evaluated between the SAQ survey scores and the NSQIP data. The researchers found that only communication and collaboration with attending physicians and not the six factors of the SAQ influenced risk adjusted morbidity in surgical patients. They concluded that the SAQ may have been inadequate in demonstrating a link between climate and risk adjusted outcomes in surgical patients. The researchers did not discuss how adding another scale to the SAQ may have influenced the responses, and psychometric testing was not repeated. They also did not discuss if practices specific to the VA setting, such as predominately teaching hospitals or characteristics of VA hospital culture, may have contributed to the results. The hierarchical role of attending surgeons and residents was only discussed from the viewpoint of how this might differ between academic and community hospitals, and not in regard to how this hierarchy might have influenced survey respondents. Given that the data collection was restricted to surgical patients in the VA system, the NSQIP measure may not have been the appropriate outcome measure in evaluating the relationship between outcomes and climate.

Singer, Lin et al. (2009) used data from the Patient Safety Climate in Healthcare Organizations (PSCHO) Survey to examine the relationship between hospital level climate and selected patient safety indicators (PSIs) recommended by the AHRQ. The PSIs were identified by the AHRQ as indicators of 20 potential in-hospital patient safety events that are readily available from hospitals through medical record abstracting (Rivard et al., 2005). Examples of PSIs are complications of anesthesia, decubitus ulcer, infection due to medical care, and postoperative hemorrhage or hematoma.

Using a composite set of 12 PSIs, the researchers found that a 1% reduction in the patient safety climate score (indicating poorer climate) was associated with a 3.4% relative increase in risk of PSIs (Singer, Lin et al., 2009). Using a composite PSI score, results showed that hospitals with higher fear of blame and fear of shame were significantly at risk of experiencing a greater volume of PSIs. Senior management's safety climate perception did not predict increased risk of PSIs, but the safety climate of frontline staff was marginally associated with increased risk of PSIs. When analyzing additional PSIs separately as dependent variables and climate scores as predictor variables, there was inconsistency in the relationships between PSIs and safety climate. There was a strong association between overall higher safety climate and lower risk of decubitus ulcer (1.064) which may have biased the results for other PSIs. Three other individual PSIs showed a less strong relationship to overall safety climate (post-operative hemorrhage, post-operative reparatory failure, and post-operative pulmonary embolism (PE) or deep vein thrombosis (DVT). Fear of blame and fear of shame continued to be a strong predictor of 14 out of 24 individual PSIs.

The AHRQ PSIs are new in comparison studies, and more research is needed to determine if the indicators are sensitive and reliable in most hospitals (Singer, Lin et al., 2009). The strength of the study is that it is one of the first to evaluate patient safety climate with both composite and individual indicators of patient care quality. Limitations include the stratified random sample of the hospitals, which reflected more nonprofit and teaching hospitals, most of which were in the Western region of the U.S. The sampling strategy of surveying 100% of senior managers, 100% of physicians, and 10% of all other employees created over-sampling of physicians and possible under-sampling of direct patient care providers which could have biased the climate results.

Pronovost et al. (2005) implemented a multi-step safety program in two intensive care units in one hospital to demonstrate the effectiveness and validity of unit based educational programs to improve patient safety. The program included administering a baseline patient safety survey; educational sessions, assigning senior leaders to meet with unit staff once a month, identifying improvements, and repeating the safety climate survey. The educational programs presented information on the extent of adverse patient events, understanding how to improve systems and not blame individuals for errors in care, interpersonal skills in speaking up, bringing errors and potential errors to the attention of others, and team responsibilities for improving systems. Pronovost et al. found the patient safety climate scores increased after the educational program. They also found that physicians on the units improved the process of coordinating inpatient and discharge medication orders. Another finding was a decrease in patient LOS of 24 hours for one unit and 16 hours for the other unit after implementing the program. Nursing turnover was not significantly different.

Limitations to this study include that although the authors state that medication errors were decreased, the evidence for this is based on better physician documentation and not actual observed or reported medication errors (Pronovost et al., 2005). The study was also restricted to two units in an academic medical center and therefore the results can only be interpreted within the context of that specific sample. Since no control group was used in the study, the findings cannot be attributed to the unit based educational intervention, nor state that there is a causal relationship between improvements in safety climate and these outcomes.

Zohar et al. (2007) surveyed nurses in three tertiary care hospitals in Israel using the Nursing Climate Scale (NCS), which was developed by the researchers. The NCS indicates the level and strength of safety climate scores. Emergency safety was measured by reviewing resuscitation (crash) carts on hospital units checking for daily records of cart preparedness checks, correct number of medications and supplies per policy, and evidence of updated emergency procedures. Safe medication practice was measured by a 12-item checklist assessing routine practices such as medication storage, checking medication expiration dates, documentation of medication administration, patient identification, and observing for medications left at the patient bedside.

Zohar et al. (2007) reported that when hospital wide patient safety scores are high, unit scores are also high. They also found that when overall hospital-wide patient safety scores were low, unit level scores stayed high suggesting that unit managers can compensate when organization wide safety priority is different than on the unit. Their interpretation of the usefulness of the NCS was that it predicted the patient safety climate on the nursing units in relation to medication safety and emergency preparedness. The study introduced two new concepts. One was the assessment of the level (low to high) of the perception of the priority of safety, and strength (weak to strong) of the extent of the agreement among staff as to the priority of safety. The other was the potential to use patient safety climate scores to predict the likelihood of the occurrence of adverse patient events in a unit. The researchers suggest using the predictive quality of the instrument to plan efforts to prevent patient adverse events in selected units.

Limitations in this study are that the safety practices were monitored six months after the survey was done, and it is unclear why this time lag occurred or if other unit or hospital-based safety initiatives during that time could have influenced the results. Also, the medication safety practice observations could have been strengthened by reviewing unit-based data from incident reports or significant events, and both the medication observation and emergency preparedness could have had a longer observation time than over a two week period. The sample size was small and specific to teaching hospitals (three tertiary care hospitals) and the results were reported in the aggregate and did not differentiate between hospitals or units.

The findings from the research studies described here demonstrate that there is conflicting evidence that patient safety climate scores relate to patient outcomes and selected hospital and unit level data. The study by Davenport et al. (2007) attempted to link patient safety climate scores and patient morbidity and mortality, finding that only collaboration and communication with attending physicians (not residents or consulting physicians) correlated with patient morbidity. Singer, Lin et al. (2009) reported a strong relationship between overall safety climate and decreased risk of decubitus ulcer, but found no consistent relationship between other patient safety indicators (PSIs) and climate scores. Pronovost et al. (2005) attempted to link patient safety climate to the unit characteristics of LOS, nurse turnover, and physician documentation. The findings note that physicians improved documentation in ordering medications; however, decreased medication errors can not be assumed based only on improved documentation. Although LOS decreased, it was not significant, and nursing turnover was also not significant. The results did find that patient safety climate scores increased after the educational program.

Zohar et al. (2007) reported the ability to predict improved emergency preparedness and medication safety practices using patient safety climate scores, although this was based on limited observations of these practices six months after the survey implementation. There was not enough evidence provided to support a relationship between patient safety climate scores and improved emergency and medication safety practices.

Clinical outcomes considered sensitive to nursing care, such as falls, medication errors, hospital acquired pressure ulcers, nosocomial infection, and other indicators have been studied in relationship to the quality and safety of patient care, along with nurse-to-patient staffing (Aiken, Clarke, Sloane, Sochalski, & Silber, 2002; Blegen, 2006; Dunton, 2004; Kane, Shamliyan, Mueller, Duval, & Wilt, 2007; Krauss et al., 2005; Lake & Cheung, 2006; Needleman, Buerhaus, Mattke, Stewart, & Zelevinsky, 2002). The essential role of nurses in assessment, monitoring, intervention and evaluation in patient care is the rationale for examining factors that influence patient care (Aiken et al., 2002; Page, 2004).

Krauss et al. (2005) conducted a case-control study of patients who fell in different patient care units of an academic medical center to identify what activities, environmental factors, patient-specific factors (including medications), and care-related factors influenced falls. The intention was to gather information that could be used to develop fall prevention programs. Findings showed that most patients (82%) fell in their hospital room and 85% fell when they were not being assisted by a provider or a device (walker, cane) even though they used an assistive device at home, and had orders to be up with assistance. Almost half of the patients were ambulating when they fell, and 47% of these falls were related to toileting. Patient related characteristics included increased falls with age; incontinent of bowel or bladder; unbalanced gait; and certain medications (antiarrhythmics, sedatives, and diabetes medications). Patients who needed help (up with assist, bathroom privileges) were more likely to fall. The authors also found that the more patients a nurse was assigned, the greater the risk that the patient would experience a fall. Krauss found that the likelihood of falling was three times higher for patients when their nurse had four to six patients, and seven times higher when the nurse had seven or more patients. This finding adds to the evidence that the incidence of patient falls is sensitive to nursing care.

Krauss et al. (2005) also suggests that falls are multifactorial and that a patient's gait, toileting, level of confusion, and the use of specific medications (sedatives, hypnotics, or diabetes medications) play an important part in falls risk. This study relied on voluntary incident reports for the falls data and therefore they may not have obtained the total number of falls in the study period (approximately one month). Interviewers were only able to discuss the fall event with 35% of the cases and 43% of the control subjects. Nurses were interviewed more often than the patients for the cases, and patients interviewed more often for the controls, which may have introduced recall bias. Also, multiple sources for data collection (interviews, incident reports, medical record review) could have provided biased information. There was also a time delay between investigator receipt of the fall report and interview of cases and controls.

Pressure ulcers have been associated with increased mortality rate, patient complaints of pain and significant financial impact in health care (De Latt, Reimer, & Achterberg, 2005; Lyder, 2003; Reddy, Gill, & Rochon, 2006). According to Lyder (2004) the majority of pressure ulcers can be prevented through skin assessments, identifying risk factors, use of the correct bed surface, and education to patients and staff members. Although prevention is considered a multidisciplinary effort, monitoring for skin breakdown and prevention of pressure ulcers is one of the primary goals of inpatient nursing (Blegen, 2006; Lyder, 2004). Reddy et al. (2006) conducted a review of 57 randomized control trials (RCTs) investigating interventions designed to prevent pressure ulcers in hospital, long term care (LTC) and rehabilitation facilities. Seventy-two percent (72%) of the RCTs were conducted in the hospital setting. The authors grouped the RCTs into 3 categories based on what intervention was being evaluated: (a) mobility impairment, (b) nutritional impairment, and (c) skin health. Nursing care activities such as obtaining the appropriate bed surface for the patient, repositioning the patient at time intervals, obtaining nutritional interventions, and applying topical preparations to the skin were reviewed.

Findings for interventions designed to address impaired mobility showed that specialized bed surfaces are more effective in reducing pressure ulcers than standard hospital mattresses (Reddy et al., 2006). Two RCTs addressed positioning patients on specialized bed surfaces every four hours but this strategy was not found to be anymore effective than repositioning every 2 hours. Nutritional supplement interventions were addressed in five of the RCTs. One of the RCTs followed over 600 patients for over two weeks and found that supplements reduced pressure ulcer incidence in hospitalized patients. The other studies had smaller sample sizes (three inpatient, one LTC) and may have not had sufficient power to find an effect. Three RCTs reviewed interventions targeting skin health. Different topical skin agents were reviewed with mixed results. One study using a preparation of hyperoxygenated fatty acids versus a placebo resulted in pressure ulcer incidence of 7.3% and 17.3%, respectively. The other studies of different formulations for improving dry sacral skin did not find statistical significance.

Reddy et al. (2006) stresses the importance of assessing risk factors for pressure ulcers (immobility, history of stroke, and difficulty with ambulation) as the first step in choosing the right interventions for pressure ulcer prevention. Nutritional supplements may not be indicated in patients who are well nourished. The authors recommend use of commonly available skin moisturizers as a low-cost, low-harm intervention. Interventions for reducing pressure ulcer prevalence needs more research. Nursing assessment of the risks for pressure ulcer development provides the information to guide selection of existing interventions.

Although findings from research in nurse staffing has been inconsistent, the majority of studies indicate there is an association between staffing and the quality and safety of patient care. In a meta-analysis of 101 studies at the hospital level and patient level of analysis, Kane et al. (2007) identified 28 studies that reported associations between registered nurse (RN) to patient staffing and adjusted odds ratios of patient outcomes (hospital-related mortality, hospital-acquired pneumonia, cardiac arrest, nosocomial infection, and other outcomes). Other variables considered in the comparison were the type of design of the study, the definition of how nurse-to-patient ratios were calculated (RN hours per patient day or number of patients cared for by one RN), and multiple statistical analyses to control for confounding variables in evaluating the strength of the association between registered nurse-to-patient ratios and outcomes.

Findings included that with the addition of one nurse full time equivalent (RN FTE) there was a 1.2% reduction in hospital mortality rates overall (Kane et al., 2007). There was a reduction of 19% in the odds of hospital-acquired pneumonia for all patients, and a reduction of 30% for patients in intensive care units (ICU). In ICU, reducing the number of patients for each RN per shift from 3.3 to 1.6 reduced the odds of cardiac arrest by 34% and of nosocomial sepsis by 43%. In surgical patients, reducing the number of patients from five to two per RN per shift (hospital level analysis) was associated with a 49% reduced odds of nosocomial sepsis. The authors note that they did not find any studies reporting the odds ratios for patient falls or pressure ulcers in relation to nurse to patient staffing levels. There was no association between hours of nursing care and urinary tract infection or surgical bleeding.

Overall this review of research findings between nurse staffing and selected patient outcomes demonstrated there is an association between nurse staffing and the quality and safety of patient care in some of the studies, but the authors caution that causal relationships could not be established (Kane et al., 2007). Many other variables could influence the association between staffing and patient outcomes such as hospital volume, physician practice, nurses' job satisfaction, nurses' education, skill level and other variables (Needleman et al., 2002).

Lake and Cheung (2006) reviewed eleven research studies linking nurse staffing to falls and pressure ulcers at the hospital and unit level of analysis. The premise for their review was that the nurse's role is one of surveillance and care. Therefore, patients should experience fewer falls and pressure ulcers in hospitals that were better staffed with nurses, including non-registered nurses. The researchers compared the eleven studies according to how the patients were risk adjusted, adverse event rates, nurse staffing measures, and the source of the data. Pressure ulcer data was obtained both from administrative data (diagnosis codes from medical record abstracting) and observational and chart data (unit based data). Falls were identified at the hospital level from patient discharge data (diagnosis or event codes) and at the unit level from incident reports. Methods of risk adjusting the severity and intensity of patient care differed among the studies, with the studies using matched cases (patient who fell matched to patients who did not fall), admission data reflecting the baseline status of the patient, discharge data (including diagnosis related groupings or DRG, scheduled admission or not, and other variables), the hospitals' Medicare Case Mix Index, and a calculation factoring in nurse staffing hours and nursing resources needed for patients in selected DRG categories. Multiple staffing hours and skill mix measures reflected differences in definition and focus on discrete nursing classifications (registered nurse, licensed vocational nurse, or nurses' aide). The authors concluded that the evidence from the research reflected two subsets of outcome studies. One subset linked nurse staffing to falls and pressure ulcers at the unit level and the other subset linked staffing to falls and pressure ulcers at the hospital level.

The findings linking both nurse staffing hours to patient outcomes of pressure ulcers and falls was inconsistent (Lake & Cheung, 2006). Four out of six of the research studies had significant findings linking total nursing hours (licensed nurses and unlicensed providers) to pressure ulcers, although two were positive (Blegen, Goode, & Reed, 1998; Cho, Ketefian, Barkauskas, & Smith, 2003) and two were negative (Lichtig, Knauf, & Milholland, 1999; Sovie & Jawad, 2001). Significant findings were found in one study in the association between licensed nursing staff and lower incidence of pressure ulcers (Unruh, 2003). The findings for linking falls and nurse staffing were also mixed, with nine of the nineteen studies having significant findings for the association. One study showed a relationship between lower rates of falls and pressure ulcers when licensed hours of nursing care per day were increased (Unruh, 2003). RN and licensed skill mix had a significantly negative result in nine of the studies for pressure ulcers.

Comparison of studies is challenging due to the numerous research designs used, the level of analysis (hospital or unit level), and data source (adverse events by voluntary report, administrative databases, and statistical analysis). In summary, Lake and Cheung (2006) conclude that research findings in the association of nurse staffing with falls and pressure ulcers were inconsistent. They conclude that more research is needed in understanding how differences in nurses' staffing patterns are associated with the quality and safety of patient care, and specifically adverse events such as falls and hospital acquired pressure ulcers (HAPU).

Measuring the quality of health care across the United States has shown that patient care is not consistent and may not follow recommended guidelines based on evidence based practice (Werner & Bradlow, 2006). In 2001, the Centers for Medicare and Medicaid (CMS) launched the Hospital Quality Alliance to develop a comprehensive data set that would establish valid quality measures for hospital performance United States Department of Health and Human Services, 2008). The measures were developed based on evidence based clinical practice guidelines (Williams, Schmaltz, Morton, Koss, & Loeb, 2005). These performance based measures were based on the concept that adherence to evidence based guidelines for patient care and consistent implementation of the guidelines would result in better care.

Few studies have investigated if the hospital performance measures established by the Hospital Quality Alliance are associated with observed and risk adjusted inpatient mortality rates (Peterson et al., 2006). Peterson and colleagues evaluated hospital's overall compliance with the American College of Cardiology/American Heart Association (ACC/AHA) guidelines for providing evidence based treatment patients with non-ST segment elevation acute coronary syndrome (ACS). This study took place in 350 hospitals in the U.S. over a two year period. The sample size was 64,775 patients. Data was abstracted from medical records to determine if the performance measures were provided to patients (aspirin, beta-blocker, heparin, intravenous glycoprotein inhibitors) in the first 24 hours of hospital care, as well as appropriate medications ordered at discharge (aspirin, beta-blocker, ACE inhibitor, lipid lowering medication, and clopidogrel).

Results showed that the care of patients with non-ST segment elevation ACS met the ACC/AHA guidelines 74% of the time (Peterson et al., 2006). The hospital mean in the highest quartile met all of the elements of the guideline (resulting in a composite score) 82% of the time (range 80%-84%), and in the lowest quartile 63% (range 59%-66%). Significant differences in mortality for these patients were found when hospitals used the treatments as single process measures, not completing all nine of the recommended treatments. Hospital mortality rates when all treatments were provided had a negative association with in-house mortality ($r=-.30$, $p<.001$). Every 10% increase in compliance with all nine treatments was associated with a decease in the hospital's inpatient mortality by 10% (adjusted OR, 0.90; 95% CI, 0.84-.97; $p<.001$). After adjusting for hospital and patient characteristics, every one percent increase in adherence to the guidelines resulted in an equivalent decrease in the likelihood of mortality while the patient was in the hospital. The authors summarize their findings by noting that 25% of the chance to provide guideline-recommended care was missed, indicating variability in the care for patients presenting with these symptoms. Peterson et al. (2006) acknowledge that the association could be confounded by the patient's severity of illness, socioeconomic status, existing guideline adherence, and other factors. The authors acknowledge that as science strengthens current treatment recommendations, the treatment guidelines and hospital performance measures be updated as indicated. They recommend further studies in this patient population and in other hospital performance measures to evaluate if hospital processes of care indicators are associated with patient outcomes for those conditions.

Werner and Bradlow (2006) examined hospital process of care measures for acute myocardial infarction, heart failure and pneumonia in over 3,600 acute care hospitals in the U.S. Five measures for acute myocardial infarction (AMI), two measures for heart failure, and three measures for pneumonia were evaluated. The measures were also evaluated as a composite score for each condition. The researchers also calculated condition specific hospital risk adjusted mortality rates for these conditions for comparison.

The findings for the AMI performance measure showed the absolute risk adjusted mortality rates for hospitals performing in the 25^{th} percentile versus the 75^{th} percentile was 0.005 for inpatient mortality, 0.006 for 30-day mortality, and 0.012 for 1-year mortality (Werner & Bradlow, 2006). For the heart failure measures, absolute risk adjusted mortality rates for hospitals performing in the 25^{th} percentile versus the 75^{th} percentile were 0.001 for inpatient mortality, and 0.002 for 1-year mortality. The absolute risk adjusted mortality rates for hospitals performing in the 25^{th} percentile versus the 75^{th} percentile for pneumonia was 0.001 for 30 day mortality up to 0.005 for inpatient mortality. For the composite measures, between 8% and 14% of the hospitals were identified as high performers in meeting all treatment recommendations. The authors state that the mortality odds ratios are small and this may indicate that differences between hospitals are small. They provide another interpretation by observing that if patients received care for AMI at high performing hospitals instead of low performing hospitals, approximately 3,000 lives could be saved.

Werner and Bradlow (2006) state that the “modest” findings (p. 2700) may be due to the reliability of the data they used, or by hospital inflating how well they perform, although they used statistical modeling to account for this effect. They acknowledge that their sample was restricted to Medicare beneficiaries and not all patients presenting with these conditions. They recommend that the hospital performance measures endorsed by the Hospital Quality Alliance are not explicitly linked to patient mortality, and that further research should focus on developing more accurate performance measures.

Summary

Patient safety is a concern for providers, health care consumers, and regulatory agencies, and creating a culture of safety in hospitals is recommended as a strategy to protect patients (Kohn et al., 2000). Research in occupational safety from non-health care and health care settings has demonstrated that there is a link between organizational safety culture and safety climate, and outcomes such as worker injuries, lost work days, and enhanced safety behaviors (Guldenmund, 2000; Johnson, 2007; Stone et al., 2007; Zohar, 2002). Patient safety is different from worker safety in that the quality and safety of the patient's care is influenced by the behaviors of the health care provider. The results of that care are measured in indicators of the quality and safety of patient care at the unit and hospital level. Conceptually, the knowledge that work place climate affects staff behaviors can be applied to the hospital unit and organizational levels. In a hospital with a strong patient safety climate, behaviors that influence the individual staff member's actions in the practice of delivering safe care would be reflected in quality and safety indicators followed at both the unit level and hospital level.

Research in defining and understanding health care patient safety climate is currently evolving as survey instruments are being developed to describe and measure the concept of patient safety climate. Results from research using these instruments have indicated that differences in patient safety climate exist between hospitals, work units, and health care provider disciplines. This provides investigators with the opportunity to study the climate of that group or organization; climate is a dynamic and variable factor in hospitals. Results from patient safety climate surveys have been used to establish baseline measures of patient safety climate in performance improvement programs, and also to document results from these programs.

There is a lack of research linking patient safety climate, patient outcomes, and selected hospital and unit level characteristics. The available studies have shown conflicting evidence for a relationship between patient safety climate factors and indicators of quality and safety in patient care; marginally significant relationships between patient safety climate scores and LOS, nurse staffing, and physician documentation; and an increase in safe behaviors after measuring patient safety climate in a one-time observational study. More research in this area is needed because measurable outcomes document progress to the goals of improvement in the reliability and safety of patient care processes (Kohn et al., 2000).

The majority of research supports that the nursing role of assessment, monitoring intervention and evaluation in patient care can be measured in patient outcomes such as falls and pressure ulcers. Falls and pressure ulcer prevalence may also be related to nurse to patient staffing, as several studies found that decreasing the number of patients per RN FTE could reduce the odds of hospital acquired pneumonia, cardiac arrest, and nosocomial sepsis (Kane et al., 2007). Reduction of falls and pressure ulcers through increased hours of nursing care by licensed versus non-licensed providers was supported in one study but not in others (Lake & Cheung, 2006). Comparison studies are difficult due to the level of analysis (unit or hospital), data sources, and statistical analyses.

Few studies have investigated performance measures at the hospital level as indicators of the quality of care based on evidence based guidelines and mortality rates (Peterson et al., 2006; Werner & Bradlow, 2006). Although Peterson et al. found significant differences in mortality rates for non-ST segment ACS patients, Werner and Bradlow did not find significant differences between hospitals in mortality for acute myocardial infarction, heart failure and pneumonia patients. Their study found that hospitals overall do not provide high quality of care (only between 8% and 14 % of the hospitals studied) as indicated by evidence based guidelines, leading to the assumption that most hospitals in the U.S. may not be providing adequate care to patients.

Few research articles incorporated assessment of the organizational safety culture and unit safety climate into investigating patient outcomes, the impact of staffing on patient outcomes, or on collaborative processes of care at the hospital level. Understanding the safety culture and climate is one of the recommendations of the Institute of Medicine (IOM) and The Joint Commission, along with other organizations. Patient safety climate needs to be investigated to determine how climate influences the front line staff at the unit level, and the relationship between climate and patient outcomes, nurse staffing, and overall hospital performance measures. Patient safety climate may be a missing link in determining how health care providers and hospital leaders can expand and enhance improvement activities to protect hospitalized patients.

The following section describes the conceptual framework for this research project. First, institutional theory concepts provide the background for placing hospitals in the framework of health care institutions. Secondly, organizational culture theory provides the context for understanding the concept of climate in the work unit. Finally, a framework for linking patient safety climate to outcomes is proposed.

Conceptual Framework

Institutional theory holds that institutions create cultural systems that inform employees how to behave and how to conform to the values, beliefs, and intuitional work myths of the organization (Scott, 2001). These values and beliefs give meaning to work behaviors and make up an organization's social reality. Institutionalization describes the process that an organization undergoes in developing its identity and portraying its unique set of values. Three elements, or pillars, enable organizations to institutionalize practices, technology, and new concepts. The regulative pillar uses rule-setting, monitoring, laws, and formal or informal coercion to control workplace behaviors. The normative pillar bases compliance on the values and norms of the organization, emphasizing the social obligation of the employee to conform. Behaviors that lead to certification and accreditation are enforced as evidence of an organization's legitimacy. The characteristics of the regulatory and normative pillars are already familiar in hospitals; for example, federal laws and regulations, institutional policies and procedures and accreditation agency processes. The cognitive-cultural pillar emphasizes that a worker creates meaning from the work environment. This personal interpretation is shared with others, and a framework for sharing concepts and experiences forms an organization's culture. Gradually these patterns and behaviors become ingrained, and are presented to other staff as "the way we do things around here" (Scott, 2001, p. 57). Leaders can use the cognitive-cultural pillar to show how staff values, beliefs, and actions can transform the workplace culture into one that institutionalizes patient safety as *the* top priority, leading to safer patient care behaviors. Although institutional theory provides an understanding of how organizations function in a global sense, organizational culture theory provides the link between institutional theory phenomena and understanding staff behaviors in organizations.

Organizational culture describes the hidden, complex life in groups, organizations, and occupations (Schein, 2004). Most definitions imply that the concept of culture is socially constructed, that it represents the beliefs and values of the group, and that culture is manifested in the behaviors of the group (Glisson, 2000; Mannion, Huw, &

Marshall, 2005). Many authors have adopted the definition developed by Schein (2004) that states

> The culture of a group is a pattern of shared basic assumptions that was learned by a group as it solved its problems of external adaptation and internal integration that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems. (p. 17)

Culture is the combination of shared perceptions created by group members who have a history of working together (Schein, 2004). Schein suggests that culture can be observed from different levels, and these levels indicate how visible the culture is to a researcher or observer (Schein, 1990, 2004). The artifacts level, or group climate of the workplace, is what a person unfamiliar with a new culture sees, hears, and feels when joining a group. The next level, espoused beliefs and values, is the organizational philosophy and underlying assumptions of the staff that are so deeply ingrained and taken for granted that they are unquestioned. These work behaviors influence how group members think and feel, especially in unfamiliar or stressful situations. To change these underlying assumptions is extremely difficult because questioning them disrupts the stability of the work unit, creating high levels of anxiety. Organizational culture theory is useful in understanding patient safety because it describes how socialization in the work environment influences beliefs, values, and feelings about the work and how it should be done (Schein, 2004).

The focus of this research project is the artifacts, or climate, of the workplace: the visible, measurable attitudes and behaviors of employees (Schein, 2004). Organizational climate is defined as the perceptions of the workers about appropriate actions and behaviors concerning a specific focus in the workplace, in this study, patient safety (Schneider, 1975). Climate is influenced by staff opinions about their leaders' values, the characteristics of the organization, such as communication governance, and the working conditions (work designs, commitment to quality, staffing) (Clarke, 2006a). Several types of climate can exist in an organization, including service climate, leadership climate, and safety climate (Schneider, 1975; Schneider et al., 1998).

Research in industrial work unit climate that focused on the safety climate, safety behaviors and worker injuries, found that safety climate scores predicted worker injuries at the unit level (Zohar, 2002). Zohar suggests that research into this relationship could be used to design interventions to reduce the human and economic costs of accidents in the industrial setting. Research in industrial worker safety has found that workers were less likely to engage in unsafe practices when perceptions of the safety climate were high (Hoffman & Stetzer, 1996). This research found that although accidents were influenced by the individual's behaviors and practices, safety practices that were enforced in the organization were also influential in staff adopting those practices. In a meta-analysis of research in industry describing the relationships between safety climate, safety practices, and occupational accidents and injuries, Clarke concluded that the safety climate influences the level of employee commitment to engage in safety procedures; that is, higher climate perception results in more staff engagement in following safety practices (Clarke, 2006b). Clarke also concluded that the association between safety climate and employee accidents is not clear and that a range of work-related attitudes, such as job satisfaction and commitment to a job, also influences accident avoidance.

Studies of the health care safety climate have focused on the safe work behaviors of health care workers, such as preventing needlestick injuries and reducing worker injuries. This research found an association between organizations with strong safety climates that support and reinforce individual safety behaviors, and fewer worker injuries as well as an increased likelihood that staff will report risk factors and near misses in the workplace (Clarke et al., 2002; Gershon et al., 2000; Gershon et al., 2007). Gershon et al. (2000) state that staff who adopt safer work behaviors, gradually influence other staff members to conform to those behaviors. The authors also note that the opposite can be true. For example, when staff members fail to comply with infection control precautions, other unit staff may model this noncompliance, and safe practices are threatened. These studies contribute to understanding the relationship of safety climate to policies, procedures, and rules to direct safe reliable patient care and the impact climate can have on influencing safety practices.

Patient care safety presents unique characteristics that differ from occupational safety because patients and staff are affected by the safety climate of the work unit (Katz-Navon et al., 2005). Conceptually, the research findings in occupational safety climate from industry and health care showing that climate influences worker outcomes (reduced injuries, increased reporting of errors, commitment to engage in safer work practices) can be applied to patient safety in the hospital setting. Health care providers manifest the shared perceptions of the values, characteristics, and working conditions of the workplace through their actions in delivering patient care, for example, by consistently following recommended standards of care, reporting and learning from patient care errors, collaboration with team members, and maintaining high levels of communication regarding the quality and safety of patient care. Individual staff members make judgments about, and perform functions necessary for, patient care, and the climate of the work place can affect the quality of the practice behaviors of those staff and of the overall health care team (Clarke, 2006a). Organizations with strong safety climates could cultivate the behaviors that enhance learning and the application of beliefs and values about the causes of patient care errors and their solutions (Singer, Lin et al., 2009). The quality and safety of patient care activities, such as medication administration, intravenous access, physical assessments, and other actions are measured in indicators of safe, high quality care at both the unit and hospital level. (Patient care activities will not be addressed in this research study). Establishing links between patient safety climate and measurable patient outcomes provides unit managers and hospital leaders with concrete information. This information can be used for performance improvement activities aimed at identifying behaviors that enhance or detract from vigilance in patient care quality and safety. A diagram of this relationship is provided in Figure 1.

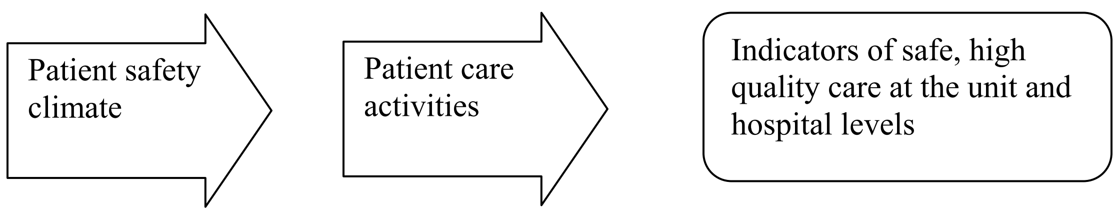

Figure 1. Patient safety climate influences staff member care practices which are measured using indicators of patient care quality and safety.

The Institute of Medicine (IOM) supports using a systems approach to understanding the multiple factors involved in keeping patients safe (Kohn et al., 2000). A systems approach incorporates advanced technologies, understanding workforce capacity, improved work processes, and knowledge gained from safety climate research in both health care and non-health care industries to understanding how these findings can translate into patient safety. Understanding how the patient safety climate at the work unit level influences the delivery of safe patient care is an important step in creating a culture of safety in the hospital setting.

Summary

Patient safety has come to the forefront of attention for providers, consumers, health care organizations, and regulatory agencies. Research in developing a body of literature to describe patient safety science is evolving. Efforts are underway to develop instruments to understand provider attitudes to patient safety and how those attitudes relate to the behaviors of providers and leaders in acute care settings. Research into understanding what indicators are the most reflective of the quality and safety of patient care at the unit and hospital levels also continues to evolve, with nursing care quality indicators of significant interest.

The definition of patient safety needs clarification, as well as definitions for patient safety climate and culture. More research is needed to develop a common language for describing patient safety (Gershon et al., 2004; Kohn et al., 2000). Recent research has documented the variation in patient safety climate within hospital units and between units and hospitals, creating an opportunity for research in identifying the dimensions of patient safety climate for benchmarking, and for comparison studies (Bognar et al., 2008; Sexton, Helmreich et al., 2006; Singer, Lin et al., 2009). Differences in the perception of patient safety between disciplines have also been found (Sorra & Nieva, 2004a; Zohar et al., 2007).

Knowledge also exists that suggests a multifaceted approach to patient safety, including use of technology, understanding capacities of the workforce, increasing efficiency of work process, and creating a culture and climate of safety as defenses to threats to patient safety (Kohn et al., 2000; Page, 2004). There is an assumption that better climate will result in better care, but there is limited evidence supporting this assumption (Nieva & Sorra, 2003; Singer, Lin et al., 2009). This research project will contribute to new knowledge in evaluating linkages between patient safety climate and indicators of the quality of patient care. Chapter III describes the research design, sample, data collection methods, and data analysis for further study into the evaluation of the relationship between patient safety climate, patient outcomes, unit staffing and hospital performance measures.

CHAPTER THREE

RESEARCH METHODS

Chapter III describes the comprehensive plan used to conduct the secondary data analysis to evaluate the relationship between patient safety climate, patient outcomes, staffing, and hospital performance measures. The research methodology is presented in detail, starting with the research question, aims and hypotheses. The research design, description of the sample and Institutional Review Board approval, data collection procedures, variable description and plan for analysis and interpretation are included.

Research Question, Aims, and Hypotheses

The overall research question is: What is the relationship between the patient safety climate, patient outcomes, staffing, and hospital performance measures? The four aims of the study were to:

1. Describe the patient safety climate at the unit and hospital level.

2. Describe the relationship between patient safety climate at the unit level, and the selected patient outcomes of falls and hospital acquired pressure ulcers (HAPU).

3. Describe the relationship between the patient safety climate at the unit level and registered nurse hours per patient day (RNHPPD), total nursing care hours per patient day (TotNHPPD), and percent of nursing hours supplied by registered nurses (%RNH).

4. Describe the relationship between the hospital level patient safety and hospital performance measures.

The hypotheses underlying these aims are as follows:

Hypothesis for Aim 1: No hypothesis because the aim is descriptive..

Hypothesis for Aim 2: Patient safety climate is inversely associated with falls and HAPU.

Hypothesis for Aim 3: Patient safety climate is positively associated with the unit staffing variables (RNHPPD, TotNHPPD, %RNH).

Hypothesis for Aim 4: Patient safety climate is inversely associated with hospital performance measures.

Research Design

This study uses a cross sectional, descriptive, correlational, model testing design using secondary data collected by 10 hospitals in a health care system. Cross-sectional designs are used to describe relationships between phenomena at a single point in time (Polit & Hungler, 1995). Correlational studies are used to determine if relationships exist between variables, and are used in hypothesis testing. Correlational studies calculate the strength of a relationship between variables, but do not infer causation from that correlation (Munro, 2005).

Sample

Human Subjects Assurance

The Committee on Human Research of the University of California, San Francisco (UCSF) approved this study under the category of Revised Exempt research, Category 4, Approval No. 08033637, which governs studies using existing data where the subjects cannot be identified either directly or indirectly (Appendix A). Subject anonymity was insured in this study because all hospital and unit data were coded and aggregated. Because no staff or patient data were used written informed consent was not required. All data were secured using password protection throughout the study. After reviewing the study, the health system’s legal department sent this researcher a letter that authorized the use of data from the Safety Attitudes Questionnaire (SAQ), the National Database of Nursing Quality Indicators (NDNQI), the California Nursing Outcomes

Coalition (CalNOC), and the Centers for Medicare and Medicaid Hospital Quality Alliance (HQA).

Nature and Size of the Sample

The data were originally collected by the quality management, nursing, and human resource departments in a convenience sample of 10 hospitals of a Catholic health care system located in California and Texas. One large, urban hospital with over 1400 licensed beds offers general medical and surgical services and specialty services including cardiac surgery, neurosurgery, obstetrics, pediatrics, oncology, orthopedics and trauma care. Four hospitals, licensed for 300-400 beds, offer general medical and surgical services in addition to cardiac surgery, obstetrics, oncology, orthopedic, pediatrics, and emergency care. Five hospitals range from 35 to 189 beds, and offer general medical and surgical services plus obstetrics, oncology, orthopedic, and inpatient rehabilitation services.

The inpatient unit sample is 59 units, composed of adult medical, surgical, combined medical and surgical, step-down, and intensive care units (ICU) from the 10 hospitals in the health system. The licensed bed count per unit ranges from 10 to 38 beds. Medical, surgical and combined medical-surgical units care for patients with a wide range of needs: cardiology and cardiac surgery, general surgery, general medicine, orthopedic surgery and respiratory care.

The staff members who responded to the SAQ worked anywhere in the 10 hospitals (n=6631). They identified their professional position as staff administrative, environmental services, nurse manager/charge nurse, nurses’ aide, nutritionist /dietician, pharmacist, physician, RN, social worker, technician, therapist (occupational therapist, respiratory therapist, and speech therapist), or other. They also identified their primary work site and tenure in that unit. All full time or part time staff who had worked in a unit for at least one month, and influenced, or were influenced by, the working environment were eligible to complete the survey. If assigned to more than one unit, a staff member could complete the survey for the unit in which he or she had made a significant work commitment (Sexton, Helmreich et al., 2006). No identity-specific information was obtained from the survey respondents.

The unit level patient sample included all adult medical or surgical patients on the 59 units. All reported falls on the units, with or without injury, were counted. For the HAPU measure, the unit level sample included all adult patients on medical, surgical, combined medical/surgical, step down, or critical care units who were present when the quarterly pressure ulcer prevalence survey was done. An adult is defined as a person aged 16 years or older. The data did not include specific patient information as all data were in aggregate form.

The sample for the hospital level performance measures included all patients aged 65 years old and Medicare beneficiaries who met the criteria of the ICD-9 diagnostic codes for acute myocardial infarction (AMI), heart failure, or community acquired pneumonia (CAP). These diagnostic categories were collected as part of the Centers for Medicare and Medicaid (CMS) Hospital Quality Alliance (HQA) .The CMS and others developed these measures with the understanding that adherence to evidence-based clinical practice guidelines will improve the quality and safety of patient care (Williams et al., 2005). These measures are described in detail in this chapter's Measurement section of this chapter, under the heading *Hospital Level Performance Measures*. Medical records coders identified the patients after hospital discharge by using a medical records abstraction tool supplied by the CMS. No patient-specific identifying information was obtained.

Criteria for Sample Selection

The hospitals described above were selected for this study because they offered several data sets that could be used to evaluate the relationships between the patient safety climate, patient outcomes, unit staffing, and hospital level performance measures. All of the hospitals had participated in the SAQ at the unit level. In addition, each hospital had established data collection procedures for the unit level patient outcome and staffing variables, and the hospital level performance measure variables.

Data Collection Methods

Measurement

Safety Attitudes Questionnaire (SAQ)

In 2006, the SAQ was administered to staff members in the 10 hospitals to obtain a baseline measure of the patient safety climate in the health system (Appendix B). The University of Texas Center of Excellence for Patient Safety Research and Practice developed the SAQ to assess the patient safety attitudes of frontline patient care providers in hospital units (Sexton, Helmreich et al., 2006). The developers of the SAQ define the patient safety climate as a snapshot of the safety culture at the unit or group level where safety culture is the “product of individual and group values, attitudes, perceptions, competencies, and patterns of behavior that determine the commitment to, and the style and proficiency of, an organization’s health and safety management” (Sexton, Helmreich et al., 2006, p. 45). Table 4 lists the six subscales of the SAQ and the items associated with each subscale (Sexton, Thomas, Helmreich et al., 2003).

Table 4

Safety Attitudes Questionnaire (SAQ) Subscales and Items

Subscale/Items
Teamwork Climate
-It is easy for personnel in this (unit) to ask questions when there is something that they do not understand. -I have the support I need form other personnel to care for patients. -Nurse input is well received in this (unit). -In this (unit) it is difficult to speak up if I perceive a problem with patient care. (R) -Disagreements in this (unit) are resolved appropriately (i.e., not *who* is right, but *what* is best for the patient). -The physician and nurses here work together as a well-coordinated team.
Safety Climate
-The culture in this (unit) makes it easy to learn from the errors of others. -Medical errors are handled appropriately in this (unit). -I know the proper channels to direct questions regarding patient safety in this (unit). -I am encouraged by my colleagues to report any patient safety concerns I may have. -I receive appropriate feedback about my performance. -I would feel safe being treated here as a patient. -In this (unit), it is difficult to discuss errors(R)
Job satisfaction
-This hospital is a good place to work. -I am proud to work at this hospital. -Working in this hospital is like being part of a large family. -Morale in this (unit) is high. -I like my job.
Stress recognition
-When my workload becomes excessive, my performance is impaired. -I am more likely to make errors in tense or hostile situations. -Fatigue impairs my performance during emergency situations (e.g., emergency resuscitation, seizure). -I am less effective at work when fatigued.
Perceptions of Management
-Hospital management does not knowingly compromise the safety of patients. -Hospital administration supports my daily efforts. -I am provided with adequate, timely information about events in the hospital that might affect my work. -The levels of staffing in this clinical area are sufficient to handle the number of patients.
Working conditions
-All the necessary information for diagnostic and therapeutic decisions is routinely available to me. -This hospital constructively deals with problem physicians and employees. -Trainees in my discipline are adequately supervised. -This hospital does a good job of training new personnel

Note. R= reverse coded

The SAQ's validity and reliability have been tested at the unit level in over 250 hospitals in New Zealand, the United Kingdom, and in the United States (Sexton, Helmreich et al., 2006). Content validity was developed by using items from a reliable and valid tool used in safety attitude surveys for aviation team research, by a literature review of health care safety, by interviews, and with focus groups of health care providers. Construct validity was established by using both exploratory factor analysis and confirmatory factor analysis, which supported the six factor structure of the survey. Over 10,800 surveys were returned during pilot testing from 2000 to 2003 (Sexton, Helmreich et al., 2006). Since that time the survey has been administered in both inpatient and outpatient settings, and additional psychometric testing has been done. The SAQ's validity and reliability has been described as comprehensive and sound, and it is one of two instruments used to evaluate the associations between the patient safety climate and process measures related to patient outcomes (Colla et al., 2005).

Research studies have found that the SAQ is sensitive to detecting differences across work units and hospitals, and between provider types (Bognar et al., 2008; Grant et al., 2006; Huang et al., 2007; Sexton, Makary et al., 2006) including RN and physician responses. Physicians had higher percent positive responses than nurses to the Working Conditions, Job Satisfaction, and Perception of Management subscales in a study of three ICU (Huang et al., 2007). Research has also revealed conflicting findings. In a children's hospital, researchers found that the Job Satisfaction factor scores rated high for all staff, but Perception of Management and Stress Recognition scores rated low for all staff (Grant et al., 2006). Results for the Safety Climate factor showed that RN scored higher than physicians in the study by Grant et al. but showed no significant differences between disciplines in research studies in surgical settings (Bognar et al., 2008; Makary et al., 2006). Research found that communication and collaboration between physicians correlated significantly with risk-adjusted morbidity in surgical patients. The morbidity rate, however, was not associated with other patient safety climate subscales (Davenport et al., 2007).

Reliability testing was done specific to the overall sample (n = 6697) for this study using Cronbach's alpha coefficient (see discussion in Chapter Four). Good reliability estimates for group comparisons range from .50 to .80. Researchers recommend that the alpha coefficient be at least .70 for instruments in beginning stages of development, and at least .80 for developed instruments (Ferketich, 1990; Switzer et al., 1999). The SAQ subscale reliability for this study ranged from .65 to .85. These values were within the same range of reliability scores found in the SAQ psychometrics study (Sexton, Helmreich et al., 2006).

Hospital Characteristic Data

Hospital characteristics are data that describe the individual hospitals by their size (number of licensed beds) and the Medicare Case Mix Index (CMI). Assigned to hospitals by the CMS, the CMI is a measure that indicates the relative severity of illness and intensity of services in a patient population. The CMI is a weight assigned to each diagnostic related group (DRG) that identifies patient diagnoses, procedures, complications, and other information when a patient is discharged from a hospital (American Hospital Directory, 2008). The CMI is the average DRG weight for a hospital's total Medicare volume. A higher CMI indicates a more complex patient mix.

Patient Outcome Data

For this study, the quality outcome indicators for patient care are based on recommendations of the National Quality Forum (NQF), the American Nurses

Association (ANA), the California Nursing Outcomes Coalition (CalNOC), and the National Database of Nursing Quality Indicators (NDNQI). In the 1990s, the ANA conducted studies of patient outcomes considered to be sensitive to nursing care to evaluate the effect of such care on safe, quality patient care (Montalvo, 2007). The ANA team developed an initial set of 10 nurse-sensitive indicators of quality nursing care: (a) the mix of RNs, licensed vocational nurses (LVN)/licensed practical nurses (LPN), and unlicensed staff caring for patients in acute care settings; (b) the total nursing care hours per patient day; (c) pressure ulcers, (d) patient falls; (e) patient satisfaction with pain management; (f) patient satisfaction with educational information; (g) patient satisfaction with overall care; (h) patient satisfaction with nursing care; (i) the nosocomial infection rate, and (j) nursing staff satisfaction. The ANA contracted with the University of Kansas to develop the National Database of Nursing Quality Indicators (NDNQI) organization to support, monitor, and disseminate data for continuing research into nursing sensitive outcomes (Montalvo, 2007).

The National Quality Forum (NQF), a voluntary organization of health care stakeholders from public and private organizations, endorsed 15 voluntary consensus standards for evaluating the quality of nursing care. Some of these patient-centered outcome measures are similar to the NDNQI standards, including falls prevalence and pressure ulcer prevalence (National Quality Forum, 2008).

The data on falls and hospital acquired pressure ulcers for the California hospitals in this study include data that has also been submitted to the CalNOC. Organized in response to an ANA request that state nursing associations develop strategies to conduct health services research at the state level (Aydin et al., 2004), the CalNOC is a voluntary, statewide databank of nursing outcome measures using standardized tools and analysis methods (Brown et al., 2001). Each California hospital in the study has been participating in the CalNOC project on an ongoing basis. Data integrity is managed by each hospital and ongoing orientation is available for the CalNOC site coordinators. The CalNOC team continuously maintains the integrity of the database by cleaning data, checking for completeness, and contacting sites by telephone for clarification. Site coordinators have the opportunity to make retroactive corrections to data submissions in any quarter (Aydin et al., 2004).

The Texas hospital data for falls and HAPU are the data sent to the National Database of Nursing Quality Indicators (NDNQI). Data submission to the NDNQI is an established process at the hospital; the site coordinator is responsible for data integrity. The NDNQI also offers ongoing instruction in submitting data, updates on changes to the program, and periodic teleconferencing. All data sent to both the CalNOC and the NDNQI databases are also sent to the health system's quality department for monitoring and benchmarking for nursing services in the health system.

Falls are measured in both the NDNQI and CalNOC databases as a ratio of the number of falls divided by 1000 patient days (Donaldson, Bolton et al., 2005; Dunton, 2004). Falls data are collected by each hospital and rely on voluntary reporting by nurses or other staff. Although research has shown that voluntary incident reporting can be extremely unreliable (Dunton, 2004; Elnitsky et al., 1997), one study found that nurses regarded falls as the most important patient incident to report (Evans et al., 2006).

The CalNOC and NDNQI define HAPU as any skin lesion caused by unrelieved pressure resulting in damage of underlying tissue. The definition is taken from clinical practice guides disseminated by the National Pressure Ulcer Advisory Panel (NPUAP) and the Agency for Health Care Policy and Research (now the Agency for Healthcare

Research and Quality, or AHRQ). These guidelines were developed collaboratively to establish a common terminology for providers and policy makers (Cuddigan, Berlowitz, & Ayello, 2001). HAPU are defined as ulcers that do not meet the following criteria: (a) Staff documented the ulcer on hospital day 1; (b) A prevalence study was conducted on hospital day 1; (c) A prevalence study occurred on hospital day 1 and the patient was found to have a Stage 2 ulcer or greater; and (d) Staff documented a Stage 2 ulcer or greater on hospital day 2 (Donaldson, Brown, Aydin, Bolton, & Rutledge, 2005). The HAPU rate formula is the number of patients identified on the day of the pressure ulcer prevalence study with HAPU divided by the total number of patients examined during the prevalence study. Table 5 presents the definitions and measurement for the CalNOC and NDNQI unit level variables.

Nurse staffing data

The hospital's unit staffing data are gathered as part of the CalNOC and NDNQI data collection and submission processes for the hospitals. The productive hours of care are counted for those nurses with at least 50% direct patient care hours, and included in the staffing matrix for an individual unit. Productive hours of care do not include sick time, vacation, education leave, or committee time. The unit staffing data and definitions are also shown in Table 5.

Table 5

CalNOC and NDNQI Unit Level Patient Outcomes and Staffing Variables Definition and Measurement

Definition	Measurement
Patient fall Unplanned descent to the floor.	Number of falls in unit/1000 patient days Derived from incident reports
Hospital acquired pressure ulcers Any lesion caused by unrelieved pressure resulting in damage of underlying tissue NPUAP-AHCPR Ulcer stage I-IV	Number of patients with HAPU/number of patients surveyed Derived from quarterly pressure ulcer prevalence studies
Registered Nurse (RN) hours per patient day	Total number of productive hours worked by all registered nurses with direct patient care responsibilities
Nursing care hours per patient day	Nursing Care Hours are the productive hours worked by the nursing staff that are on the facility's payroll who have direct patient care responsibilities/assignments on the defined unit and are included in the staffing matrix
Non-RN/LVN staff hours per patient day	Total number of productive hours worked by other staff (i.e., aides and other direct care providers included in the staffing matrix excluding unit clerks, monitor techs, and others with no direct patient care responsibilities.).

Note. CalNOC = California Nursing Outcomes Coalition; NDNQI = National Database of Nursing Quality Indicators; HAPU = hospital acquired pressure ulcers; NPUAP-AHCPR = National Pressure Ulcer Advisory Panel (NPUAP) - Agency for Health Care Policy and Research

Hospital Level Performance Measures

Three hospital level performance measures, part of the Centers for Medicare and Medicaid (CMS) Hospital Quality Alliance (HQA) will be examined for this study (United States Department of Health and Human Services, 2008). Hospital level performance measures were instituted in the early 2000s to track the quality of care for specified conditions (Jencks, Huff, & Cuerdon, 2003; Nolan & Berwick, 2006; Williams et al., 2005). The measures are composed of indicators for determining the quality of patient care, based on scientific evidence from the literature and evidence based clinical practice guidelines (Williams et al., 2005). Measures are added or removed depending on opportunities for continuing improvement in the practice (Jencks et al., 2003). During the time frame for this study, all hospitals were following three of the four performance measures, and had not implemented the fourth measure (surgical infection prevention) in all sites. The measures evaluated here are acute myocardial infarction (AMI), heart failure, and community acquired pneumonia (CAP).

Jencks et al. (2003) discussed the disparity between the care patients receive in hospitals and the quality of the care they should receive. The goal of developing hospital wide performance, or process, measures was to track improvements in the quality of patient care by comparing care on a national level and providing quarterly feedback reports to hospitals on their own performance (Williams et al., 2005). The process measures are accomplished by nursing units and ancillary departments (e.g., imaging, laboratory, and pharmacy) working together and reveal how the health care team can improve patient care from admission to discharge. Hospitals can use the outcomes of these measures to identify how systems of care have provided patients with all the elements of care required by evidence based guidelines (Nolan & Berwick, 2006).

The HQA measures indicate whether recommended tests, treatments, and discharge instructions were done for each eligible patient. Audits result in all-or-none scores; in other words, any missing element indicates that the treatment did not follow evidence based recommendations. While some debate the merit of all-or-none measures as the best metric of care using evidence-based guidelines, others advocate using item-by-item measurement (reporting each element of care separately), or composite measures (evaluating intended treatments and assigning a composite score) as better indicators of appropriate treatment (Nolan & Berwick, 2006).

An advantage to all-or-none measurement is that it reflects a systems approach to patient care, acknowledging that hospitals must improve communication and processes to facilitate appropriate, timely care (Nolan & Berwick, 2006). For example, in the AMI measure, an emergency department must complete all of the elements specific to care while in the department before the patient is transferred to an inpatient setting. Although hospitals may score high on compliance with individual measures of care (e.g., a patient with pneumonia has blood cultures sent from the emergency department before transfer), other elements may not be in compliance, and therefore the patient did not receive all intended treatments (Nolan and Berwick, 2006). The all-or-none measures are criticized, however, for disallowing flexibility in timed assessments, pointing out that a difference of a week or a month for an outpatient examination of a patient's diabetic foot does not indicate a failed measure (Chelmowski, 2006). Hospital level all-or-none measures have the advantage of a defined time limit for treatment (e.g., within the patient's hospital admission), and therefore the data can be captured at discharge. The all-or-none measures are reported in ratios as the number of patients meeting all elements of the HQA process of care elements, divided by the total number of patients meeting eligibility criteria (Medicare recipients over 65 years old). The HQA definitions and measures are described in Table 6.

Table 6

Hospital Quality Alliance (HQA) Indicator Definitions and Measures

Diagnosis	Process of Care Measure
Acute Myocardial Infarction (AMI)	-Aspirin at arrival to hospital -Aspirin at discharge -ACE (angiotensin converting enzyme) inhibitor or ARB (angiotensin receptor blocker) inhibitor for left ventricular systolic dysfunction -Beta blocker at arrival to hospital -Beta blocker at discharge -Fibrinolytic medication within 30 min of arrival -Percutaneous coronary intervention (PCI) within 90 min of hospital arrival -Smoking cessation advice/counseling
Heart Failure	-Evaluation of left ventricular systolic function -ACE inhibitor or ARB for left ventricular systolic dysfunction -Discharge instructions (diet/ exercise) - Smoking cessation advice/counseling
Community Acquired Pneumonia	-Oxygenation assessment -Initial antibiotic timing -Pneumococcal vaccination -Influenza vaccination -Blood culture performed in the emergency department prior to initial antibiotic received in hospital -Appropriate initial antibiotic selection -Smoking cessation advice/counseling

Note. HQA = Hospital Quality Alliance; ACE = angiotensin converting enzyme; ARB angiotensin receptor blocker; AMI = acute myocardial infarction

Hospital size ranged from 35 to over 1400 beds. The hospitals provided similar services, with the larger hospitals offering more complex services such as cardiac surgery, and neonatal intensive care. All hospitals provided surgical, medical, emergency, and obstetrical care. The Case Mix Index (CMI), designated for hospitals by the Centers for Medicare and Medicaid (CMS) indicates the relative severity of illness and intensity of services in a patient population. The CMI is a weight assigned to each DRG that identifies patient diagnoses, procedures, complications, and other information when a patient is discharged from the hospital (American Hospital Directory, 2008). The CMI is the average DRG weight for all of a hospital's Medicare volume. A higher CMI indicates a more complex patient mix and serves in this study as an indicator of patient acuity. The CMI values for the 10 hospitals ranged from 1.21 to 1.71.

Procedure

Data Collection Procedures

The study hospitals collected the SAQ data in 2006. At the direction of the health system's quality department, the SAQ was chosen to provide a baseline measure of the patient safety climate on all units in each hospital. The patient safety manager or a member of the quality improvement department coordinated the process at each site. The survey coordinator distributed surveys to the unit's nurse manager. The nurse manager and/or the survey coordinator then distributed the surveys to those staff members who met the criteria of having worked on the unit for at least a month, and who influenced, or were influenced by, the unit. The physicians who met the criteria received the survey and were requested to return it to the survey coordinator. All surveys were mailed to the SAQ contact in the Quality and Safety Research Group at Johns Hopkins University School of Medicine. The surveys were scored and final reports were sent to the health system's quality department for distribution to the individual hospitals.

Acquisition of Study Data

J. Bryon Sexton, PhD, one of the developers of the SAQ, provided the SAQ data for the study. He worked closely with the health system to coordinate distribution, return, and scoring of the surveys. The Statistical Package for the Social Sciences (SPSS) was used to create a file of the respondent's data. After a personal orientation to the data by Dr. Sexton, this researcher received the file in electronic form.

The CalNOC and NDNQI data were also collected during 2006. Data collection is an established process at the study sites and is a collaborative effort of the human resources departments (for unit staffing data) and the risk management and quality management departments (for falls and HAPU). Each hospital's CalNOC or NDNQI site coordinator monitors the integrity of the data submitted quarterly using a web portal specific to each database. Codebooks for both databases specifically describe the criteria for sampling for each variable, and emails also alert the Site Coordinators to any changes to the sampling procedure or indicator change. The health system's quality department emailed the CalNOC and NDNQI data to this researcher. The CalNOC data was contained in a single Excel spreadsheet. The NDNQI data was in report form, as received by the hospital from the NDNQI office.

The hospitals' medical records departments collected hospital wide clinical outcome measures according to the HQA process. This process uses the CMS Abstraction & Reporting Tool (CART) for medical record data abstraction. The CART includes all of the data elements for each of the outcomes identified by ICD 9 codes for AMI (eight elements), heart failure (four elements), and CAP (seven elements). A detailed technical manual is available to the abstractors that explains the standard abstraction protocols and transmission requirements. The completed tool is then sent to a CMS certified vendor who cleans the data and sends it to CMS on behalf of the health system. This researcher obtained the HQA data for this study by email from the health system's quality department. The data were contained in multiple Excel spreadsheets.

Data Screening, Cleaning, and Creating Files

The data were obtained in several data sets. Each data set was examined using a three-step process of repeated cycles of screening, diagnosing, and editing (Van den

Broeck, Cunningham, Eeckels, & Herbst, 2005). This process is described in Table 7. Frequency distributions were used to identify missing data. Visual inspection of the data with histograms and boxplots were used to assess the shape of the distributions for the SAQ, falls, HAPU, and staffing data. Boxplots were also used to asses for outlier data for all of the study variables. Repeated cycles of screening, diagnosing, and editing were used as separate data sets were created for unit and hospital level variables.

Table 7

Data Screening, Diagnosing, and Editing Process

Screening	Diagnosing	Editing
Lack or excess of data	Errors and missing data	Correction
Outliers and inconsistencies	True extreme	Deletion
Unusual or strange patterns	True normal	Leave unchanged
Suspect analysis results	No diagnosis, still suspect	

Initially, the SAQ data from the California and Texas hospitals were kept in separate data sets. Before they were merged together, the data sets were manipulated in several ways. An individual identification number was assigned to each respondent to facilitate the merger process. Two SAQ items, originally negatively worded, were reverse coded to align scoring with the other items. The staff position (discipline) variable was standardized in the two data sets. A coding scheme was developed to assign an identifying number for each hospital, patient care unit, and ancillary department. After these corrections were made, the two datasets were merged into one SPSS file.

The California hospitals completed all seven of the SAQ subscales. The Texas hospital completed four of the subscales (Teamwork Climate, Safety Climate, Perception of Hospital Management, and Perception of Unit Management). Missing data were infrequent. Less than 3% of responses were missing from the subscales completed for all hospitals.

A unit level data set was then created in a separate SPSS file. The unit level mean for each SAQ subscale was calculated by summing the individual subscale scores and dividing that value by the number of unit respondents. The NDNQI and CalNOC unit level patient outcome data (falls and HAPU) and unit level staffing data (RNHPPD, TotRNHPPD, and %RNH) were taken from the other data sets and matched to the unit in the SPSS file. Units reported zero falls to the health system if none had occurred. All hospitals reported the HAPU rate from the prevalence study closest to administration of the SAQ.

A separate SPSS file was created for the hospital level variables. The combined hospital mean for each SAQ subscale was calculated and entered into the file. The number of licensed beds per hospital, and the hospital's CMI score were matched to the corresponding hospital. The performance measures data (AMI, heart failure, and CAP) were matched to the correct hospital, and entered into the SPSS file as failure rates. The health system's quality department decided that this was the best method to express the concept of zero failure; that is, the goal is to achieve a failure rate of zero in providing all of the elements of care to patients with these diagnoses. For example, if a calculation showed a 70% rate for delivering all elements of AMI care to an eligible population of patients with acute myocardial infarction, the result was reported as a 30% failure rate to deliver the highest quality of care. Eight of the hospitals reported AMI failure rates, all 10 hospitals reported heart failure rates, and nine hospitals reported CAP failure rates.

Data Analyses

The data were evaluated in a step by step fashion. First, descriptive statistics were run for each variable. Frequencies were run to examine the sample demographic characteristics (gender and tenure on unit and in facility) and the frequency of responses to the SAQ. Descriptive statistics were run to describe the mean, standard deviation (*SD*), and minimum and maximum ranges for the SAQ subscale scores at the unit and hospital level, the unit level falls, HAPU, three staffing variables, and the hospital level variables. Then, histograms were run to visually observe the distribution pattern for each variable. Count data and percentages were then used to describe the frequency of responses by staff position (RN, nurse manager, physician and others).

The average of three months' falls data (number of falls per 1,000 patient days) was calculated to obtain a quarterly fall rate for each unit and entered into the unit-based SPSS file. The HAPU data ratio was calculated by dividing the number of patients with HAPU divided by the total number of patients assessed during the pressure ulcer prevalence study closest to the timeframe the SAQ was implemented. Both the falls and HAPU data had zero values that were evaluated for outlier status by reviewing boxplots and by computing outlier status by the formula Standard Deviation (*SD)* multiplied by 3, divided by the mean. Two ICU were outliers for the HAPU data. The data were therefore entered as missing into the dataset in order to retain the units for further analysis of the falls and staffing variables.

The nursing hours per patient day for each unit level staffing variable (RNHPPD, TotNHPPD and %RNH) were calculated separately by dividing the monthly hours by the monthly number of patient days for each unit. Calculations were done for each unit for three months. Then a final calculation was done averaging three months together to create a three month average for each unit. This value was matched to each unit in the unit level SPSS file. The staffing variables were described using descriptive statistics (mean, *SD*, minimum and maximum values). The inpatient units were separated into ICU and non-ICU categories due to the higher average hours of registered nurse HPPD in the ICU, and the observation that the staffing for non-ICU was essentially identical in these units. The non-ICU category consisted of the medical, surgical, combined medical-surgical, and step down units. The analysis of variance (ANOVA) test was used to determine significant differences in the SAQ subscale scores between units. Bonferroni correction post hoc analysis was used to identify which groups were significantly different from one another.

Hierarchical Data Analysis

Overview

Organizational research studies the relationships between individuals and the groups or organizations in which they work. Individuals interact with and are influenced by one another, and therefore the groups to which they belong are influenced by the individuals making up the group (Maas & Hox, 2005; Snijders & Bosker, 1999). This general concept of individuals and the social groups to which they belong is called a hierarchical system. Observations made in this type of system are analyzed at the group level (Level 1), taking dependency within groups into account at the cluster variable level, or Level 2. In addition, characteristics of groups can be examined to estimate Level 2 effects on group responses from Level 1. There are two levels in the dataset for this study, nursing units at Level 1 and hospitals at Level 2. Nursing units are considered to be Level 1 because they are clustered within hospitals. Hospitals are considered to be at Level 2 (Maas & Hox, 2004; Park & Lake, 2005; Wu, 1995).

The hierarchical linear model is a type of regression model, and the purpose is to select the type of model that best expresses how the dependent variable depends on, or is explained by, the predictor variables (Snijders & Bosker, 1999). If conventional regression models are used to analyze hierarchical data, the assumption of independence is violated, and the estimated standard errors are smaller than actual standard errors. This underestimation of standard error increases the chance of a Type I error, where the researcher has a higher chance of concluding that the results are significant when they may not be (Park & Lake, 2005).

In a sample identified for hierarchical linear model analysis, i.e., having groups (nursing units) clustered at a higher level (hospitals), four properties may affect the parameter (statistical) estimates and the corresponding standard errors: (a) number of groups at Level 2 (in this study, hospitals), (b) number of Level 1 units (ICU and non-ICU), (c) the intraclass correlation (ICC) which refers to the correlation among observations within the cluster (hospitals), and (d) parameter estimation method (Maas & Hox, 2005; Park & Lake, 2005). These factors are discussed along with the methods associated with hierarchical analysis in the following section.

Types of Multilevel Models

For comparison, a conventional linear regression presumes that all observations are independent: $y = \alpha + \beta_0 + \varepsilon$ where y is the independent variable, α is the intercept, β_0 is the effect of the covariate, and ε represents the error term for observations that are not related to one another (Park & Lake, 2005). If the values of y are correlated due to the clustering of observations at Level 2, the error terms among the observations also become correlated as the term represents measurement error or some omitted factors in the model (Park & Lake, 2005). Therefore, a multilevel or hierarchical model is appropriate to use as it will take into consideration the correlated nature of the group observations to estimate the standard errors.

Two commonly used hierarchical models are the random intercepts model and the random coefficients model. The models differ by how variation in intercepts and slopes at

Level 1 are addressed at Level 2 (Park & Lake, 2005). In the random intercepts model the intercept is treated as a random component of the model, while in the random coefficients model both the intercept and the slopes for the predictors are treated as random variables. Choosing the best model should be based on parsimony in the model (Park and Lake, 2005), as well as sample size; with small samples, restricted maximum likelihood will provide unbiased estimates of the random effects and is preferred when the assumption of normality is valid (Maas & Snijders, 2003).

In the random intercepts model, the intercept α varies across Level 2 groups (hospitals) while the slope is held constant. The formula is expressed as: $yij = (\alpha + \beta xij) + (\mu j + eij)$ where y is the dependent variable for observation i in cluster j, α is the intercept, βxij is the effects of the covariate xij, μj is the Level 2 random effect (residual) and eij is the Level 1 random effect, or residual. The model can be considered to have two parts, fixed effects and random effects (Maas & Snijders, 2003; Park & Lake, 2005). The fixed effects section $(\alpha + \beta xij)$ does not change regardless of the number of observations and clusters, and the random effects section, $(\mu j + eij)$ can change depending on the number of observations and clusters.

The random coefficients model allows the slope and intercept to vary across the clusters (hospitals). The formula is expressed as: $yij = (\alpha + bxij) + (ujxij + \mu j + eij)$ where y is the dependent variable for observation i in cluster j, α is the intercept, *b* is the effect of the covariate xij, and uj is the amount by which the coefficient of cluster (hospital) j deviates from cluster *b.* The formula ends with $\mu jxij$ and uj representing the Level 2 random effect and eij the Level 1 random effect.

Intraclass correlation

The intraclass correlation refers to correlation among observations within a cluster (Park & Lake, 2005).The intraclass correlation coefficient (ICC) for an intercept only model estimates the proportion of variance due to differences between the Level 2 groups when the model has no covariates. The intercept only model does not account for any variance in the dependent variable. In this study, the ICC represents the proportion of variance in the dependent variable that is due to differences between hospitals. This research study is primarily concerned with Level 1 (unit level) analyses.

Parameter estimation model and sample size

In multilevel research, studies are concerned with the sample size at Level 2 because the Level 2 size is always smaller than the total sample size at Level 1. In many studies, including this research project, there is a limited set of groups or organizations (hospitals) available for analysis (Maas & Hox, 2005). Stating that there is no strong evidence to guide researchers in designing multilevel studies Maas and Hox (2005) used Monte Carlo simulation to evaluate the accuracy of parameter estimations and the corresponding standard errors using different sample sizes. The authors found that a group sample size of 30 is needed to assume non-bias in parameter estimates although there is a negligible bias in standard errors. A group size of 10 was sufficient to estimate fixed effects. The authors conclude by recommending that when using fixed effects in the model, a group (Level 2) size of 10 can lead to good estimates; 30 groups are needed when addressing contextual effects (which focus on individual behaviors), and 50 groups are needed when estimating standard errors (Maas & Hox, 2005).

The most common parameter estimation methods used are the maximum likelihood (ML) techniques, (also called full maximum likelihood, or FML) and restricted maximum likelihood (RML). The RML technique is best in small sample parameter estimation (Maas & Hox, 2005). Based on the restrictions of a finite secondary data set, small sample size, and best model fit, the hierarchical linear model used in this study for Aims 2 and 3 was the random intercepts model with fixed effects, using the restricted maximum likelihood (RML) parameter estimation method.

Data Analysis for Aim 1

Aim 1: Describe the patient safety climate at the nursing unit level and hospital level. Aim 1 is descriptive in nature, and therefore no hypothesis was formed.

The analysis for this aim started with identifying units and departments appropriate to this study. Outpatient surgical services, obstetrical units and pediatric units were not used because the focus was on inpatient adult medical and surgical units, emergency departments, cardiac catheterization laboratories, and selected ancillary departments that work closely with the study units. Inpatient units included ICU and combined medical/surgical units from each hospital. The ancillary services departments were pharmacy, imaging, and laboratory.

Descriptive statistics, including the mean, standard deviation (*SD*), minimum and maximum, for the SAQ scores were run for these types of units. Histograms were examined to assess the distribution of each of the subscales. To determine the significant differences in the SAQ subscale score means between unit types, the analysis of variance (ANOVA) test was run. The Bonferroni multiple corrections procedure was used when significant differences were found. The Bonferroni procedure divides the alpha level (.05) among the comparisons to keep the alpha consistent for each comparison. With large numbers of comparisons, the Bonferroni technique reduces the incidence of false significance, or Type I error (Pallant, 2007).

Data Analysis for Aim 2

Aim 2: Describe the relationship between the patient safety climate at the unit level and falls and hospital-acquired pressure ulcers. In this aim the dependent variable is the patient outcome measures (falls and HAPU) and the independent variables are the SAQ subscales, evaluating if the subscales are predictors of the outcomes. The hypothesis for Aim 2 is that patient safety climate is inversely associated with falls and hospital-acquired pressure ulcers.

Frequency distributions and histograms were created to assess the distribution of falls and HAPU and identify outliers. Both ICU and non-ICU reported zero falls and HAPU, producing positively skewed patterns. The analysis of this aim used hierarchical linear modeling (HLM) methods in the STATA software program to allow for the interdependence of groups (units) within the clusters (hospitals). The model building pattern incorporated adding the independent variable alone with the dependent variable in the model, then adding unit type, followed by a third step, adding an interaction term. An alpha level of .05 was used for all statistical tests.

Data Analysis for Aim 3

Aim 3: Describe the relationship between the patient safety climate at the unit level and registered nurse hours per patient day (RNHPPD), total nursing care hours per patient day (TotNHPPD), and percent of nursing hours supplied by registered nurses (%RNH). In this aim, the SAQ subscales are the dependent variable, and the unit staffing variables are the independent variables. The hypothesis for Aim 3 is that the patient safety climate is positively associated with RNHPPD, TotNHPPD, and %RNH.

Frequency distributions, boxplots, and histograms were created to assess the shape and distribution of the variables. The data for RNHPPD, TotNHPPD and %RNH showed a normal distribution. The analysis of this aim also used hierarchical linear modeling (HLM) techniques. The general pattern for modeling building was to add each dependent variable (e.g., Teamwork Climate, Safety Climate, and so on) to the model, then add the unit type variable (ICU/non-ICU), then add the interaction term (independent variable plus unit type). The model building followed this basic pattern for each of the SAQ subscales and the three staffing variables, with the total number of tests run greater than 21.

Data Analysis for Aim 4

Aim 4: Describe the relationship between hospital level patient safety climate and hospital performance measures. The hypothesis for Aim 4 is that patient safety climate is inversely associated with hospital level performance measures related to three conditions: acute myocardial infarction (AMI), heart failure, and community acquired pneumonia (CAP).

The hospital level performance measures were reported as the failure rate in percent for each measure (AMI, heart failure, CAP) for each of three months. The percentages were combined and averaged to create an aggregate failure rate for each measure. Two hospitals did not report AMI failure rates, one hospital reported a zero failure rate for heart failure (suspect value), and one hospital did not report data for the CAP measure.

A Pearson product-moment correlation matrix was run to evaluate the strength and direction of the relationship between the hospital level SAQ subscale scores, AMI, heart failure, and CAP, bedsize, and CMI. The analysis of variance (ANOVA) test was run to determine the strength and direction of SAQ subscale scores between hospital means. Bonferroni correction post hoc analysis were used to identify significant differences between the hospitals' hospital level SAQ subscale scores, hospital level performance measures, bedsize, and Case Mix Index (CMI).

Interpretation of the Results

There were several important aspects in interpreting the result of the relationships between patient safety climate, patient outcomes, unit staffing, and hospital performance measures in this research project. One was to be able to describe the patient safety climate at the unit and hospital level, which was the purpose of Aim 1, and to evaluate the relationship between variables, which was the purpose of Aims 2, 3 and 4. The results were reviewed for accuracy and meaning of the findings for the study sample. This included an assessment of whether the findings were similar to studies related to climate descriptions in other hospitals. The interpretation of the findings is important to hospital leaders and clinical managers because the patient safety climate is part of a multifaceted approach to reducing the barriers to patient safety in the hospital setting. The findings contribute to patient safety science by identifying trends in the similarities and differences in patient safety climate within units and between hospitals. The findings are also important in contributing to the reliability and validity of using the SAQ to assess the patient safety climate in a hospital system.

Using hierarchical linear modeling (HLM) for analysis of Aims 2 and 3 takes into consideration the non-independence of the observations on the units, secondary to the influence staff have on each other as they work together, and the cluster effect of the units within hospitals. The hypotheses were tested by constructing multilevel models for each aim and finding the model with the best fit. However, the limitation of the small Level 2 sample size (hospitals) necessitates caution in interpretation of the results.

Chapter IV presents the results of the plan for analysis for the four aims using both HLM and descriptive statistics to describe the patient safety climate in units and hospitals, the relationship between the patient safety climate and patient outcomes, and the patient safety climate and hospital level performance measures.

CHAPTER FOUR

RESULTS

Chapter four presents the results of the data analysis. A cross-sectional, descriptive, correlational, model testing design was used to examine the relationships between the patient safety climate, patient outcomes, staffing, and hospital level performance measures. The chapter is divided into three sections: the description of the sample, the description of the study variables, and the analysis of the aims.

The study used a convenience sample of 59 units in 10 community hospitals in California and Texas. Patient outcomes, unit staffing data, and hospital level performance measure data for the study were obtained from the health system's quality management office. The data from the Safety Attitude Questionnaire (SAQ) was obtained from the administrator of the survey. The data analysis was performed using the Statistical Package for Social Sciences (SPSS for Windows, Version 15.0) and STATA Data Analysis and Statistical Software (STATACorp, Version 10SE).

The overall research question was: What is the relationship between the patient safety climate, patient outcomes, staffing, and hospital performance measures? The four aims of the study are to:

1. Describe the patient safety climate at the unit and hospital level.

2. Describe the relationship between patient safety climate at the unit level, and the selected patient outcomes of falls and hospital acquired pressure ulcers (HAPU).

3. Describe the relationship between the patient safety climate at the unit level and registered nurse hours per patient day (RNHPPD), total nursing care hours per patient day (TotNHPPD), and percent of nursing hours supplied by registered nurses (%RNH).

4. Describe the relationship between patient safety and hospital performance measures.

The hypotheses underlying these aims are:

Hypothesis for Aim 1: No hypothesis because the aim is descriptive.

Hypothesis for Aim 2: Patient safety climate is inversely associated with falls and HAPU.

Hypothesis for Aim 3: Patient safety climate is positively associated with the unit staffing variables (RNHPPD, TotNHPPD, %RNH).

Hypothesis for Aim 4: Patient safety climate is inversely associated with hospital performance measures.

Sample Description

The 10 hospitals included in the research study are not-for-profit, faith based, community hospitals located in California and Texas. The hospitals, whose bed size ranged from 35 to over 1400, are located in rural and urban settings. Each hospital has inpatient units for medical and surgical care, telemetry monitoring, obstetrics, pediatric, and emergency services. All except two rural hospitals have a cardiac catheterization laboratory and step down units for postoperative care and ongoing monitoring of cardiac and other medical conditions. Specialty services in the larger hospitals include high risk obstetric and neonatal care, comprehensive cancer care, cardiac surgery, and neurosurgery.

The SAQ was administered to all departments in each hospital over a one-month period in the third quarter of calendar year 2006. The health system returned the surveys to the SAQ administrator, who subsequently made the survey data available for this research study. The overall SAQ response rate for the 10 hospitals was 81.1% (6697 surveys returned out of 8255 surveys administered). The unit response rate for the hospitals ranged from 70% to 100%. Data were missing for approximately 3% of the responses. Respondents were predominantly female (73.7%).

Table 8 lists the frequency of unit responses to the SAQ by discipline for ICU, combined medical-surgical units, emergency departments, cardiac catheterization laboratories, and ancillary departments that work closely with nursing units (n = 3716). The data for surgical and medical units were categorized with the data for combined medical-surgical unit data because unit staffing and patient populations were essentially the same. The data for step down units were also categorized with the data for medical-surgical units because their staffing was essentially identical (RNHPPD, TotNHPPD, and %RNH) indicating that patient acuity and staffing hours and skill mix are similar to medical-surgical units. Data for operating rooms and post-anesthesia recovery units are not included because those services include both ambulatory and inpatient care.

Staff nurses comprised 42.08% of the SAQ respondents. Nurses' aides and technicians comprised the next highest group (24.91%). Nurse Managers accounted for 5.54% of the study sample. Physicians accounted for 4.44% of the respondents. Table 8 displays response data by unit and discipline.

Table 8

Frequency of SAQ Responses by Unit or Department and Discipline (n = 3716)

Unit	Staff RN	RN Manager	LVN/ LPN	MD	Pharmacist	Nurse Aide/ Technician	Other	Total Unit Responses
ICU	413	43	22	26	10	26	97	637
Combined Medical/ Surgical	846	126	93	73	8	252	252	1650
Emergency Department	226	27	1	49	0	75	86	464
Cardiac Catheterization Laboratory	51	6	0	5	0	38	12	112
Pharmacy	4	0	0	0	91	77	27	199
Imaging	21	4	0	7	0	209	117	358
Laboratory	3	0	0	5	0	249	39	296
Total (%)	1564 (42.08%)	206 (5.54%)	116 (3.12%)	165 (4.44%)	109 (2.93%)	926 (24.91%)	630 (16.95%)	3716 (100%)

Note. SAQ = Safety Attitudes Questionnaire; RN = registered nurse; LVN/LPN = licensed vocational nurse/licensed practical nurse; MD = physician; tech = technician; ICU = intensive care unit; Other = Ward Clerks/Unit Assistant, other Managers, Dieticians, Social Workers, Facilities staff.

Study Variables

Safety Attitudes Questionnaire

The SAQ’s six subscales are Teamwork Climate, Safety Climate, Job Satisfaction, Stress Recognition, Perceptions of Management, and Working Conditions. The Perceptions of Management subscale contains items on the perceptions of both unit management and hospital management. Therefore, the subscale was divided into two parts, Perceptions of Unit Management and Perceptions of Hospital Management, totaling seven subscales available for analysis in this study. The Texas hospital completed an abbreviated SAQ using only the Teamwork Climate, Safety Climate, Perceptions of Hospital Management, and Perceptions of Unit Management subscales.

Overall subscale score means, standard deviation (*SD*), minimum and maximum SAQ scores are presented in Table 9 (*n* = 3716). Mean scores ranged from 3.54 to 4.29 (1 = Strongly disagree, 2 = Slightly disagree, 3 = Neutral, 4 = Slightly agree, 5 = Strongly agree). One item in the Teamwork Climate subscale (“In this unit, it is difficult to speak up if I perceive a problem with patient care”) and one item in the Safety Climate subscale (“In this unit it is difficult to discuss errors”) were negatively worded. These items were reverse coded to maintain the same direction of Likert scale responses as the other subscale items.

Table 9

SAQ Mean, Standard Deviation (SD), Minimum and Maximum Subscale Scores (n = 3716)

	Mean	Standard Deviation (*SD*)	Minimum	Maximum
Teamwork Climate	4.16	.71	1.0	5.0
Safety Climate	4.16	.66	1.29	5.0
Perception of Hospital Management	3.54	.99	1.0	5.0
Perceptions of Unit Management	3.62	1.15	1.0	5.0
Job Satisfaction	4.29	.77	1.0	5.0
Stress Recognition	3.72	1.02	1.0	5.0
Working Conditions	3.84	.87	1.0	5.0

Note. SAQ = Safety Attitudes Questionnaire; *SD* = standard deviation.

Reliability testing was done specific to this study using Cronbach’s alpha coefficient (see Table 10). Good reliability estimates for group comparisons range from .50 to .80. Researchers recommend that the alpha coefficient be at least .70 for instruments in beginning stages of development, and at least .80 for developed instruments (Ferketich, 1990; Switzer et al., 1999). The Job Satisfaction (.851) and Stress

Recognition (.802) coefficients are greater than .80, demonstrating high reliability. The Teamwork Climate (.749), Safety Climate (.776), Perceptions of Hospital Management (.702), Perceptions of Unit Management (.654) and Working Conditions (.774) demonstrate acceptable reliability. The reliability coefficients for Stress Recognition (.802) in this sample are higher than for the SAQ pilot study which ranged from .67-.76 (Sexton, Thomas, Helmreich, et al., 2003).

Table 10

SAQ Subscales and Cronbach's Alpha Coefficient

SAQ Subscale	Current Study Cronbach's alpha	Pilot Study Cronbach's alpha
Teamwork Climate	.749	.62-.84
Safety Climate	.776	.62-.84
Perceptions of Hospital Management	.702	.63-.74
Perceptions of Unit Management	.654	.63-.74
Job Satisfaction	.851	.81-.93
Stress Recognition	.802	.67-.76
Working Conditions	.774	.67-.83

Note. SAQ = Safety Attitudes Questionnaire

Unit Level Variables

The patient outcome and staffing variable data were collected from the ICU, medical, surgical, combined medical-surgical units, and step down units of the 10 hospitals. This is the same data submitted by the California hospitals to the CalNOC and by the Texas hospital to the NDNQI. The falls, HAPU, and staffing data were collected proximate to the September, 2006 administration of the SAQ. Six hospitals reported falls data in July, August and September, 2006; three hospitals reported falls data from August, September and October, 2006; and one hospital reported falls from April, May, and June, 2006. The HAPU data were reported from prevalence studies in August, September and October, 2006. The unit staffing data for nine hospitals are from July, August and September, 2006, and for one hospital from April, May and June, 2006.

Patient Falls

Falls data from voluntary incident reports were submitted to the health system's quality management office for the ICU, medical, surgical, and combined medical-surgical units, and step down units. The unit falls rate is calculated as the total number of falls in a month divided by the patient days in that month, multiplied by 1,000. The average of 3 months' falls data was calculated to obtain a quarterly fall rate for each unit. The falls data were positively skewed indicating that the total number of falls clustered in the low range. Twenty-two percent of the non-ICU (10 out of 45 units) reported zero falls. The mean number of non-ICU falls was 6.70 (*SD* 6.76). Eighty-five percent of ICU (12 of 14 units) reported zero falls. The mean number of ICU falls was 0.57 (*SD* 1.71).

Hospital Acquired Pressure Ulcers (HAPU).

Hospital acquired pressure ulcer (HAPU) data were collected during quarterly pressure ulcer prevalence studies in the ICU, medical, surgical, combined medical-surgical units, and step down units of each hospital. The prevalence studies were conducted in the patient care units by teams of nurses and wound care specialists. One hospital reported the combined HAPU score for three medical-surgical units. The percentage of patients with HAPU was calculated by dividing the number of patients with HAPU by the number of patients surveyed during the prevalence study. This data was also positively skewed, indicating more scores in the low range. Forty-four percent (20 out of 45 units) of the non-ICU reported zero HAPU; the mean HAPU rate was 6.94% (*SD* 9.14). Five out of 14 ICU (35.7%) reported zero HAPU. The mean HAPU rate in the ICU was 10.17% (*SD* 12.00).

Staffing Variables

The data for the three unit staffing variables, RNHPPD, TotNHPPD, and %RNH, were reported by the departments of nursing administration for the ICU, medical, surgical, combined medical-surgical units, and step down units of the 10 hospitals (*n* = 59). The RNHPPD were calculated by dividing the number of RN hours by the number of patient days per month. TotNHHPPD was calculated by dividing the combined RN, LVN/LPN, and non-RN/LVN hours by patient days per month. The %RN hours of care was calculated by dividing the number of RN hours by the total nursing hours (multiplied by 100). The average of 3 months of data was calculated for each of the staffing variables.

The trend was for higher means for all of the staffing variables in the ICU. RNHPPD were higher in the ICU (Mean 17.13, *SD* 3.28) than in the combined medical, surgical, combined medical-surgical, and step down units (Mean 6.37, *SD* 1.18). The TotNHPPD were also higher in the ICU (Mean 18.48, *SD* 2.40) than in the combined units (Mean 9.41, *SD* 1.76), and the %RNH was higher in ICU (Mean 92.58%, *SD* 9.32) than for the combined units (Mean 66.74%, *SD* 9.58).

Due to the higher number of RNHPPD, TotNHPPD, and %RNH providing patient care in intensive care units, the mean, *SD*, minimum and maximum values for the falls, HAPU, and the three staffing variables were separated into ICU and non-ICU categories for comparison. The descriptive statistics for the patient outcome and staffing variables are presented in Table 11. The mean, *SD*, minimum and maximum values are displayed by unit type (ICU/non-ICU).

Table 11

Patient Outcomes and Staffing Variable Means, SD, Minimum and Maximum Values

Unit	Mean	*SD*	Minimum	Maximum
ICU (N=14)				
Falls per 1000 patient days	.57	1.71	0	6.30
HAPU % pt with HAPU	10.17	12.00	0	33.33%
RNHPPD	17.13	3.28	10.17	21.66
TotNHPPD	18.48	2.40	14.26	22.06
% RNH	92.58	9.32	71.65	100
Non-ICU (N=45)				
Falls per 1000 patient days	6.70	6.76	0	31.48
HAPU % pt with HAPU	6.94	9.14	0	42.85
RNHPPD	6.37	1.81	2.93	10.78
TotNHPPD	9.41	1.76	5.93	14.30
% RNH	66.74	9.58	42.73	90.03

Note. SD = standard deviation; ICU = intensive care unit; HAPU = hospital acquired pressure ulcer; RNHPPD =registered nurse hours per patient day; TotNHPPD = total nursing care hours per patient day; %RNH = percent of total nursing hours supplied by RN.

Hospital Level Variables

Hospital size ranged from 35 to over 1400 beds. All hospitals provided surgical, medical, emergency, and obstetrical care, and larger hospitals offered specialty services such as neonatal intensive care and high risk obstetrics. The Case Mix Index (CMI), designated for hospitals by the Centers for Medicare and Medicaid (CMS) indicates the relative severity of illness and intensity of services in a patient population. The CMI indicates a more complex patient mix, and is used here as an indicator of patient acuity. The CMI values for the 10 hospitals ranged from 1.21 to 1.71.

The hospital level performance measures are reported as failure rates. The health system chose to report these indicators in this way because it helps staff to understand that the performance goal is zero, that is, no failures in patient assessments, treatments, and education. Failure rates for the acute myocardial infarction (AMI) performance measures (eight measures) ranged from 7.56% to 23%. For heart failure patients (four measures), failure rates ranged from 0% to 94.4%, and for the seven community acquired pneumonia (CAP) performance measures, failure rates ranged from 11.5% to 50.6%. Performance measure failure rates were reported by 8 hospitals for AMI, by 10 hospitals for heart failure, and by 9 hospitals for CAP. The hospital level variables are presented in Table 12. Hospital 10 was omitted from the analysis because of missing data for AMI and CAP failure rates and an unverified score of 0% failure rate for the heart failure rate measure.

Table 12

Hospital Level Variable Values

Hospital	Bedsize	CMI	AMI failure rate (%) *n* = 8	HF failure rate (%) *n* = 9	CAP failure rate (%) *n* = 9
Hospital 1	359	1.52	9.7	17.53	18.46
Hospital 2	191	1.71	7.56	51.8	11.53
Hospital 3	345	1.58	15.13	29.26	39.23
Hospital 4	35	1.21	n.d.	94.43	47.2
Hospital 5	412	1.67	11.60	26.06	32.5
Hospital 6	146	1.38	14.3	77.76	33.76
Hospital 7	80	1.32	11.10	33.33	33.86
Hospital 8	186	1.44	23.0	47.06	33.06
Hospital 9	304	1.51	14.80	12.0	50.63
Hospital 10	1,494	1.69	n.d.	0	n.d.

Note. CMI = Case Mix Index; AMI = acute myocardial infarction; HF = heart failure; CAP = community acquired pneumonia; n.d. = no data available.

Bivariate Analysis

A Pearson product-moment correlation matrix for the SAQ subscales was created using data from the 10 hospitals' ICU, combined medical-surgical units, emergency departments, cardiac catheterization laboratories, and ancillary services departments (pharmacy, imaging, and laboratory). Hospital 10 completed an abbreviated SAQ using the Teamwork Climate, Safety Climate, Perceptions of Hospital Management and Perceptions of Unit Management subscales. The correlations were assessed to determine the strength and direction of linear relationships between the subscales by unit (Pallant, 2007). A correlation coefficient (*r*) value range of .10 to .29 is considered small; from .30 to .49 is considered moderate, and .50 to 1.0 is considered strong (Cohen, 1988).

The correlation results (Table 13) show that the subscales were positively and moderately to strongly correlated with one another, with the exception of the Stress Recognition subscale. The Stress Recognition subscale showed a small non-significant correlation with most of the subscales, and a weak statistically significant correlation with the Teamwork Climate subscale ($r = .05$). The Stress Recognition subscale asks for staff perceptions of agreement that work stressors, such as fatigue, excessive workload, and tense or hostile situations, influence performance, especially in emergency situations (Sexton, Helmreich et al., 2006). Other research has also found that health care providers do not perceive that stress affects their work performance (Bognar et al., 2008; Grant et al., 2006; Huang et al., 2007).

Table 13

Correlation Matrix for Inpatient Units and Ancillary Department SAQ Subscales (n = 97)

	Teamwork Climate	Safety Climate	Perceptions of Hospital Management	Perceptions of Unit Management	Job Satis-faction	Stress Recogni-tion	Working Condi-tions
Teamwork Climate	1						
Safety Climate	.695**	1					
Perceptions of Hospital Manage-ment	.433**	.444**	1				
Perceptions of Unit Manage-ment	.410**	.428**	.724**	1			
Job Satisfaction	.635**	.643**	.484**	.511**	1		
Stress Recognition	-.050**	-.021	-.028	.022	-.033	1	
Working Conditions	.561**	.572**	.599**	.533**	.590**	-.026	1

Note. SAQ = Safety Attitudes Questionnaire

**= correlation is significant at the 0.01 level (two-tailed)

Pearson product-moment correlation matrices were created to evaluate the strength and direction of relationships between SAQ subscale scores, patient outcomes, and staffing variables by patient care unit type (ICU/non-ICU) for the 10 hospitals. Table 14 shows the results for the 14 ICU and Table 15 for the 45 non-ICU settings (i.e., medical, surgical combined medical-surgical, and step down units).

The SAQ subscale scores for ICU were positively, strongly correlated with one another with three exceptions. The Perceptions of Unit Management subscale correlated strongly and positively with only two subscales, the Perceptions of Hospital Management (r = .753) and the Job Satisfaction (r = .753) subscales. The Working Conditions subscale also correlated strongly and positively with only the Perceptions of Hospital Management (r = .790) and the Job Satisfaction subscales (r = .757). There were no significant correlations between the Stress Recognition subscale and the other subscales. The Stress Recognition subscale is composed of four items pertaining to staff perceptions of how fatigue and stress, and excessive workload affects their decision making and patient care (Sexton, Thomas, et al., 2003). A description of the subscale definitions is in Appendix C.

Other significant correlations in the ICU were for falls and the staffing variables. The falls variable was negatively, strongly correlated with Safety Climate (r = -.571) and with Job Satisfaction (r = -646). This finding indicates a relationship between lower reported falls and higher scores for perceptions of safety on the work unit and with higher perceptions of satisfaction with the work itself. The Working Conditions subscale was strongly, negatively correlated with both the RNHPPD (r = -.745) and %RNH (r = -.615). This suggests that there is a relationship between the total number of RN hours and the percent RN hours and a negative perception of the perceived quality of the work environment, such as how new personnel are supervised and trained, and staff disciplinary policies. The RNHPPD were strongly, positively correlated with TotNHPPD ($r = .874$), and %RNH ($r = .804$).

Table 14

Correlation Matrix for ICU SAQ Subscales, Patient Outcomes and Staffing Variables (n = 14)

ICU	Teamwork Climate	Safety Climate	Perceptions of Hospital Management	Perceptions of Unit Management	Job Satisfaction	Stress Recognition	Working Conditions	Falls	HAPU	RNHPPD	Tot NHPPD	%RNH
Teamwork Climate	1											
Safety Climate	.964**	1										
Perceptions of Hospital Management	.634*	.649*	1									
Perceptions of Unit Management	.368	.398	.719**	1								
Job Satisfaction	.898**	.932**	.863**	.753**	1							
Stress Recognition	-.162	-.103	-.403	-.245	-.264	1						
Working Conditions	.545	.569	.790**	.599	.757**	-.271	1					
Falls	-.482	-.571*	-.404	-.157	-.646*	-.383	-.591	1				
HAPU	-.343	-.421	-.214	-.120	-.388	.264	-.147	.022	1			
RNHPPD	-.413	-.361	-.398	.218	-.502	.122	-.745**	.439	.243	1		
TotNHPPD	-.319	-.274	-.286	.219	-.412	.038	-.557	.489	.429	.874*	1	
%RNH	-.422	-.349	-.238	.214	-.369	.332	-.615*	.175	.026	.804*	.422	1

Note. ICU = intensive care unit(s); SAQ = Safety Attitudes Questionnaire; Falls = # of patient falls per 1,000 patient days; HAPU = hospital acquired pressure ulcers; RNHPPD = registered nurse hours per patient day; TotNHPPD = total nursing hours per patient day; %RNH = percent of total nursing hours supplied by registered nurses
*= Correlation significant at the 0.05 level (two-tailed)
**= Correlations significant at the 0.01 level (two-tailed)

In the non-ICU patient care settings, the SAQ subscale scores were moderately to highly, positively correlated with one another with the exception of the Stress Recognition subscale, which did not correlate with any of the other subscales (Table 15). The reported falls per 1,000 patient days were moderately, positively correlated with the Perceptions of Unit Management (r = .431) subscale. This finding suggests a relationship between staff perceptions of the unit's management in providing enough staff and creating a supportive environment for safety, and reporting patient falls.

There was a moderate, negative correlation between RNHPPD and the Teamwork Climate (r = -.305) and Job Satisfaction (r = -.461) subscales, and a positive correlation with the Perceptions of Unit Management (r = .324) subscale. In the non-ICU, a relationship exists between increased RNHPPD and lower perceptions of teamwork and satisfaction with the work on the unit. There was also a positive relationship between RNHPPD and staff perceptions of a supportive management on the work unit. The TotNHPPD also had a moderate, positive correlation with Perceptions of Unit Management (r = .352).

The %RNH were moderately to strongly, negatively correlated with the Teamwork Climate (r = -.321) and Job Satisfaction (r = -.578) subscales, suggesting that perceptions of teamwork and satisfaction with the work of patient care decrease as the percentage of RN increase. The % RNH were moderately, positively correlated with falls (r = 425), and weakly positively with HAPU (r = .295). All three staffing variables had a moderate to strong, negative relationship to the Working Conditions subscale (RNHPPD r = -.693; TotNHPPD r = -.460, and %RNH r = -.694). This finding indicates that as the number of staff hours increase, along with the percentage of RN on the unit, perceptions of the quality of the work environment decrease. This finding may suggest that staff are not as positive about their work as more nurses are needed to care for patients, perhaps secondary to increased patient acuity. The three staffing variables were highly, positively correlated with one another.

Table 15

Correlation Matrix for Non-ICU SAQ Subscales, Patient Outcomes and Staffing Variables (n = 45)

Non ICU	Teamwork Climate	Safety Climate	Perceptions of Hospital Management	Perceptions of Unit Management	Job Satisfaction	Stress Recognition	Working Conditions	Falls	HAPU	RNHPPD	Total Nursing HPPD	%RNH
Teamwork Climate	1											
Safety Climate	.896**	1										
Perceptions of Hospital Management	.588**	.629**	1									
Perceptions of Unit Management	.364*	.458**	.796**	1								
Job Satisfaction	.854**	.856**	.724**	.767**	1							
Stress Recognition	-.211	-.077	-.158	-.175	-.221	1						
Working Conditions	.710**	.787**	.817**	.741**	.855**	-.155	1					
Falls	-.054	.012	.196	.431**	.170	.102	.031	1				
HAPU	.164	.273	.158	.275	.132	.164	.174	.216	1			
RNHPPD	-.305*	-.277	-.142	.324*	-.461**	.089	-.693**	.363*	.202	1		
Total Nursing HPPD	-.230	-.219	-.041	.352*	-.227	-.010	-.460**	.275	.107	.923**	1	
%RNH	-.321*	-.260	-.150	.285	-.578**	.237	-.694**	.425**	.295*	.845**	.588**	1

Note. Non-ICU = combined medical-surgical, medical, surgical, step down units; SAQ = Safety Attitudes Questionnaire; Falls = # of patient falls per 1,000 patient days; HAPU = hospital acquired pressure ulcers; RNHPPD = registered nurse hours per patient day; TotNHPPD = total nursing hours per patient day; %RNH = percent of total nursing hours supplied by registered nurses
*= Correlation significant at the 0.05 level (two-tailed)
**= Correlations significant at the 0.01 level (two-tailed)

Analysis of Aims

Aim 1: Describe the Patient Safety Climate at the Nursing Unit Level and Hospital Level

The unit patient safety climate will be described from the perspective of type of patient care unit including ICU, combined medical-surgical units (medical, surgical, medical/surgical, and step down units), emergency departments, cardiac catheterization laboratories, and the departments working closely with nursing units (pharmacy, imaging, and laboratory). Aim 1 was descriptive in nature, and therefore no hypothesis was formed.

The analysis of variance test (ANOVA) was run to determine significant differences in the mean SAQ subscale scores between units. Table 16 presents the mean, *SD*, and ANOVA significance for these units. Bonferroni correction post hoc analysis was used to identify which groups significantly differed from one another. The Bonferroni multiple comparisons procedure divides the alpha level (.05) among the comparisons to keep the alpha consistent for each comparison (Pallant, 2007). When a large number of comparisons are involved, this technique reduces the incidence of false significance, or Type I error; the researcher determines there is a significant difference when the difference may have occurred by chance (Pallant, 2007; Shott, 1990). Table 17 identifies which types of units differ from one another in SAQ subscales, identified by the Bonferroni test. Note that Hospital 4 and 7 do not have a cardiac catheterization laboratory.

Patient care unit mean subscale scores ranged from 3.47 to 4.37 (Neutral to Slightly Agree). Ancillary department means were similar, ranging from 3.48 to 4.29 (see Table 16). Four of the subscales had overall means in the Neutral range: Perceptions of Hospital and Unit Management, Stress Recognition, and Working Conditions, with the remaining subscale overall means in the Slightly agree range. The ANOVA identified significant differences across units in all SAQ subscale scores except for the Safety Climate subscale, where differences were not significant at the $p < .05$ level. The Eta square was calculated to determine if the non-significance was due to lack of variance between the units or if the sample size was too small to detect a significant difference. The Eta square (calculated by dividing the sum of squares between by the sum of squares total) was .003066, indicating that the Safety Climate subscale explains approximately .31% of the variance in the unit differences. According to Cohen (1988), an Eta square of .01 (1%) is considered a small effect size, .06 (6%) a medium, and .138 (13.8%) a large effect size. A small effect size coupled with the non-significant ANOVA indicates that there is essentially no variance between the unit and department Safety Climate mean scores in this study sample. Although the ANOVA analysis indicated significant differences across units for the Job Satisfaction subscale, the Bonferroni post hoc analysis did not identify any units with significant differences.

Table 16

Patient Care Unit Type and Ancillary Department SAQ Means, Standard Deviation (SD), and ANOVA Significance

SAQ subscale	Unit Mean/*SD*/							ANOVA Significance
	ICU N = 14	Combined Medical-Surgical N = 45	Emergency Dept N = 9	Cardiac Catheterization Laboratory N = 7	Pharmacy N = 6	Imaging N = 8	Laboratory N = 7	
Teamwork Climate	4.24/.70	4.18/.71	4.18/.66	4.22/.67	3.98/.75	4.13/.74	4.04/.74	.000*
Safety Climate	4.14/.69	4.16/.65	4.16/.60	4.28/.58	4.07/.72	4.17/.70	4.23/.67	.074
Perceptions of Hospital Management	3.56/1.01	3.49/1.0	3.48/.93	3.47/1.09	3.58/.97	3.82/.91	3.49/1.03	.000*
Perceptions of Unit Management	3.72/1.15	3.52/1.2	3.57/1.02	3.61/1.15	3.56/1.24	3.92/1.03	3.77/.97	.000*
Job Satisfaction	4.26/.85	4.33/.76	4.26/.72	4.37/.59	4.10/.74	4.29/.74	4.20/.84	.015*
Stress Recognition	3.82/.97	3.80/.99	3.54/1.04	3.60/1.07	3.78/1.03	3.50/1.04	3.63/1.06	.000*
Working Conditions	3.86/.88	3.92/.83	3.74/.82	3.84/.80	3.48/.87	3.90/.96	3.64/.95	.000*

Note. SAQ = Safety Attitudes Questionnaire; *SD* = standard deviation; min = minimum mean score; max = maximum mean score; ANOVA = analysis of variance; ICU= intensive care unit

*p < .05 Post hoc analysis described in Table 17

Statistically significant differences in safety attitudes were found across unit types (see Table 17). No specific pattern was found in the differences and the high and low SAQ subscale means are described in terms of the individual units or departments. The ICU had highest mean scores in the Teamwork Climate and Stress Recognition subscales. Combined medical-surgical units had highest scores for the Working Conditions subscale and lowest scores for Perceptions of Unit Management. The cardiac catheterization laboratories (CCL) were statistically different from the other units only in the Perceptions of Hospital Management subscale (see Table 17). Cardiac catheterization laboratories had the highest mean scores in Job Satisfaction and lowest for Perceptions of Hospital Management. Pharmacies had the lowest mean scores in the Teamwork Climate, Safety Climate, Job Satisfaction and Working Conditions subscales. Imaging departments had the highest scores in the Perceptions of Hospital and Unit Management scores, and the lowest score for Stress Recognition.

Table 17

ANOVA Statistics and Bonferroni Post Hoc Significant Differences Across Patient Units and Ancillary Departments (n = 3716)

SAQ Subscale	Mean Square Between Groups	Mean Square Within Groups	*F*, *df**	Group Differences
Teamwork Climate	16.669	1907.673	5.447	ICU: Pharmacy, Laboratory Pharmacy: ED, M/S Laboratory: M/S
Perceptions of Hospital Management	37.589	3666.170	6.382	ICU: Imaging ED: Imaging Imaging: Laboratory, CCL, M/S
Perceptions of Unit Management	37.589	4886.571	6.382	ICU: M/S Imaging: M/S, Pharmacy, ED Laboratory: M/S
Stress Recognition	43.410	2829.130	7.235	ICU: ED, Imaging ED: M/S Imaging: M/S
Working Conditions	35.932	2091.301	7.946	ICU: Pharmacy, Laboratory ED: M/S Pharmacy: Imaging, M/S Laboratory: Imaging, M/S

Note. ANOVA = analysis of variance; SAQ = Safety Attitudes Questionnaire; *F* = F ratio: variance between groups divided by the variance within groups; *df* = degrees of freedom; ICU = intensive care units; M/S = medical-surgical Units; ED = emergency department; CCL = cardiac catheterization laboratory

**df* = 6, 3747

Table 18 describes the hospital level patient safety climate subscale score means, *SD*, and the ANOVA significance. The overall safety attitudes scores for each hospital are described by aggregating the means for each subscale score for the selected patient units and ancillary departments. Hospital 10 used an abbreviated SAQ using four of the subscales (Teamwork Climate, Safety Climate, Perceptions of Hospital Management, and Perceptions of Unit Management). The Bonferroni correction post hoc analysis was used to identify which hospitals were significantly different from another. Post hoc differences are displayed in Table 19.

The mean SAQ subscale scores at the hospital level ranged from Neutral to Slightly agree. Three subscales, Teamwork Climate, Safety Climate and Job Satisfaction, showed hospital overall mean scores in the Slightly agree range, with the exception of Hospital 6. The Perceptions of Hospital and Unit Management, Stress Recognition, and Working Conditions mean scores were in the Neutral range; this was also reflected in the overall unit subscale mean findings.

Significant differences were found across hospitals in each of the SAQ subscales. Specifically, mean scores were highest in Hospital 1 and Hospital 8 for Perceptions of Unit Management. Hospital 4 and Hospital 7 scored highest in Teamwork Climate. Hospital 4 also scored highest in Safety Climate and Job Satisfaction. Hospital 5 scored highest in Working Conditions. Hospitals 3 and 6 had the highest means for Stress Recognition. Hospital 8 had the highest means for Perception of Hospital and Unit Management, and lowest for Stress Recognition. Hospital 10 scored lower than any other hospital in the Perceptions of Unit Management subscale.

Hospital 6 had the lowest means for more subscales than the other hospitals (Teamwork Climate, Safety Climate, Job Satisfaction, Perceptions of Hospital

Management, and Working Conditions). Hospital 6 was also one of two hospitals with the highest scores in the Stress Recognition subscale. These findings would indicate that the overall patient safety climate for Hospital 6 is lower than that of the other hospitals. Findings such as this may serve as an indicator for the health system leadership of how the priority of patient safety is communicated in this hospital, and need for further understanding of the contributors to the lower subscale scores.

Table 18

Hospital SAQ Means, Standard Deviation (SD), and ANOVA Significance (n = 3716)

SAQ Subscale	Hospital mean/ SD										ANOVA Significance
	H 1	H 2	H 3	H 4	H 5	H 6	H 7	H 8	H 9	H 10	
Teamwork Climate	4.23/.67	4.18/.70	4.07/.75	4.27/.70	4.22/.70	3.98/.78	4.27/.70	4.16/.70	4.02/.76	4.18/.70	.000*
Safety Climate	4.23/.65	4.15/.67	4.12/.69	4.31/.56	4.23/.64	3.98/.74	4.24/.64	4.17/.62	4.15/.69	4.12/.66	.000*
Perceptions of Hospital Management	3.67/.93	3.56/.86	3.37/1.0	3.44/1.0	3.70/.96	3.16/.92	3.46/.85	3.81/.92	3.41/1.0	3.44/1.1	.000*
Perceptions of Unit Management	4.02/.88	3.78/.91	3.62/.10	3.87/.93	3.86/.93	3.62/.87	3.84/.96	4.0/.90	3.73/1.02	3.03/1.4	.000*
Job Satisfaction	4.38/.76	4.30/.74	4.13/.78	4.61/.62	4.39/.73	3.78/.94	4.37/.65	4.4/.68	4.17/.79	n.d.	.000*
Stress Recognition	3.66/1.04	3.61/1.0	3.87/.97	3.77/1.4	3.73/1.0	3.86/.94	3.79/.97	3.55/1.1	3.84/.97	n.d.	.002*
Working Conditions	3.99/.81	3.82/.83	3.60/.85	3.78/.79	4.0/.86	3.23/.88	3.75/.79	3.98/.84	3.7/.88	n.d.	.000*

Note. SAQ = Safety Attitudes Questionnaire; *SD* = standard deviation; ANOVA = analysis of variance; H = hospital; n.d. = no data.

*=Post hoc analysis described in Table 19

Overall, the hospital level Bonferroni post hoc analyses indicate that the Perceptions of Hospital and Unit Management, Job Satisfaction, and Working Conditions subscales showed the highest frequency of significant differences between hospitals. This analysis identified hospitals with the lowest and highest scores in the SAQ subscales (see Table 19). Hospital 6 was significantly different in more subscales than any of the other hospitals. These findings are important because they support previous evidence that the patient safety climate varies across institutions, allowing the concept to be measured and interpreted. Identifying the “depth and breadth” of the attitudes toward patient safety at the organization level is valuable in identifying high and low performing institutions (Rose et al., 2006, p. 437). This analysis specifically demonstrated that Hospital 6 scored significantly lower in more subscales than the other hospitals. Hospital and nursing leaders can use this kind of information to identify hospitals experiencing both high and low overall patient safety climate as well as in specific subscales, and investigate what factors influence the level of patient safety climate. These findings can assist health system leaders, including nursing leaders, in allocating resources for further assessment and improvement in safety climate in more efficient ways.

Table 19

ANOVA Statistics and Bonferroni Post Hoc Significant Differences Across 10 Hospitals

SAQ Subscale	Mean Square Between Groups	Mean Square Within Groups	F*	Group Differences
Teamwork Climate	20.435	1903.907	4.457	H5: H3, H6, H9 H6: H1, H5 H9: H1, H10
Safety Climate	13.561	1646.908	3.424	H6: H1, H5 H10: H5
Perceptions of Hospital Management	98.523	3605.236	11.332	H3: H1, H6, H9 H5: H3, H6, H9 H6: H1, H2 H8: H3, H6, H9 H10: H1, H5, H8
Perceptions of Unit Management	506.642	4442.722	47.149	H1: H3, H6, H9 H3: H5, H8 H6: H8 H10: H1, H2, H3, H4, H5, H6, H7, H8, H9
Job Satisfaction	69.952	1602.870	15.106	H3: H1, H4, H5,H8 H6: H1, H2, H3, H4, H5, H7, H8, H9 H9: H1, H2, H5, H8
Stress Recognition	25.669	2846.871	3.115	H8: H3, H9
Working Conditions	116.386	2010.847	20.062	H3: H1, H2, H5, H8 H6: H1, H2, H3, H4, H5, H7: H8, H9 H9: H1, H5, H8

Note. ANOVA = analysis of variance; *F* = F ratio: variance between groups divided by the variance within groups; SAQ = Safety Attitudes Questionnaire; H = Hospital

**df for* Teamwork Climate, Safety Climate, Perceptions of Hospital Management, and Perceptions of Unit Management subscales = 9, 3706; *df* for Job Satisfaction, Stress Recognition, and Working Conditions subscales = 8, 3707

The distribution of the SAQ subscales was reviewed before analysis of Aims 2 and 3. The Perceptions of Unit Management subscale was identified as negatively skewed and overdispersed, indicating that the variance was greater than the mean. Before proceeding, the subscale was reversed coded to allow the options of using negative binomial regression and Poisson regression which allow better parameter estimations when data is highly skewed and has an overdispersed distribution (Hutchinson & Holtman, 2005). In interpreting the results for the Perceptions of Unit Management subscale, the negative coefficient would be interpreted as disagreeing with perceptions that the unit management is compromising the safety of patients or not responsive to adjusting staffing levels to meet workload.

The SAQ subscales were also centered around the grand mean to allow the intercept to be interpreted as the expected outcome for a unit when the independent variables (SAQ means) are equal to the means across the unit (Paccagnella, 2006). If the SAQ scores were not centered, then used in an interaction term, the interaction term would be so highly correlated with the other variables in the model that the intercept could not be interpreted within the same model.

Aim 2: Describe the Relationship Between the Patient Safety Climate at the Unit Level and Falls and Hospital Acquired Pressure Ulcers (HAPU)

In this aim, the dependent variables were the patient outcome measures (patient falls and HAPU) and the independent variables were the SAQ subscales. The hypothesis for Aim 2 was that the patient safety climate was inversely associated with falls and HAPU.

Frequency distributions and histograms were created to assess the distribution of the falls and HAPU variables. Eighty-five percent of the ICU and 22% of the non-ICUs reported zero falls in a three month period. Forty-four percent of the non-ICU and 35% of the ICU reported zero HAPU. Negative binomial regression was used for analysis based on the non-normality of the data, that it makes no assumption of equal dispersion, and can be used when data is overdispersed (Hutchinson & Holtman, 2005). Models were created with each SAQ subscale and falls and separate models for the HAPU data.

Models were created with the independent variable (SAQ subscales) entered into the model with both unit types (ICU =1, non-ICU = 0). Another model was created for comparison by entering the independent variable with only non-ICU. (The interaction term was not added to in the model based on findings from Aim 3, which showed a high colliniarity between ICU and the predictors in the models). The Wald overall model statistics were not significant at the $p < .05$ level, and inclusion of zero in the confidence interval further demonstrated non-significance. The models were not statistically significant for predicting falls or HAPU from the SAQ subscales (see Table 20 and 21).

Table 20

Hierarchical Linear Modeling Results for Falls, Unit Type, and SAQ Subscales

SAQ subscale	Unit Type	Coefficient	*df*	*t* or *z* statistic	Significance	CI LB/ UB	Wald (significance)
Teamwork Climate	ICU/non-ICU	-.56	48	*z* -1.35	.17	-1.39/ .25	1.82 (.17)
	Non-ICU	-.19	34	*z* -.56	.574	-.87/ .48	.32 (.57)
Safety Climate	ICU/non-ICU	-.25	48	*z* -.50	.61	-.12/ .73	.25 (.61)
	Non-ICU	-.17	34	*z* .43	.66	-.98/ .62	.19 (.66)
Perceptions of Hospital Management	ICU/non-ICU	-.27	48	*z* -.67	.50	-1.09/ .53	.45 (.50)
	Non-ICU	.06	34	*z* .20	.84	-.56/ .69	.04 (.84)
Perceptions of Unit Management	ICU/non-ICU	-.15	48	*z* .42	.67	-.88/ .57	.18 (.67)
	Non-ICU	.22	34	*z* .71	.48	-.39/ .84	.50 (.47)
Job Satisfaction	ICU/non-ICU	.10	35	*z* .31	.76	-.58/ .80	.09 (.76)
	Non-ICU	.31	24	*z* 1.01	.31	-.30/ .94	1.02 (.31)
Stress Recognition	ICU/non-ICU	-.17	35	*z* -.25	.80	-1.55/ 1.20	.06 (.80)
	Non-ICU	.07	24	*z* .14	.88	-1.01/ 1.17	.02 (.88)
Working Conditions	ICU/non-ICU	.18	35	*z.* 46	.64	-.59/ .96	.21 (.64)
	Non-ICU	.12	24	*z* .35	.72	-.57/ .82	.12 (.72)

Note .SAQ = Safety Attitudes Questionnaire; *df* = degrees of freedom; *t* statistic in SPSS; *z* statistic in STATA; CI = confidence level; LB = lower bound; UB = upper bound; ICU = intensive care units; non-ICU: combined medical-surgical, medical, surgical, and step-down units; Wald = overall model significance

Table 21

Hierarchical Linear Modeling Results for HAPU, Unit Type, and SAQ Subscales

SAQ subscale	Unit Type	Coefficient	*df*	*z* statistic	Significance	CI LB/ UB	Wald (significance)
Teamwork Climate	ICU/non-ICU	-.32	46	*z* -.67	.50	-1.29/ .63	.45 (.50)
	Non-ICU	.04	34	*z* .09	.93	-1.06/ 1.16	.01 (.93)
Safety Climate	ICU/non-ICU	.04	46	*z* .08	.93	-1.14/ 1.24	.01 (.93)
	Non-ICU	.63	34	*z* .93	.35	-.71/ 1.99	.86 (.35)
Perceptions of Hospital Management	ICU/non-ICU	-.50	46	*z* -1.11	.26	-1.39/ .38	1.24 (.26)
	Non-ICU	-.34	34	*z* -.64	.52	-1.39/ .70	.41 (.52)
Perceptions of Unit Management	ICU/non-ICU	.07	46	*z* .26	.79	-.47/ .61	.07 (.79)
	Non-ICU	.26	34	*z* .78	.43	-.39/ .92	.60 (.43)
Job Satisfaction	ICU/non-ICU	-.31	33	*z* -.68	.49	-1.22/ .59	.47 (.49)
	Non-ICU	.09	24	*z* .18	.86	-.98/ 1.18	.03 (.86)
Stress Recognition	ICU/non-ICU	1.72	33	*z* 1.87	.06	-.08/ 3.52	3.50 (.06)
	Non-ICU	1.55	24	*z* 1.56	.11	-.39/ 3.50	2.44 (.11)
Working Conditions	ICU/non-ICU	-.15	33	*z* -.26	.79	-1.31/ 1/01	.07 (.79)
	Non-ICU	-.03	24	*z* -.06	.95	-1.36/ 1.28	.00 (.95)

Note. HAPU = hospital acquired pressure ulcers; SAQ = Safety Attitudes Questionnaire; *df* = degrees of freedom; *t* statistic in SPSS; *z* statistic in STATA; CI = confidence level; LB = lower bound; UB = upper bound; ICU = intensive care units; non-ICU: combined medical-surgical, medical, surgical, and step-down units

Aim 3: Describe the Relationship Between the Patient Safety Climate at the Unit Level and RNHPPD, TotNHPPD, and %RNH

In this aim, the dependent variable is the SAQ subscales and the independent variable is the staffing variables. The hypothesis for Aim 3 that the patient safety climate is positively associated with three unit staffing variables: RNHPPD, TotNHPPD, and %RNH was not supported by the findings.

Each staffing variable was examined using SPSS software with the Mixed Models/Linear command. The warning 'Hessian Matrix not positive definite' for the Teamwork Climate subscale for the three staffing variables and the Job Satisfaction subscale for %RNH necessitated that additional hierarchical modeling algorithms be used, which were available in the STATA software. The algorithms included the Newton-Raphson algorithm, the Davidon-Fletcher-Powell algorithm, and the Broyden-Fletcher-Goldfarb-Shannon algorithm. (Hutchinson & Holtman, 2005).

Each of the staffing variables was introduced into the model in several predetermined steps. First, the staffing variable was placed into the model, then the staffing variable and unit type (ICU = 1, non-ICU = 0), then an interaction term (interaction between the staffing variable and unit type).

The RNHPPD and ICU interaction variable was significant for the Working Conditions subscale (see Table 22). For every 1 unit (hour) increase in RHNPPD in the ICU, the Working Conditions subscale mean score decreased by .116. The TotNHPPD was significant by itself in the Teamwork Climate and Working Conditions models. For each 1 unit increase in TotNHPPD, the Teamwork Climate mean score decreased by .044, and for the Working Conditions subscale decreased by .084 (see Table 23). ICU was significant by itself for the Teamwork Climate subscale, increasing mean scores by

.466. The ICU was not significant by itself at the .05 level in the Working Conditions model.

The %RNH was significant by itself in several models. Increasing the %RNH by 10% decreased the mean scores for Teamwork Climate by .12, for Safety Climate by .10, for Job Satisfaction by .35, for Perception of Hospital Management by .15, and for Working Conditions by .30 (see Table 24). Decreased mean scores indicate staff perceptions are lower for that subscale. When in the model by itself, ICU was significant except for the Perceptions of Unit Management and Stress Recognition subscales, which was not significant at the .05 level.

Due to the colliniarity of the ICU setting with the staffing variables, significant results for the RNHPPD, TotNHPPD, and %RNH may not be meaningful. ICU have higher RN staffing and total nursing hours of care due to the complexity and severity of patients in these units. The ICU setting may also represent other confounding variables not explored in this study, such as nurses' education, nurses' experience, hospital volume, patient acuity, physician practice, skill level, and other variables which could have influenced the significant findings (Needleman et al., 2002).

Table 22

Hierarchical Linear Modeling Results for RNHPPD, Unit Type, and SAQ Subscales

SAQ subscale	Coefficient	*df*	*t* or *z* statistic	Significance	CI LB/ UB	Wald (significance)
Teamwork Climate						3.90 (.27)
Intercept	4.29	48	*z* 34.45	.00	4.05/ 4/54	
RNHPPD only	-/01	48	*z* -.96	.33	-.04/ .01	
ICU/non-ICU	.72	48	*z* 1.44	.15	-.26/ 1.70	
RNHPPD*ICU	-.02	48	*z* .87	.38	-.09/ .03	
Safety Climate						4.67 (.00)
Intercept	4.22	26	*t* 31.07	.00	3.95/ 4.50	
RNHPPD only	.-.00	47	*t* -.42	.67	-.04/ .02	
ICU/non-ICU	.55	52	*t* 1.24	.21	-.34/ 1.46	
RNHPPD*ICU	-.03	50	*t* -1.05	.29	-.08/ .02	
Perceptions of Hospital Management						4.85 (.00)
Intercept	3.71	37	*t* 22.10	.00	3.37/ 4.05	
RNHPPD only	-.02	53	*t* -1.21	.22	-.06/ .01	
ICU/non-ICU	.97	52	*t* 1.83	.07	-.08/ 2.04	
RNHPPD*ICU	-.03	51	*t* -1.12	.26	-.10/ .03	
Perceptions of Unit Management						4.87 (.00)
Intercept	3.70	40	*t* 14.66	.00	3.19/ 4.21	
RNHPPD only	.00	54	*t* .04	.96	-.05/ .06	
ICU/non-ICU	1.09	51	*t* 1.46	.14	-.40/ 2.58	
RNHPPD*ICU	-.05	50	*t* -1.06	.29	-.14/ .04	
Job Satisfaction						3.94 (.00)
Intercept	4.41	35	*t* 20.66	.00	3.98/ 4.84	
RNHPPD only	-.01	38	*t* -.44	.65	-.06/ .03	
ICU/non-ICU	1.77	36	*t* 1.73	.09	-.30/ 3.84	
RNHPPD*ICU	-.09	36	*t* -1.63	.11	-.21/ .02	
Stress Recognition						4.10 (.00)
Intercept	3.81	37	*t* 35.04	.00	3.56/ 4.03	
RNHPPD only	.00	39	*t* .31	.75	-.021/ .029	
ICU/non-ICU	-.26	38	*t* .49	.62	-1.34/ .81	
RNHPPD*ICU	.01	38	*t* .34	.72	-.05/ .07	
Working Conditions						4.06 (.00)
Intercept	3.97	34	*t* 24.13	.00	3.64/ 4.31	
RNHPPD only	-.01	37	*t* -.73	.46	-.04/ .02	
ICU/non-ICU	1.85	36	*t* 2.49	.01	.34/ 3.36	
RNHPPD*ICU	-.10	36	*t* -2.43	.02	-.19/ -.01	

Note. RNHPPD = registered nurse hours per patient day; SAQ = Safety Attitudes Questionnaire; *df* = degrees of freedom; *t* statistic in SPSS; *z* statistic in STATA; CI = confidence level; LB = lower bound; UB = upper bound; RNHPPD*ICU = Interaction term; ICU = intensive care units; non-ICU: combined medical-surgical, medical, surgical, and step-down units

Table 23

Hierarchical Linear Modeling Results for TotNHPPD, Unit Type, and SAQ Subscales

SAQ subscale	Coefficient	*df*	*t* or *z* statistic	Significance	CI LB/ UB	Wald (significance)
Teamwork Climate						4.34 (.11)
Intercept	4.60	48	*z* 21.21	.00	4.18/ 5.03	
TotNHPPD only	-.04	48	*z* -1.9	.04	.02/ .91	
ICU/non-ICU	.46	48	*z* 2.06	.04	.02/ .91	
TotNHPPD*ICU	.00	48	*z* .01	.99	-.091/ .092	
Safety Climate						4.66 (.00)
Intercept	4.53	25	*t* 15.18	.00	3.92/ 5.15	
TotNHPPD only	-.03	30	*t* -1.24	.22	-.09/ .02	
ICU/non-ICU	.37	50	*t* .57	.56	-.94/ 1.69	
TotNHPPD*ICU	-.00	52	*t* -.09	.92	-.088/ .080	
Perceptions of Hospital Management						4.85 (.00)
Intercept	3.65	39	*t* 9.53	.00	2.86/ 4.42	
TotNHPPD only	-.01	44	*t* -.32	.74	-.09/ .06	
ICU/non-ICU	.84	51	*t* 1.05	.29	-.76/ 2.45	
TotNHPPD*ICU	-.03	52	*t* -.710	.48	-.13/ .06	
Perceptions of Unit Management						4.89 (.00)
Intercept	3.32	47	*t* 6.07	.00	2.22/ 4.42	
TotNHPPD only	.03	51	*t* .69	.49	-.07/ .14	
ICU/non-ICU	.83	50	*t* .75	.45	-1.37/ 3.03	
TotNHPPD*ICU	-.04	51	*t* -.70	.48	-.19/.09	
Job Satisfaction						3.97 (.00)
Intercept	4.66	40	*t* 8.62	.00	3.57/ 5.76	
TotNHPPD only	-.03	40	*t* -.64	.36	-1.31/ 3.49	
ICU/non-ICU	1.09	35	*t* .92	.36	-1.31/ 3.49	
TotNHPPD*ICU	-.04	36	*t* -.63	.52	-.19/ .10	
Stress Recognition						4.05 (.00)
Intercept	4.21	40	*t* 15.55	.00	3.66/ 4.75	
TotNHPPD only	-.03	40	*t* -1.37	.17	-.08/ .01	
ICU/non-ICU	-.27	36	*t* -.47	.64	-1.45/ .90	
TotNHPPD*ICU	.02	36	*t* .82	.41	-.04/ .10	
Working Conditions						4.13 (.00)
Intercept	4.71	41	*t* 14.28	.00	4.05/ 5.38	
TotHPPD only	-.08	41	*t* -2.71	.01	-.14/ -.02	
ICU/non-ICU	.56	41	*t* 1.95	.057	-.01/ 1.14	
TotNHPPD*ICU	-.01	35	*t* -.35	.72	-.12/ .08	

Note. TotHPPD = registered nurse hours per patient day; SAQ = Safety Attitudes Questionnaire; *df* = degrees of freedom; *t* statistic in SPSS; *z* statistic in STATA; CI = confidence level; LB = lower bound; UB = upper bound; RNHPPD*ICU = Interaction term; ICU = intensive care units; non-ICU: combined medical-surgical, medical, surgical, and step-down units

Table 24

Hierarchical Linear Modeling Results for %RNH, Unit Type, and SAQ Subscales

SAQ subscale	Coefficient	*df*	*t* or *z* statistic	Significance	CI LB/ UB	Wald (significance)
Teamwork Climate						8.32 (.01)
Intercept	5.02	48	*z* 16.73	.00	4.43/ 5.6	
%RNH only	-.012	48	*z* -2.81	.00	-.02/ -.00	
ICU/non-ICU	.38	48	*z* 2.56	.01	.09/ .68	
%RNH *ICU	-.00	48	*z* -.44	.66	-.02/ .01	
Safety Climate						4.76 (.00)
Intercept	4.88	20	*t* 13.93	.00	4.15/ 5.61	
%RNH only	-.01	23	*t* -2.07	.04	-.02/ -4.89	
ICU/non-ICU	.23	39	*t* 1.52	.13	-.07/ .55	
%RNH *ICU						
Perceptions of Hospital Management						4.92 (.00)
Intercept	4.55	40	*t* 10.00	.00	3.63/ 5.47	
%RNH only	-.015	44	*t* -2.31	.02	-.02/ -.00	
ICU/non-ICU	.44	52	*t* 2.29	.02	.05/ .83	
%RNH *ICU	-.01	49	*t* -1.37	.17	-.03/ .00	
Perceptions of Unit Management						4.82 (.00)
Intercept	4.28	52	*t* 6.07	.00	2.86/ 5.69	
%RNH only	-.00	54	*t* -.80	.42	-.02/ .01	
ICU/non-ICU	2.66	48	*t* 1.95	.06	-.06/ 5.39	
%RNH *ICU	-.02	48	*t* -1.5	.12	-.05/ .00	
Job Satisfaction						16.76 (.00)
Intercept	6.80	35	*z* 10.98	.00	5.58/ 8.01	
%RNH only	-.035	35	*z* -4.06	.00	-.05/ -.01	
ICU/non-ICU	.88	35	*z* 3.34	.00	.36/ 1.39	
%RNH *ICU	-.01	35	*z* -.46	.64	-.07/ .04	
Stress Recognition						4.13 (.00)
Intercept	3.38	36	*t* 8.18	.00	2.54/ 4.22	
%RNH only	.00	37	*t* 1.12	.27	-.00/ .01	
ICU/non-ICU	-1.37	38	*t* -.85	.39	-4.61/ 1.87	
%RNH *ICU	.01	39	*t* .70	.48	-.02/ .04	
Working Conditions						4.05 (.00)
Intercept	6.03	36	*t* 10.99	.00	4.91/ 7.14	
%RNH only	-.030	37	*t* -3.97	.00	-.04/ -.01	
ICU/non-ICU	.64	40	*t* 2.85	.00	.18/ 1.09	
%RNH *ICU	-.04	37	*t* -1.71	.09	-.08/ .00	

Note. %RNH = percent of total nursing hours supplied by RN; SAQ = Safety Attitudes Questionnaire; *df* = degrees of freedom; *t* statistic in SPSS; *z* statistic in STATA; CI = confidence level; LB = lower bound; UB = upper bound; RNHPPD*ICU = Interaction term; ICU = intensive care units; non-ICU: combined medical-surgical, medical, surgical, and step-down units

Aim 4: Describe the Relationship Between Hospital Level Patient Safety Climate and Hospital Performance Measures

The hypothesis for Aim 4 was that patient safety climate is inversely associated with hospital level performance measures related to three conditions: acute myocardial infarction (AMI), heart failure, and community acquired pneumonia (CAP). A Pearson product-moment correlation matrix was run to evaluate the strength and direction of the relationship between the hospital level SAQ subscale scores, hospital level performance measures, bedsize, and the CMI (see Table 25). The three performance measures (AMI, heart failure, and CAP) each have several treatments and procedures that must be delivered to a patient to achieve a zero percent failure rate (achieving the right care, for the right patient, at the right time). The desired result is a zero failure rate for each of the aggregate performance measures. Hospital CMI values and number of beds were included in the matrix as indicators of hospital size and patient complexity.

The failure rate measure for community acquired pneumonia (CAP) was the only measure that correlated with the SAQ subscales. There was a strong, negative correlation between the CAP measure and the Perceptions of Unit Management subscale (r = -.749), suggesting a relationship between staff perceptions of being supported by the managers on their workplace unit, and lower failure rates for CAP. This is the desired direction to achieve zero failure rates for the hospital performance measures. To determine the power needed to detect significant differences for this sample size (n = 9), Hulley, Cummings, Browner, Grady, and Newman (2001) recommends the following calculation. Using the correlation coefficient from this study as the approximate measure of effect size (.75), the alpha was set at .05 and the power at .80. Using the table provided by Hulley et al. (p. 89) the correlation coefficient would need to be <= .70 in order to be statistically significant. The table indicates the sample size should be a minimum of 13 hospitals. Therefore, the interpretation of the significance of the results of this study is that there is not enough power to detect statistical significance at the .05 level.

Hospital bedsize was strongly, positively correlated with the CMI indicating that the larger hospitals care for patients with more complex conditions. Bedsize was strongly, negatively correlated with the failure rate for the performance measure of heart failure (r = -.762). Although this finding suggests that there is a relationship between larger hospitals and a lower failure rate for delivering appropriate care for patients with heart failure, the small sample size prohibits finding statistical significance at the .05 level.

Table 25

Correlation Matrix for Hospital Level SAQ subscales, Bedsize, Case Mix Index, and Hospital Performance Measures

	Teamwork Climate	Safety Climate	Perceptions of Hospital Management	Perceptions of Unit Management	Job Satisfaction	Stress Recognition	Working Conditions	Bedsize	CMI	AMI	HF	CAP
Bedsize	-.439	-.532	.242	-.021	-.378	.156	.056	1				
CMI	.004	-.018	.498	.261	-.059	-.383	.327	.762*	1			
AMI N = 8	-.076	-.068	.351	-.093	.086	-.132	.103	-.110	-.384	1		
HF N =9	.148	.340	-.279	-.136	.233	-.111	-.234	-.762*	-.570	.141	1	
CAP N = 9	-.316	-.153	-.470	-.749*	-.011	.222	-.294	-.158	-.526	.545	.112	1

Note. SAQ = Safety Attitudes Questionnaire; CMI = Case Mix Index; AMI= acute myocardial infarction; HF = heart failure; CAP = community acquired pneumonia.

*=Correlation significant at the .05 level (two-tailed)

**=Correlation significant at the .01 level (two-tailed)

Summary of Findings

This research project used a cross-sectional, descriptive, correlational, model testing design to examine the relationship between SAQ patient safety subscale scores, falls, HAPU, three staffing variables (RNHPPD, TotNHPPD, and %RNH), and hospital level performances measures (AMI, heart failure, and CAP).

Aim 1 described the patient safety climate at the unit and hospital levels. The overall SAQ subscale means for the patient care units (ICU, combined medical-surgical, emergency department, and cardiac catheterization laboratories) and ancillary departments (laboratory, imaging and radiology) ranged from Neutral to Slightly agree. The overall means for four of the subscales (Perceptions of Hospital and Unit Management, Stress Recognition, and Working Conditions) were in the Neutral range. There were statistically significant overall differences in unit and department SAQ subscale responses except for the Safety Climate subscale.

Post hoc testing of models that were significant in the ANOVA showed that the patient care units varied in the patient safety climate mean subscale scores. ICU had higher mean scores in the Teamwork Climate and Stress Recognition subscales. The combined medical-surgical and emergency departments shared the highest mean scores for the Working Conditions subscale. Combined medical-surgical units had the lowest scores for Perceptions of Unit Management. In ancillary departments, pharmacies had the lowest mean scores for more of the subscales than other ancillary departments (Teamwork Climate, Safety Climate, Job Satisfaction and Working Conditions). Imaging departments had the highest scores in the Perceptions of Hospital and Unit Management scores, and the lowest for Stress Recognition. Although the cardiac catheterization laboratories had the highest mean for the Job Satisfaction and lowest mean for the

Perceptions of Hospital Management subscales, they differed significantly from other work areas only in the Perceptions of Hospital Management subscale. No patterns emerged across unit types.

Hospital SAQ subscale means also ranged from Neutral to Slightly Agree. The Perceptions of Hospital and Unit Management, Job Satisfaction, and Working Conditions subscales had the highest frequency of significant differences between hospitals. All hospitals reported a mean score in the neutral range for the Perceptions of Hospital Management and Stress Recognition subscales. Hospital 6 had neutral scores for all of the SAQ subscales, with the other Hospitals reporting Neutral to Slightly agree for the subscales. The ANOVA identified statistically significant differences between hospitals, and post hoc analyses identified which hospitals varied significantly in SAQ mean scores. Hospital 6 showed a pattern of lower scores. Hospital 10 had the lowest mean for Perceptions of Unit Management, and was significantly different than the other hospitals in this subscale.

Aim 2 described the relationship between the patient safety climate at the unit level and falls and hospital-acquired pressure ulcers. Multilevel negative binomial regression was used in the analysis. Patient safety climate was not significantly associated with falls and hospital-acquired pressure ulcers. Both falls and HAPU data were skewed, with a large percentage of units reported zero falls and HAPU.

Aim 3 described the relationship between the patient safety climate and RNHPPD, TotNHPPD, and %RNH. Hierarchical linear modeling algorithms were used in the analysis. Several significant findings contradicted the hypothesis as increasing the RNHPPD, TotNHPPD, and %RNH by one unit resulted in decreased SAQ mean subscale scores. SAQ subscale scores increased (except for the Safety Climate subscale) in ICU settings. The interaction between RNHPPD and the ICU was associated with a decrease in Working Conditions subscale scores. Statistically significant findings were not found at the .05 level and interpretation of the results should conclude with the understanding that the higher nurse staffing levels in ICU result in collinearity between these two variables.

Aim 4 described the relationship between the patient safety climate and three hospital level performance measures. The hypothesis for Aim 4 was that patient safety climate is inversely associated with hospital level performance measures related to three conditions: acute myocardial infarction (AMI), heart failure, and community acquired pneumonia (CAP). There was a strong, negative correlation between the Perceptions of Unit Management subscale and the failure rate for CAP. This finding suggests that there is a relationship between increased perceptions of staff that the unit management supports safety efforts and provides adequate staffing, and low CAP failure rate (desired direction).

The overall pattern of statistical differences in patient safety climate across units and departments supports that climate is unique to each work unit, and subsequent analyses showed the SAQ was significantly related to patient outcomes. The theoretical model describing patient safety climate influencing staff care behaviors, which can be measured in indicators of patient care quality and safety, was supported only at the hospital level in perceptions of the management support for safety in the units. Correlations for the SAQ subscales, patient falls, HAPU and staffing variables showed statistically significant differences between ICU and non-ICU settings.

Little is known about how the patient safety climate in hospitals influences patient outcomes. This study contributes new knowledge toward understanding the role of the patient safety climate at the unit and hospital level in enhancing patient safety by identifying climate differences across units and hospital, by evaluating patient safety climate as a predictor of patient outcomes, by evaluating unit staffing as a predictor of climate, and by finding an association between lower failure rates for community acquired pneumonia and staff perception of support from management. Chapter five will present a discussion of the study results in relation to the overall research question and hypotheses, the limitations of the study, implications for nursing, and future research.

CHAPTER FIVE

DISCUSSION

Chapter five presents the interpretation and significance of this study's findings by each of the four aims, limitations of the study, implications for nursing, and for future research in patient safety. The purpose of this study was to evaluate the relationship between patient safety climate, patient outcomes, unit staffing, and hospital performance measures. The study used a cross sectional, descriptive, correlational, model testing design. Descriptive statistics, correlations, ANOVA, bivariate analyses, and hierarchical linear modeling techniques were used to conduct the analysis. Secondary data for the study was obtained from a convenience sample of 10 hospitals in a health care system in California and Texas. The secondary data included results from the SAQ, unit level patient falls and HAPU, unit staffing variables, and hospital level performance measures.

The literature review described safety climate in industry and health care, where findings were primarily directed to worker injuries and accidents. The review synthesized research in defining patient safety climate, concept development, and instrument testing finding that standardized definitions and tools are not available for measuring patient safety. Few research studies evaluated the relationship of patient safety climate to indicators of the quality and safety of patient care. Analysis of studies of nursing indicators of quality of care and hospital performance measures showed mixed evidence of the validity of these measures to reflect the patient safety in hospitals. Research in evaluating the relationship between patient safety climate and indicators of the quality and safety of patient care is limited. The overall purpose of this research study was to evaluate aims addressing these relationships: the relationship between patient safety climate, patient outcomes, unit staffing, and hospital level performance measures. Overall findings and findings from the specific aims are discussed in the following section.

Discussion of Findings

Overall Findings

Over 40% of the respondents to the SAQ were nurses, and the next largest group of respondents was nurse's aides and technicians. Findings from the study could therefore be biased toward reflecting the patient safety attitudes of these groups. The response rate to the survey was very high, over 80%, indicating either very engaged staff, or a rigorous survey implementation strategy, or both. Overall, the mean SAQ responses fell into the Neutral to Slightly agree categories, indicating that the perceived patient safety climate is not strong in the patient care units, ancillary departments, or hospitals in this sample.

Statistically significant differences in SAQ mean subscale scores were found across units and across hospitals. This finding supports the conceptual framework for this study. Institutional theory proposes organizations create systems of culture and climate that teach staff how to behave and how to conform to the values, beliefs, and intuitional work myths of the organization (Scott, 2001). This combination of shared perceptions is the culture of the group, created by staff members who have a history of working together (Schein, 2004). The work unit climate, or attitudes and perceptions of staff, is unique to that setting, and can be measured and assessed to evaluate characteristics of interest, such as safety climate, service climate, and other types of climate (Clarke, 2006b; Schneider, 1975; Schneider et al., 1998).

The patient outcome and unit staffing variables were described in this study. Falls data reflected the voluntary reporting of patient falls on the units over a three month period. Over 35% of the units reported zero falls over a three month period, and over

40% reported zero HAPU discovered during prevalence studies. These data are the same data sent by the health system to national and statewide databases. The hospitals have had these data collection processes in place at the hospitals for some time, and reliability in data reporting and collection is assumed by the health system's quality department. It is unclear if the falls reflect a typical three month period in the reporting units. The HAPU data reflects a one-time prevalence study and it is also unclear if the data are a true representation of the status of hospital acquired pressure ulcer prevalence in the hospitals. Staffing data revealed the expected pattern of higher levels of nurse staffing in ICU.

Differences were noted between the unit types in relationship to the patient outcomes in the correlation analyses. Falls in the ICU were negatively correlated with the Safety Climate and Job Satisfaction subscales; as subscale scores increased, reported falls decreased. In non-ICU, falls were positively related to staffing; as nursing hours increased, reports of falls increased. It is not known if these findings point to higher numbers of patient falls, or indicate differences in voluntary reporting of falls. A similarity between the units was that the three staffing variables were negatively associated with perceptions of the quality of the work environment. The items for the Working Conditions subscale pertain to supervising new personnel and disciplinary practices. This result suggests that when nursing hours increase, and when RN hours increase, there is decreased satisfaction with the work environment. Several factors could have influenced the responses. Increased RN percentages may reveal increased patient acuities, thereby increasing the workload. There may be differences between night and day shifts. Increasing the percentage of RN staff may not reflect the actual needs at the bedside and duties that could be done by other staff members. Staff may not feel that increasing the percentage of RN care means that there is better teamwork, or increases the quality and safety of patient care.

The Stress Recognition subscale did not correlate with the other subscales, patient outcomes, or staffing variables in either unit type for this sample. The subscale items ask for staff perceptions of how stressors such as fatigue, excessive workload, and a tense work environment influence their work performance. The Cronbach's alpha coefficient, however, demonstrated high reliability (.802) for this subscale, which supports that it is consistent in measuring the concept across multiple items (Switzer et al., 1999). The lack of association between the Stress Recognition subscale, the other SAQ subscales, and other variables supports findings from other studies (Bognar et al., 2008; Grant et al., 2006; Huang et al., 2007). Researchers have questioned whether this is an indication that health care providers do not perceive stress as influencing their decisions and actions related to providing patient care, or if there are interpretation issues by staff in understanding the items for this subscale. The subscale may not be an effective measure of evaluating the impact of stressors on performance. The subscale may need to be interpreted in conjunction with the other subscales and not on its own.

Aim 1: Describe the Patient Safety Climate at the Unit and Hospital Level

This study found significant differences in perceptions of patient safety climate across the patient units, ancillary departments, and hospitals in the sample. This finding is important because the patient safety climate in specific work areas and in hospitals varies, and therefore can be measured and evaluated. Hospital-specific findings are also important because they can be used to identify systematic weaknesses as opposed to hospital-specific performance (Singer, Gaba et al., 2009). Singer et al. propose that introducing technological or condition-specific interventions may not be successful unless the patient safety climate of a hospital is sufficiently high enough to support these measures.

Staff in ICU reported higher mean scores in Teamwork Climate and Stress Recognition, while medical-surgical units had higher scores for the Working Conditions subscale. Medical-surgical units had the lowest scores for perceptions of support for safety from unit managers. In comparing these results with previous research using the SAQ, the Job Satisfaction and Working Conditions were significantly different, ranging from low to moderate, across the ICU in a single hospital (Huang et al., 2007). Using the Patient Safety Climate in Healthcare Organizations (PSCHO) tool, emergency departments had the lowest patient safety climate, followed by medical-surgical units (Singer, Gaba et al., 2009).

Previous research has not evaluated the patient safety climate of ancillary units that work closely with nursing units in detail. Two studies discussed ancillary units. Rose et al. (2006) referenced radiology and diabetes management department patient safety climate at the overall hospital level, identifying variation in scores for a single item. Singer, Gaba, et al. (2009) found higher patient safety climate in non-clinical areas that included pharmacy and laboratory departments but did not identify specific differences between the departments. This study's results from ancillary departments show that hospital leaders have the opportunity to improve the patient safety subscale scores for these non-direct patient care areas.

The overall neutral subscale scores in this study sample for four of the seven SAQ subscales, with two of the subscales relating to management support of patient safety, signals the level of prioritization for patient safety that the patient care units and ancillary departments perceive from hospital leadership. The overall neutral scores indicate that staff do not perceive a strong message from management about the priority of safety. Measuring the patient safety climate at the unit and departmental level quantifies the attitudes of staff about protecting patients from harm and also reflects on the overall patient safety culture of the organization. Identifying what units and departments have high patient safety climate scores and exploring the characteristics of that work area can guide interventions in other units and departments to improve the climate. Certainly, the Teamwork Climate, Safety Climate, and Job Satisfaction subscale overall mean scores in the slightly agree category would challenge hospital leaders to outline goals and action plans for improving organizational scores. For example, Rose et al. (2006) discuss setting the goal of 80% strongly agree for the Teamwork and Safety Climate subscales for 80% of all clinical areas.

The results from this study found that patient safety climate differed across individual hospitals. The hospital level means for the SAQ subscales ranged from Neutral to Slightly agree. The Perceptions of Unit Management, Job Satisfaction, and Working Conditions subscales showed the highest frequency of significant differences. The description of the hospital patient safety climate in this study supported evidence from previous research that patient safety climate is unique to each hospital setting (Singer, Gaba, et al. 2009). In this study, the post hoc testing of significant ANOVA results demonstrated significant differences between hospitals. One hospital was identified as having lower scores for each SAQ subscale compared to the other hospitals. This finding points to the potential for identifying if systemic or local characteristics are influencing the perceptions of patient safety climate. In reviewing these findings the health system leadership could formulate several questions such as, what messages are being received by the hospitals regarding the system's prioritization of patient safety? What is the overall cultural message about keeping patients safe in this health care system? What hospitals have higher (or lower) patient safety climate scores and what are the characteristics of the hospitals that are determining those scores?

Aim 2: Describe the Relationship Between the Patient Safety Climate at the Unit Level and Falls and Hospital Acquired Pressure Ulcers

The hypothesis for Aim 2 was that patient safety climate was inversely associated with falls and hospital-acquired pressure ulcers. The hypothesis was not supported as none of the SAQ subscales were inversely associated with the patient outcomes, controlling for unit type.

The very high reporting of zero values for both the falls and HAPU variables is concerning for the evaluation of this aim. Possible explanations could include inadequate data collection and reporting mechanisms in the individual hospitals. Also, staff may not have a good understanding of the incident reporting policies of the hospital. Relying on voluntary incident reports is recognized as a challenge in data collection, although patient falls have been documented as most frequently reported on incident reports (Evans et al., 2006). Another explanation for the skewed falls data could be that taking the average of three months of patient falls data does not accurately reflect falls rates. Another consideration is that the hospitals may have implemented falls reduction programs that have helped to reduce patient falls, and therefore patient falls are less common.

The HAPU rate from one prevalence study during the time frame for this project may not provide enough data to accurately reflect nosocomial pressure ulcer rates. Accurate data collection is also influenced by the assessment skills and pressure ulcer identification skills of the teams who participate in the prevalence studies. The usual ongoing training for the pressure ulcer prevalence teams is conducted by the wound care nurse at each hospital, but this cannot guarantee the individual assessment skills of each team member. The data could also be a reflection of performance improvement activities that have reduced the prevalence of HAPU.

Aim 3: Describe the Relationship Between the Patient Safety Climate at the Unit Level and RNHPPD, TotNHPPD, and %RNH

The hypothesis for Aim 3 was that patient safety climate was positively associated with three unit staffing variables: RNHPPD, TotNHPPD, and %RNH. The hypotheses were not supported as the staffing variables were not associated with the SAQ subscale scores. In fact, the results were found to be the opposite of the proposed hypothesis of a positive relationship.

The interaction variable (RNHPPD in the ICU) was found to be significant for the Working Conditions subscale, suggesting that for every 1 unit (hour) increase in RHNPPD in the ICU, the Working Conditions subscale mean score decreased by .116. Other significant results found negative associations between staffing and the SAQ subscales. Increasing the %RNH by 10% decreased the mean scores for Teamwork Climate, Safety Climate, Job Satisfaction, Perception of Hospital Management, and Working Conditions. These findings are similar to findings from correlations in this study that indicated a relationship between increased nursing hours and RN staffing, and lower perceptions of patient safety climate.

The fact that ICU have higher registered nurse staffing may be a threat to the accuracy of the findings in this study. Larger samples of both ICU and non-ICU would be necessary to evaluate the relationship between staffing and patient safety climate using the SAQ. Other variables not explored in this study, such as nurses' education, nurses' job satisfaction, inpatient volume, patient acuities, skill level and other variables, could have influenced the significant findings.

Aim 4: Describe the Relationship Between the Patient Safety Climate and Hospital Performance Measures

The hypothesis for Aim 4 was that patient safety climate scores are inversely associated with hospital level performance measures related to AMI, heart failure, and CAP.

The failure rate for the CAP was the only hospital performance measure correlated with one of the SAQ subscales. The Perceptions of Unit Management subscale had a strong, negative correlation for the CAP performance measure. This indicates a relationship between lower failure rates for CAP treatments and procedures when staff perceive increased support from unit managers through adequate staffing levels, administrative support, and creating a nonpunitive environment in the unit. The performance measures are designed to reflect the teamwork and systems involved in delivering evidenced based patient care. Hospital leaders who are committed to improving patient care as evaluated by the CAP performance measure would benefit from this finding by evaluating how the relationship between patient safety climate and measurable patient outcomes can improve the reliability and safety of patient care. An additional finding was that larger hospitals cared for more complex patients as evidenced by the finding that hospital bedsize was strongly, highly correlated with hospital CMI. Bedsize was also correlated with lower failure rates for heart failure, suggesting that larger hospitals achieve higher rates of compliance with intended treatments for heart failure.

In conclusion, overall research in patient safety climate has largely been descriptive studies, assessing the climate of patient care units and hospitals. The few research studies that have evaluated outcomes of care found mixed results. One study linked several of the AHRQ Patient Safety Indicators (PSIs) to patient safety climate at the hospital level of analysis, and found that perceptions of safety from frontline staff better predicted adverse outcomes than the perceptions of safety from managers (Singer, Lin et al., 2009). Another study found no relationship between patient safety climate in VA medical center surgical services and risk-adjusted morbidity (Davenport et al., 2007). Two studies focused on the nursing unit, and the evidence for linking patient safety climate to patient outcomes was limited (Pronovost et al., 2005; Zohar et al., 2007).

The results of this study were also mixed. The patient safety climate was found to vary across patient units and ancillary departments, and between hospitals. These differences illustrate that the climate can be studied and described, and better safety climate can be identified as a benchmark for other units or across hospitals in a health system. In this study, the relationships between patient safety climate, outcomes, and staffing were not clear. Although falls were negatively correlated with the overall safety climate and job satisfaction in ICUs, hierarchical linear modeling, which controls for the non-independence of the data, did not reveal statistically significant findings. There was a negative, weak correlation between HAPU and unit staffing but statistically significant relationships between HAPU and staffing were not achieved when evaluated using hierarchical linear modeling. Correlations between the unit staffing variables and the SAQ subscale scores showed that increasing the hours of nursing care and percentage of RN hours of care decreased perceptions of the quality of the work place, including perceptions of teamwork and satisfaction with the work in the unit. Although similar results were found using hierarchical linear modeling, the very strong relationship between unit type and staffing should be considered when interpreting the results.

This study has contributed to the science of patient safety in several unique ways. The study clarified the definitions of safety culture and climate, and patient safety culture and climate. The study contributed to further evaluation of the SAQ instrument's reliability by calculating the Cronbach's alpha coefficient, finding high reliability in this sample for all of the subscales. The research used correlations and more advanced statistical analysis to evaluate relationships between the SAQ subscales and the data transmitted to the CalNOC and NDNQI databases. Although the hypotheses were not supported by the hierarchical linear modeling methods, a trend for lower perceptions of safety climate in some of the SAQ subscales when nursing hours are increased was identified.

The study also found a relationship between hospital level patient safety climate and the community acquired pneumonia performance measure. The purpose of the performance measures is as an indicator of how teams work together across units and departments to deliver required elements of patient care. This finding is aligned with recommendations by the IOM for systems approaches to improving the reliability, quality and safety of patient care (Kohn et al., 2000).

Limitations

Three limitations to the study will be addressed in this section: sample size, data quality, and outcome measures. The use of secondary datasets provides advantages and disadvantages (Jacobson, Hamilton, & Galloway, 1993). One disadvantage is the finite sample in the dataset, especially when adding to the dataset is not feasible. The sample size for the ANOVA and post hoc testing was adequate for the unit and department level of analysis (n = 97). The effect size (or strength of the association) for the differences across units in all SAQ subscale scores was verified by the Eta square calculation for the Safety Climate subscale, which found a very small effect size, or very low relative magnitude between unit Safety Climate subscale scores. In Aims 1, using the Bonferroni correction post hoc analysis for group differences identified as significant by the ANOVA test protects against Type I error (finding a difference when there is no difference). The Bonferroni test provides a conservative approach by dividing the alpha among the comparisons, and is appropriate when there are a large number of comparisons (Pallant, 2007). Type II errors (finding no differences when differences actually exist) can be avoided by increasing the sample size (not possible in this study), increasing the effect size, or by changing the level of significance (Munro, 2005). For example the p value for this study might have been set at $p = .10$ rather than .05. For the analyses of Aims 2 and 3 using hierarchical linear modeling, the Level 2 group size of 10 hospitals was adequate for fixed effects, but 30 or more groups at Level 2 would be needed to correctly estimate standard errors (Maas & Hox, 2005). For Aim 4, the correlation coefficient from this study was used as the approximate measure of effect size (.75), the alpha was set at .05, and the power at .80. To achieve statistical significance at the .05 level, the correlation coefficient would need to be <= .70 and the sample size would need to be a minimum of 13 hospitals.

The quality of the data may be a concern in secondary data analyses. The data collection procedures, variable definitions, format for acquiring the data sets, age of the data, and availability of a contact person for clarification of questions need to be considered when using secondary data (Jacobson et al., 1993). Although the data for this study were collected by others, this researcher had first hand knowledge regarding the content and collection processes for all of the data, as well as the context for data submission, which helped to decrease threats to the validity of the data. A primary contact person was identified in the quality department of the health system.

The quality of the patient outcome data was concerning in this study. The high volume of zero values for the falls and HAPU data made analysis challenging, and difficult to interpret. Incident reporting systems for the falls data is the only mechanism for gathering this data, and relying on the voluntary submission of incident reports should be acknowledged as problematic. The SAQ data were more reliable, having a high response rate and less than 3% missing values. This researcher was also personally oriented to the dataset by the developer of the instrument. Questions regarding clarification of terms, abbreviations, and sampling methods were resolved during the orientation. The hospital level data had gaps, as eight of the 10 hospitals reported AMI failure rates, and nine reported community acquired pneumonia failure rates. One hospital was deleted from the analysis because of missing data for AMI and CAP failure rates and an unverified score of 0% failure rate for the heart failure rate measure.

The outcome measures for this study, patient falls, HAPU, unit staffing, and hospital level performance measures, reflect the current status for nursing quality of care and evidence based practice the community hospitals in this study. Although research has shown mixed results regarding falls, HAPU and staffing as measures of nursing care quality, these indicators are recommended by national quality groups and are followed by state and national nursing quality of care organizations (Donaldson, Brown et al., 2005; Montalvo, 2007; National Quality Forum, 2008). The hospital level performance measures have been supported by the Centers for Medicare and Medicaid (CMS) although research is mixed as to the effectiveness of these measures in assessing and improving hospital care for selected diagnoses (Peterson et al., 2006; United States Department of Health and Human Services. Centers for Medicare and Medicaid, 2008; Werner & Bradlow, 2006).

Although the SAQ has demonstrated both reliability and validity in its ability to elicit staff attitudes to patient safety, it is a relatively new instrument, used to measure a relatively new concept. Some issues related to the SAQ could include potential difficulty for understanding the items, notably items from the Stress Recognition subscale. Although the percent of missing data was low, no correction was made for non-respondents to the SAQ in this study.

Other limitations of the study should be noted. The sample consisted of hospitals in a faith-based health system based in California and Texas. The influence of how faith-based hospitals differ from secular hospitals could not be considered. The practice variations that might be evident across states (California and Texas) were not explored, including nurse-to-patient assignments that might differ between the states. Although the hospitals are part of the same health system, individual hospital characteristics could have influenced the results.

Nurse's educational level, specialty certification, and years of experience were not factored into this study as these data were not available for all the hospitals. Possible differences between night and day shifts were not addressed. Patient level risk-adjusting was limited to assignment to unit type (ICU or non-ICU).

Implications for Nursing Practice

Findings from this study provide a foundation for further research into the relationships between patient safety climate, unit level outcomes, and hospital level outcomes. Although the small sample size requires caution in interpretation of the results, relationships specific to nursing practice were found. Two findings (a) patient safety climate varied depending on unit type and (b) increasing the registered nurse staffing levels suggests decreased perceptions of the safety on the patient care units, provides an opportunity to examine nurses' attitudes toward patient safety more closely. The next step would be to determine if these results, which are characteristic of this sample, represent nurse attitudes in other samples. Previous research has identified that nurses report more negative attitudes to unit and organizational patient safety than other professions, yet it is unknown what factors contribute to this these findings (Scherer & Fitzpatrick, 2008; Sexton, Holzmueller et al., 2006).

Future Research

The IOM recommends addressing patient safety through a systems approach, including assessment of the culture of safety (Kohn et al., 2000).There has been an explosion of patient safety culture and climate tools developed in the last decade. More research is needed to clarify definitions of patient safety, patient safety culture, and patient safety climate in order to create a common language for describing patient safety. Evaluation of the instruments used to assess patient safety is needed to ensure that the phenomenon is captured as thoroughly as possible, and to determine if there are core items essential to understanding the patient safety climate in health care overall, or if different tools are needed for different health care settings such as hospitals, long term care facilities, and ambulatory care facilities. Research is limited in identifying what factors create the patient safety climate in the work unit or in the organization. Little is known about how patient safety can be improved or the appropriate timeframes for assessing the climate. Although descriptive studies of the patient safety climate are needed, more research is needed in evaluating the relationships between patient safety climate, patient outcomes and other indicators of patient care quality. Objective measures of the quality of patient care are needed to document progress in creating a culture of safety that improves the reliability and safety of patient care (Kohn et al., 2000).

Patient safety climate may also need to be studied as a moderator of indicators of the quality and safety of patient care. A moderator is a variable that changes the association between the predictor variable (for example, actions and behaviors of staff) and the outcome variable (such as patient outcomes) (Bennett, 2000). A moderator variable affects the strength and direction of the association between the independent and dependent variables, and is a separate independent variable. Viewing patient safety climate as a moderator variable could shed light on understanding when the provider's care practices affect patient outcomes, explaining more than studies that focus on the direct effects of variables on these outcomes.

CONCLUSION

Research in patient safety climate is evolving. There is a sense of expectation that understanding the patient safety climate in hospitals and in other locations where patient care is delivered will contribute to reducing harm to patients. A systems approach to increasing the defenses against adverse events and medical errors incorporates creating a culture of safety and measuring the patient safety climate, along with use of advanced technologies, streamlining work processes, adequate provider staffing levels, and commitment of organizational leaders to safety (Page, 2004). Health care leaders have called for creating a culture of safety in which the primary focus is improving the reliability and safety of patient care. Although constrained by a small sample size, relationships between patient safety climate subscales and indicators of the quality of patient care were identified in this study. More research is needed to determine how understanding and improving patient safety culture and climate within the systems of health care delivery relates to decreasing adverse patient events and enhancing patient safety.

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APPENDIX A

University of California, San Francisco. Committee on Human Research. Approval for Exempt Status, Category 4.

************************************** **CHR Office Use Only** **

Certification of Exempt Status

______ **Category 4:** This research involves the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens. The sources are publicly available or the information is recorded by the investigator in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects.

X This study as proposed does not meet the definition of human subjects research and does not require review or certification now or in the future by the IRB as defined by the UCSF Policies and Procedures.

Exempt Certifications are valid for three years from the date of certification. The study must be re-certified by the expiration date if work is to continue. Also, re-certification is required before implementing any changes involving human subjects.

____________	12.15.08	12.15.11
Chair or Designated IRB Member	Certification Date	Expiration Date

Exempt Project Number

EXEMPT PROJECT NUMBER: 08033637

APPENDIX B

The Safety Attitudes Questionnaire

Safety Attitudes: Frontline Perspectives from this Patient Care Area

I work in the (clinical area or patient care area where you typically spend your time): This is in the Department of:
Please complete this survey with respect to your experiences in this clinical area.

- Use number 2 pencil only.
- Erase cleanly any mark you wish to change.

Correct Mark — Incorrect Marks

Please answer the following items with respect to your specific unit or clinical area. Choose your responses using the scale below:

A	B	C	D	E	X
Disagree Strongly	Disagree Slightly	Neutral	Agree Slightly	Agree Strongly	Not Applicable

Disagree Strongly / Disagree Slightly / Neutral / Agree Slightly / Agree Strongly / Not Applicable

1. Nurse input is well received in this clinical area. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓧ
2. In this clinical area, it is difficult to speak up if I perceive a problem with patient care. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓧ
3. Disagreements in this clinical area are resolved appropriately (i.e., not *who* is right, but *what* is best for the patient). Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓧ
4. I have the support I need from other personnel to care for patients. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓧ
5. It is easy for personnel here to ask questions when there is something that they do not understand. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓧ
6. The physicians and nurses here work together as a well-coordinated team. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓧ
7. I would feel safe being treated here as a patient. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓧ
8. Medical errors are handled appropriately in this clinical area. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓧ
9. I know the proper channels to direct questions regarding patient safety in this clinical area. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓧ
10. I receive appropriate feedback about my performance. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓧ
11. In this clinical area, it is difficult to discuss errors. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓧ
12. I am encouraged by my colleagues to report any patient safety concerns I may have. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓧ
13. The culture in this clinical area makes it easy to learn from the errors of others. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓧ
14. My suggestions about safety would be acted upon if I expressed them to management. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓧ
15. I like my job. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓧ
16. Working here is like being part of a large family. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓧ
17. This is a good place to work. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓧ
18. I am proud to work in this clinical area. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓧ
19. Morale in this clinical area is high. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓧ
20. When my workload becomes excessive, my performance is impaired. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓧ
21. I am less effective at work when fatigued. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓧ
22. I am more likely to make errors in tense or hostile situations. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓧ
23. Fatigue impairs my performance during emergency situations (e.g. emergency resuscitation, seizure). Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓧ
24. Management supports my daily efforts: Unit Mgt Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓧ Hosp Mgt Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓧ
25. Management doesn't knowingly compromise pt safety: Unit Mgt Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓧ Hosp Mgt Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓧ
26. Management is doing a good job: Unit Mgt Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓧ Hosp Mgt Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓧ
27. Problem personnel are dealt with constructively by our: Unit Mgt Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓧ Hosp Mgt Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓧ
28. I get adequate, timely info about events that might affect my work, from: Unit Mgt Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓧ Hosp Mgt Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓧ
29. The levels of staffing in this clinical area are sufficient to handle the number of patients. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓧ
30. This hospital does a good job of training new personnel. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓧ
31. All the necessary information for diagnostic and therapeutic decisions is routinely available to me. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓧ
32. Trainees in my discipline are adequately supervised. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓧ
33. I experience good collaboration with nurses in this clinical area. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓧ
34. I experience good collaboration with staff physicians in this clinical area. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓧ
35. I experience good collaboration with pharmacists in this clinical area. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓧ
36. Communication breakdowns that lead to delays in delivery of care are common. Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ Ⓧ

PROOF

BACKGROUND INFORMATION

Have you completed this survey before? ◯ Yes ◯ No ◯ Don't Know

Today's Date (month/year):____________

Position: (mark only one)

◯ Attending/Staff Physician
◯ Fellow Physician
◯ Resident Physician
◯ Physician Assistant/Nurse Practitioner
◯ Nurse Manager/Charge Nurse
◯ Registered Nurse
◯ Pharmacist
◯ Therapist (RT, PT, OT, Speech)
◯ Clinical Social Worker
◯ Dietician/Nutritionist
◯ Clinical Support (CMA, EMT, Nurses Aide, etc.)
◯ Technologist/Technician (e.g., Surg., Lab, Rad.)
◯ Admin Support (Clerk/Secretary/Receptionist)
◯ Environmental Support (Housekeeper)
◯ Other Manager (e.g., Clinic Manager)
◯ Other:____________________

Mark your gender: ◯ Male ◯ Female **Primarily** ◯ Adult ◯ Peds ◯ Both

Years in specialty: ◯ Less than 6 months ◯ 6 to 11 mo. ◯ 1 to 2 yrs ◯ 3 to 4 yrs ◯ 5 to 10 yrs ◯ 11 to 20 yrs ◯ 21 or more

Thank you for completing the survey - your time and participation are greatly appreciated.

PLEASE DO NOT WRITE IN THIS AREA

SERIAL

APPENDIX C

Safety Attitudes Subscale Definitions

SAQ Factor Definition	Example components from the literature
Teamwork Climate: Perceived quality of collaboration between personnel	Communication, willingness of juniors to seek help Collaboration, conflict resolution, appropriate assertiveness Collaboration between physicians and nurses; working well together, helping each other
Safety Climate: Perceptions of a strong and proactive organizational commitment to patient safety	Safety culture and priorities Lack of awareness of safety issues by senior management
Job Satisfaction: Positivity about the work experience	Individual motivation Like my job; like being a nurse
Stress Recognition: Acknowledgement of how performance is influenced by stressors	Overconfidence, being overly self-assured Influence of stress/fatigue Individual attitudes of staff
Perceptions of Hospital and Unit Management: Approval of managerial actions	Administrative and managerial support Staffing levels; managerial style that causes fear in the workplace
Working Conditions: Perceived quality of the work environment Training, supervision, disciplinary policy	Training, education and supervision of new personnel

Sexton, Thomas, Helmreich, et al., 2003. Frontline assessments of healthcare culture: Safety Attitudes Questionnaire norms and psychometric properties. Technical Report 04-01. The University of Texas Center of Excellence for Patient Safety Research and Practice. AHRQ Grant #10PO1HS115441. Retrieved March 1, 2008 from www.utpatientsafety.org

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