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Does Safety Culture Predict Clinical Outcomes?

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DOES SAFETY CUTLURE PREDICT CLINICAL OUTCOMES?

by

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ABSTRACT

Patient safety in healthcare has become a national objective. Healthcare organizations are striving to improve patient safety and have turned to high reliability organizations as those in which to model. One initiative taken on by healthcare is improving patient safety culture—shifting from one of a 'no harm, no foul' to a culture of learning that encourages the reporting of errors, even those in which patient harm does not occur. Lacking from the literature, however, is an understanding of how safety culture impacts outcomes. While there has been some research done in this area, and safety culture is argued to have an impact, the findings are not very diagnostic. In other words, safety culture has been studied such that an overall safety culture rating is provided and it is shown that a positive safety culture improves outcomes. However, this method does little to tell an organization what aspects of safety culture impact outcomes. Therefore, this dissertation sought to answer that question but analyzing safety culture from multiple dimensions. The results found as a part of this effort support previous work in other domains suggesting that hospital management and supervisor support does lead to improved perceptions of safety. The link between this support and outcomes, such as incidents and incident reporting, is more difficult to determine. The data suggests that employees are willing to report errors when they occur, but the low occurrence of such reportable events in healthcare precludes them from doing so. When a closer look was taken at the type of incidents that were reported, a positive relationship was found between support for patient safety and medication incidents. These results initially seem counterintuitive. To suggest a positive relationship between safety culture and medication incidents on the surface detracts from the research in other domains suggesting the

opposite. It could be the case that an increase in incidents leads an organization to implement additional patient safety efforts, and therefore employees perceive a more positive safety culture. Clearly more research is needed in this area. Suggestions for future research and practical implications of this study are provided.

This dissertation is dedicated to my parents who instilled in me the inspiration to set high goals and the confidence to achieve them; and to my family and friends who have been proud and supportive of my work and who have shared the many uncertainties, challenges and sacrifices for completing this dissertation.

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SECTION 1 - INTRODUCTION

Statement of the Problem

We live in a world that is filled with complexity and errors, especially within health care. Advances in technology, and a growing and aging population further complicate an already taxed system. As Gene Kranz (2000) entitled his book, "Failure is not an option", particularly when the lives of millions seeking safe healthcare treatment are at risk. Unfortunately, given the complexity and ambiguity of many tasks, long hours on-the-job, and difficult vigilance duties, even the most diligent and conscientious clinician will make errors (Leape, 1994; Risser, Rice, Salisbury et al., 1999). Reason (1990) has defined human error as any "occasion in which a planned sequence of mental or physical activities fails to achieve its intended outcome" either as a result of an inadequate plan or intended actions not going as planned (p. 9).

In an effort to protect humans (e.g., patients, staff), laws, regulations and governing agencies have been developed (e.g., Joint Commission for the Accreditation of Healthcare Organizations, JCAHO). State and federal regulations abound requiring hospitals to have safety initiatives in place and to report errors that cause harm to a patient or employee. However, despite these safety laws and regulations for organizations, a significant number of incidents continue to occur each year. The widely recognized Institute of Medicine report entitled "To Err is Human", details that each year between 44,000 to 98,000 Americans are thought to be harmed as a result of medical errors. Furthermore, research suggests that preventable adverse events are a leading cause of death in the United States (Kohn, Corrigan, & Donaldson, 1999). Approximately 15

million incidents of patient harm occur in US hospitals each year (Institute for Health Improvement, 2006), with top performing hospitals operating with 40% fewer errors than the lowest performing hospitals (healthgrades.com, 2007). Furthermore, some have estimated that approximately 70% of reported errors were preventable and at least 50% of errors that occur in healthcare are not reported (Leape, 1994). In most cases, the individual (e.g., doctor, nurse) does not intentionally commit the errors but these efforts found that the root of human error stems from many different sources including, but not limited to, faulty systems, inadequate training, procedures and/or safety culture (e.g., Helmreich & Merritt, 2000; Mearns & Flin, 1998; Wilson, Priest, Salas, & Burke, 2005).

The healthcare community has a number of taboos and perverse incentives that have helped to sustain a strong culture of resistance and secrecy around reporting and addressing errors and failure (e.g., 'no harm, no foul'). Admittedly, there will always be the risk of error where human operators are involved ("to err is human"). However, there are steps that organizations can take to reduce dangerous, sometimes lethal, incidents that stem from a poor safety culture. The dramatic rise in patient safety as a national healthcare policy initiative in the United States and a number of other industrialized nations has stimulated sustained dialogue about systems redesign, advancement of medical education and training, and culture change with the goal of moving towards a system such that errors are minimized. But process towards high reliability is slow and arduous and much can be learned from other industries such as aviation and nuclear power.

Despite the inevitability of human error, there are organizations operating in complex environments that are able to maintain an exceptionally safe workplace. These organizations, such as those within aviation and nuclear power, have been termed high reliability organizations (HROs). For example, the commercial aviation industry (Part 121 Scheduled Air Carriers) experienced only 25 accidents in 2006, two of which included fatalities—49 total fatalities to be exact (http://www.ntsb.gov/aviation/Table6.htm). These figures are exceptionally small considering the almost eight billion miles flown that year and millions of passengers aboard these flights. Due to their excellent safety records and continued effectiveness, high reliability organizations have received an increasing amount of attention within the past 15 years and other organizations, such as those in healthcare (e.g., pediatric cardiac surgery units; Carthey, de Leval, Wright, Farewell, & Reason, 2003), are striving to evolve to high reliability status (Weick & Roberts, 1993). One way that this is accomplished is by developing a culture in which safety and learning are a priority. However, limited theoretically-based research exists regarding the impact of these efforts. A search of the literature indicated 78 articles which empirically look at safety culture. However, only six of those focused on the impact of safety culture or climate on outcomes (e.g., errors, injury rates), whereas 10 focused on safety culture or climate on safe behaviors or participation in safety activities. Furthermore, many of these studies examined the impact of safety culture as a whole rather than what aspects of safety culture impacted outcomes. For example, Hofmann and Mark (2006) found that overall safety climate was significantly related to medication errors but it was not indicated as to

which aspects of safety climate most influenced these errors. It is not surprising that there is limited research in this area. This type of data is difficult to collect due to factors from limited time and resources, difficulty identifying a clear criterion and in general the low occurrence of incidents within HROs. In addition, criterion measures are difficult to identify and it is hard to control the various extraneous variables that may influence (e.g., moderate, mediate) the relationship between safety culture and clinical outcomes.

Purpose of the Current Study

Typical patient safety initiatives have focused on improving micro-levels of the organization (e.g., better training and education for staff). While this is one approach, it should not be the only approach (i.e., training and education alone may not be enough). Taking a lesson from high reliability organizations, healthcare organizations are now approaching patient safety from a macro-perspective. One way that this is being done is by addressing the organization's safety culture and climate. Much of the healthcare research examining safety culture and climate focuses on what impacts it and how to improve it. Research examining the impact of safety culture on clinical outcomes is virtually non-existent. Thus, the research proposed here seeks to investigate this seldom studied relationship.

Figure 1 provides the overarching framework for this dissertation. Specifically, this research will utilize high reliability theory (HRT) as an organizing framework and will focus on the relationship between high reliability values at the organizational level as they are manifested through employee perceptions (i.e., perceptions of safety culture) and

finally its impact on patient safety outcomes. Figure 2 presents a model that depicts the hypothesized relationships among variables in the proposed study. According to this model, the relationship between perceptions of organizational/supervisory support for safety (e.g., feedback and communication about errors) and outcomes are mediated by perceptions of staff level variables, such as teamwork and communication openness. The testing of this model should provide researchers with a better understanding of the impact of actions at all levels of the organization influence patient safety. Methodologically, this study will utilize perceptions of safety culture collected from employees within five critical care units at seven campuses within one large Central Florida hospital. Patient safety outcome data will be obtained from both survey-based data and various units responsible for maintaining incident databases within the hospital. Data analysis will utilize a multi-level approach further adding to the current research available in the literature.

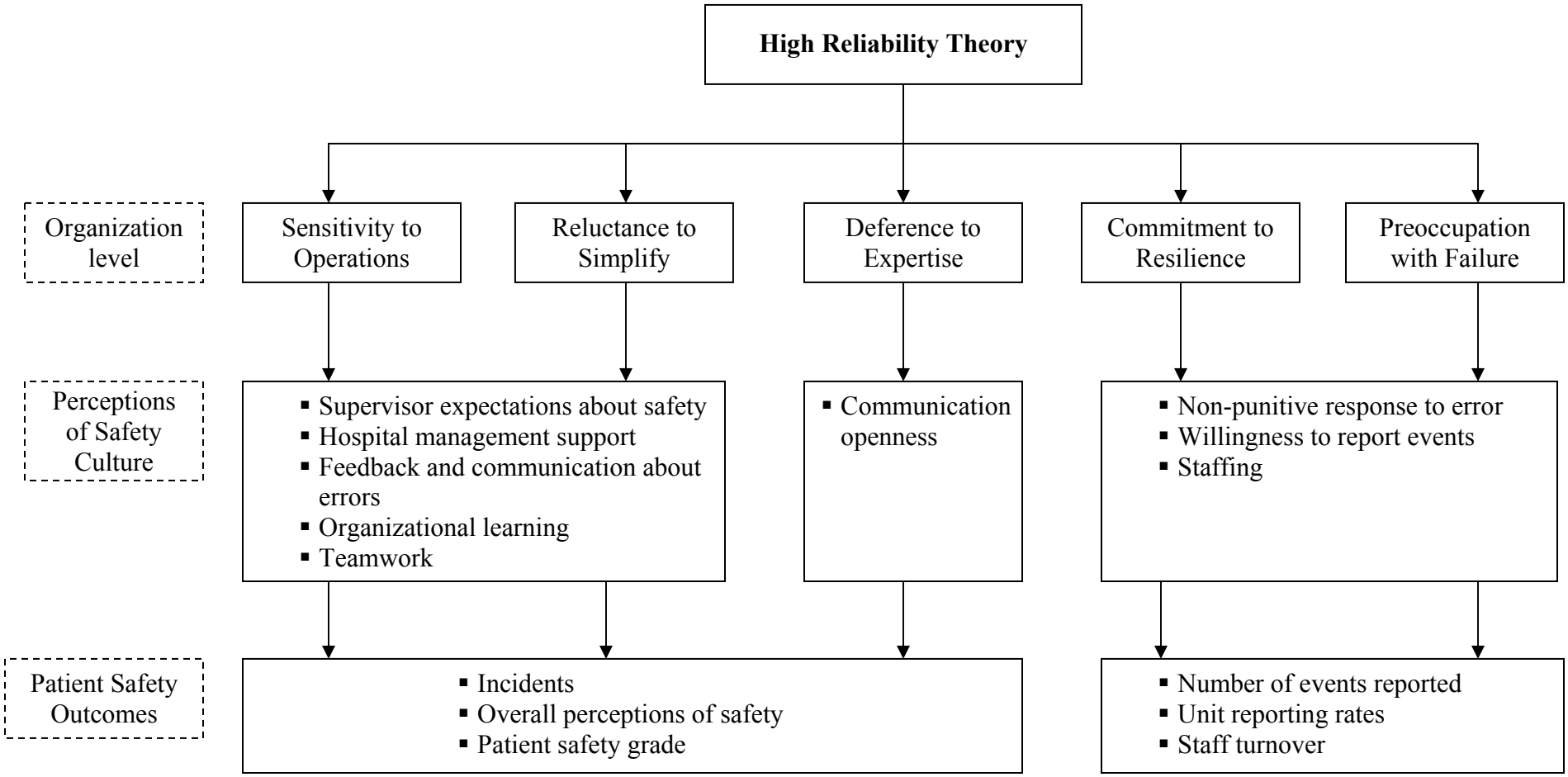

Figure 1. High reliability theory as a guiding framework

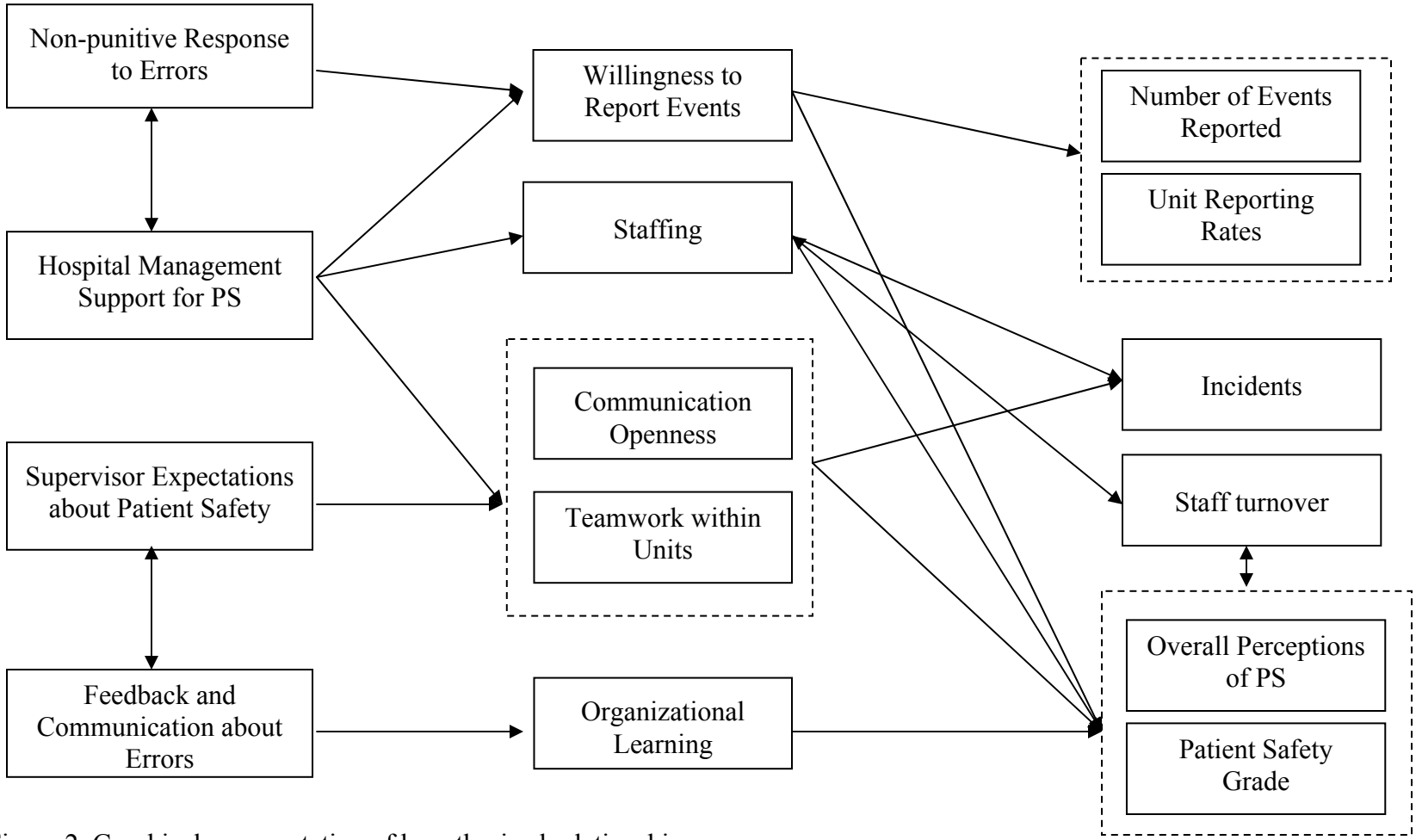

Figure 2. Graphical representation of hypothesized relationships

SECTION 2 - LITERATURE REVIEW

Safety Culture and Climate

It is clearly being recognized that facilitating a safety culture in which we learn from errors is critical to a safe environment for patients and employees. For example, the Patient Safety and Quality Improvement Act, signed by President Bush in 2005, establishes federal protections "against discovery and unauthorized disclosure of data arising from patient safety and quality improvement programs. It also provides for certification of patient safety organizations to which healthcare organizations can report this data" (http://www.medscape.com/viewarticle/532889?rss). Outside of the U.S., similar efforts ensue and building a safety culture is the first step of the U.K. National Patient Safety Association's 7 Steps to Patient Safety (NPSA, 2004).

One way that an organization's commitment to safety is manifested is through its values, and these values translate to the organization's safety culture. The safety culture is then observable through the actions and attitudes of management and employees. In this section, a brief discussion of safety culture is provided. Also relevant to this discussion is the distinction between safety culture and safety climate. While some argue that safety culture is most influential in terms of employee actions and attitudes, others argue that it is the safety climate. Further complicating the issue is the fact that others have argued that there is no difference between the two concepts, and the terms are often used interchangeably (e.g., Denison, 1996). Despite the efforts by researchers to define safety culture, making the distinction between safety culture and safety climate has

clearly encountered definitional issues (see Tables 1-3). Pidgeon (2001) states "there is currently not enough consistent (or published) data to be able to test the reliability of existing definitions or measures" of safety culture and climate (p. 54). However, more recent publications (e.g., Zhang et al., 2002) have attempted to solve such definitional issues evident in the safety literature. Furthermore, a number of surveys measuring an organization's safety culture and climate have been developed and validated in the literature (see Singla, Kitch, Weissman, & Campbell, 2006) (more later). While past efforts to define these constructs were classified as "unsystematic" and "fragmented" (Zhang et al., 2002, p. 4), a comparison of safety culture and climate by way of the available literature did yield some clear delineation between the two.

Table 1
Characteristics of Safety Culture and Climate

Safety Culture	Safety Climate
• Refers to shared values among organization members, defined at the group level. • Concerned with formal safety issues. • Relatively enduring, resistant to change, and stable. • Emphasizes contribution from people at every level of the organization. • Impacts member behavior. • Reflected in the convergence between reward systems and safety structure. • Reflected in an organization's willingness to learn from errors, accidents, and incidents.	• Refers to perceptions, a psychological phenomenon, of safety at a particular time. • Concerned with intangible issues (e.g., situational factors) • Unstable ands subject to change. • Temporal phenomena, described as a "snapshot" of safety culture.

Note: Table adapted from Zhang et al., 2002.

Table 2
Definitions of safety culture from the literature

Definition of safety culture	Domain	Reference
"The objective measurement of attitudes and perceptions toward occupational health and safety issues."	General	Coyle, Sleeman, & Adams (1995, p. 247)
"The collection of beliefs, norms, attitudes, roles and practices one uses while going about daily activities, including management decision in a broader context."	General	Toft & Reynolds (1994), as cited in Kumar & Simpson (2005, p. 330)
"'Culture' is a more complex and enduring trait reflecting fundamental norms, values, and assumptions that to some extent reside in societal culture."	Healthcare	Goodman (2003, p. 25)
"A set of norms, beliefs, attitudes and practices, regarding universal precautions, shared between people in a certain place at a certain time."	Healthcare	Lymer, Richt, & Isaksson (2004, p. 548)
"Where staff within an organisation have a constant and active awareness of the potential for things to go wrong. Both the staff and the organisation are able to acknowledge mistakes, learn from them, and take action to put things right."	Healthcare	National Patient Safety Agency (2004, p. 2)
"One in which safety is everyone's concern and there is an acknowledgement that errors can and will occur."	Healthcare	Dennis (2005, p. 51)
"The assembly of characteristics and attitudes in organizations and individuals which establishes that, as an overriding priority,…safety issues receive the attention warranted by their significance. Safety culture is attitudinal as well as structural, relates both to organizations and individuals, and concerns the requirements to match all safety issues with appropriate perceptions and action."	Nuclear	International Nuclear Safety Advisory Group (1991), as cited in Sorensen (2002)
"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."	Nuclear (adopted by healthcare)	Health and Safety Commission (1993, p. 23); adopted by Glendon & Stanton (2000); Galvan et al. (2005); Lee & Harrison (2000); McCarthy & Blumenthal (2006); Harvey et al. (2001); Cox et al. (2006)
"All forms of learned behaviors which 'add up to a shared commitment to think safely, to behave safely and toe believe and trust in the safety measures put in place by the organization.'"	Nuclear	Lee (1993), as cited in Harvey, Erdos, Bolam, Cox, Kennedy & Gregory (2002, p. 19)
"The safety culture of an organization is the product of individual and group values, attitudes, perceptions,	Nuclear	Health and Safety Commission (of Great

Definition of safety culture	Domain	Reference
competencies, and patterns of behavior that determine the commitment to, and the style and proficiency of, an organization's health and safety management."		Britain (1993)
"A subset of organizational culture, where the beliefs and values refer specifically to matters of health and safety."	Railway	Clarke (1999, p. 185)
"The shared and learned meanings, experiences and interpretations of work and safety—expressed partially symbolically—which guide peoples' actions towards risks, accidents and prevention."	Manufact-uring	Richter & Koch (2004, p. 705)
"A temporal manifestation of culture, which is reflected in the shared perceptions of the organization at a discrete point in time."	Offshore Oil	Cox & Cheyne (2000, p. 114)

Table 3
Definitions of safety climate from the literature

Definition of safety climate	Domain	Reference
"The term 'climate' best describes employee perceptions, beliefs, and attitudes."	Healthcare	Goodman (2003, p. 25)
"A subset of organizational climate, defined primarily in terms of employees' perceptions. Safety climate is the safety culture, such as it appears to and is assessed by specific healthcare workers."	Healthcare	Coyle et al. (1995), as cited in Lymer et al. (2004, p. 548)
"Molar perceptions people have of their work settings."	Construction	Dedobbeleer & Beland (1991, p. 97)
"A summary of molar perceptions that employees share about their work environments."	Industrial organizations	Zohar (1980, p. 96)
"A set of perceptions or beliefs held by an individual and/or group about a particular entity."	Manufacturing/ Produce	Brown & Holmes (1986, p. 455)
"Perceptions of management's commitment to safety, employee ownership of safety related issues, stereotyping of safety conscious employees, adherence to safety rules and procedures, and the existence of proactive approaches to managing safety."	Manufacturing	Garavan, & O'Brien (2001, p. 146)

Based primarily on the research revolving around organizational culture, the term safety culture did not become 'popularized' until the late 1980s following the Chernobyl disaster (e.g., Mearns & Flin, 1999; Glendon & Stanton, 2000). It was cited, for the first time, that a poor safety culture contributed to this major catastrophe (Zhang, Wiegmann, von Thaden, Sharma, & Mitchell, 2002). The atomic and nuclear power plant industries began the push to define safety culture and were quickly joined by other industries experiencing their own disasters (e.g., King's Cross fire, Piper Alpha oil platform explosion, Challenger and Columbia space shuttle disasters; see Pidgeon, 1998; Pidgeon & O'Leary, 2000; Reason, 1990; Zhang et al., 2002). The Institution of Occupational Safety and Health (1994, as cited in Glendon & Stanton, 2000) reviewed the many definitions of safety culture and narrowed them down to three. Their findings suggest that the meaning of a safety culture includes or refers to: (1) aspects of organizational culture that related to safety (e.g., norms, policies), (2) common values, beliefs, attitudes, and behaviors regarding safety, and (3) the joint values, attitudes, competencies, and behaviors of individuals and groups that establishes an organization's commitment to, and style and proficiency of its safety program. Similarly, Pidgeon (1991) argues that safety culture may be a useful tool in risk management and can be defined under one of three headings: (1) norms and rules for dealing with risk, (2) attitudes towards safety, and (3) the capacity to reflect on safety practices. In addition, safety culture can be approached from two perspectives as: (1) something an organization *has* (i.e., structures, practices, controls, and policies designed to promote safety), or (2) something an

organization *is* (i.e., beliefs, values, and attitudes of organizational members regarding safety; Reason, 1998). Finally, safety culture is recognized as a higher-level construct, which ultimately influences safety climate. It can be seen from these definitions and from many others (see Table 2) that safety culture is seen as relating to an individual, group, or organization's practices and *attitudes*.

Safety climate, in comparison to safety culture, is defined more as *perceptions* regarding safety rather than practices or attitudes (Guldenmund, 2000) and is a part of organizational climate (Coyle, Sleeman, & Adams, 1995). Schneider (1990, as cited in Hofmann & Stetzer, 1998) defines safety climate as an individual's perceptions regarding events, practices, procedures, and behaviors that are rewarded, supported, and expected for safety in an organization. Similarly, others define safety climate as the summary of beliefs and perceptions of workers about safety in organizations (Williamson, Feyer, Cairns, & Biancotti, 1997; see also Table 3). Unlike safety culture which was derived from the literature regarding organizational culture, safety climate is rooted more in empirical research (Glendon & Stanton, 2000; also see Brown & Holmes, 1986; Flin, Mearns, O'Connor, & Bryden, 2000; Williamson et al., 1997; Zohar, 1980) and is most often assessed by questionnaires attempting to get at certain safety dimensions.

How is a Patient Safety Culture Measured?

Typically, safety culture is measured using self-report surveys, gathering data on individual perceptions regarding overall perceptions of safety culture or organizational

and management support for safety. However, this provides a limited picture of what factors truly impact safety culture. In other words, safety culture manifests itself in more ways than just organizational level and management support, namely staff level factors such as teamwork (see Figure 2). Within healthcare, there are a number of measures available in the literature that examine the patient safety culture of an organization. It has been argued in naval and commercial aviation that the administration of safety culture surveys is a useful component of efforts to improve safety culture (e.g., Sexton, Thomas, & Helmreich, 2000; Gaba, Singer, Sinaiko et al., 2003), and other communities, such as healthcare, are following suit. The most comprehensive review of healthcare efforts to date was conducted by Singla and colleagues (2006), who reviewed 13 different instruments used within the community. The general purpose of these measures is to assess attributes of the organization which are malleable, so that interventions can be introduced within those areas in which a problem is identified. Singla et al. (2006) reviewed each of the measures to identify the dimensions assessed, as well as to evaluate the measures for validity and usability. Of these 13 measures, two were selected as being a cut above the rest—the Agency for Healthcare Research and Quality (AHRQ) Hospital Survey on Patient Safety (HSOPS) and the Safety Attitudes Questionnaire (SAQ). These instruments were selected for their psychometric properties, indicating that these measures are reliable and valid, as well as for inclusion of dimensions beyond the organization and management support level, specifically, dimensions related to teamwork or communication. In addition, both the HSOPS and SAQ surveys provide users with the ability to benchmark safety culture within one's unit or hospital with others. Table 4

compares the dimensions tapped by the HSOPS and SAQ. As will be discussed further in the methods section, this dissertation focuses on the use of the HSOPS due to the fact that the inclusion of more dimensions would be more diagnostic of the hospital's patient safety culture. For example, instead of generating an overall score for perceptions of management as measured by the SAQ, the HSOPS breaks this dimension down further to focus on supervisor expectations and actions promoting safety, organizational learning, and feedback and communication about errors, to name a few. The dimensions measured by the HSOPS will be integrated into the discussion provide next, as hypothesized relationships are proposed.

Table 4
Comparison of dimensions measured by HSOPS and SAQ

HSOPS	SAQ
Patient Safety Grade	Safety climate
Overall Perceptions of Safety	Safety climate
Frequency of Event Reporting (i.e., willingness to report errors)	Safety Climate
Supervisor/manager expectations & actions promoting safety	Perceptions of management
Organizational Learning—Continuous improvement	Perceptions of management
Communication Openness	Perceptions of management/ Teamwork climate
Feedback and Communication about Error	Perceptions of management
Non-punitive Response To Error	Perceptions of management
Hospital Management Support for Patient Safety	Perceptions of management
Teamwork Within Hospital Units	Teamwork climate
Teamwork Across Hospital Units	Teamwork climate
Hospital Handoffs & Transitions	Teamwork climate
Staffing	Working conditions
Number of Events Reported	N/A
N/A	Job satisfaction
N/A	Stress recognition

High Reliability Theory (HRT)

The guiding framework for this dissertation focuses on that of high reliability theory (HRT). HRT posits that organizations are capable of functioning within hazardous environments because of their complexity (e.g., components have multiple functions) and tight coupling (e.g., time dependent operations, specialized personnel) (Rijpma, 1997; Roberts, 1999; Perrow, 1984). Furthermore, HRT suggests that accidents occur because human operators of complex systems are not complex enough themselves to sense and anticipate problems that may be generated by the system (Ruchlin, Dublin, & Callahan, 2004), and therefore, organizations prevent accidents through organizational design and management (Pizzi, Goldfarb, & Nash, 2001). However, high reliability organizations also recognize the importance of other levels within the organization that impact safety, namely technical and social (i.e., teams) redundancies to enhance reliabilities (LaPorte & Consolini, 1991; Tamuz & Harrison, 2006; Wilson et al., 2005).

To successfully manage the factors at multiple levels, HRT suggests that an organization's "mindfulness" or their ability to exhibit "a pattern of heedful interrelations of actions" (Weick & Roberts, 1993, p. 357) has allowed them to reach their high reliability status. Furthermore, mindfulness at the organizational level is comprised of a commitment to certain values and actions—specifically, commitment to resilience, sensitivity to operations, deference to expertise, reluctance to simplify, and preoccupation with failure (Weick & Sutcliffe, 2001). Finally, in addition to holding the values previously mentioned, high reliability organizations enhance their commitment to

excellence by (a) anticipating dangers that may arise, while coping with dangers that occur (Wildavsky, 1988), (b) actively seeking knowledge about what they don't know, (c) designing reward systems that recognize both the cost of failures and the benefits of reliability, and (d) communicating the whole picture to all levels of the organization (Roberts & Bea, 2001). Thus, the successful combination of these values and characteristics, which are argued here to manifest through a culture of safety, allows high reliability organizations to reduce and mitigate errors.

One of the most widely discussed instances of HROs, and one that healthcare and other organizations can learn from, is the US Naval aircraft carrier fleet (Rochlin, La Porte, & Roberts, 1987). Each carrier, acting like its own 'organization', successfully conducts flight operations at sea while pushing the "edge of the envelope" (Rochlin et al., 1987, p. 76) in conditions that are extreme, complex, and unpredictable. Furthermore, while operations manuals are available to dictate specific procedures and tasks at the micro level, lacking is a discussion of how to integrate this into the greater whole. As if this weren't enough, approximately every 40 months, there is almost 100% turnover of all officers and crew, as each member gets reassigned to a different duty. The ability of the US Navy to maintain successful operations despite these challenges ensures its status of high reliability. So, how do they do it? First, the system operates with a set of redundancies—technical (e.g., computers, radar), supply (e.g., extra aircraft parts), decision/management (e.g., cross checking and fail-safe redundancy). In addition, the US Navy addresses the high turnover rate on carriers by training officers with general rather than specific skills that are transportable from job to job, as well as struggling to maintain

morale and unit cohesion. Finally, the fleet remains adaptable within its day-to-day operations (e.g., flight operations, planning) by 'disregarding' rank with the interest of safety. This does not mean that the steep hierarchy of rank is unimportant. Rather, the organization recognizes that each member brings his/her unique perspective and expertise to the table and that in some instances, following a chain of command is not practical if a mishap is to be averted. For example, the lowest ranking individual can suspend flight operations immediately in the interest of safety without clearance from supervisors.

But critical to the success of HROs is not just organizational support for safety, but also more micro-levels of the organization. Specifically, individuals and teams embedded within the organization are a critical factor playing into the success of a high reliability organization. Wilson et al. (2005) extracted from the high reliability organization and team literatures, arguing that to become a high reliability team, team members must exhibit behaviors that facilitate those characteristics and values held by the organization within which they operate, for example, communication, mutual performance monitoring, back up behavior, and assertiveness. While the teamwork behaviors described are those that may be exhibited by non-high reliability teams, high reliability teams differ in that they are able to consistently and effectively demonstrate these behaviors over time in complex, dynamic environments while working under high levels of stress.

Given the success of high reliability in organizations (e.g., naval and commercial aviation, nuclear), the healthcare community has begun to take strides to achieve this status. In line with the discussion of US Naval aircraft carriers, healthcare utilizes

redundant systems at the micro-level, such as technology (e.g., automated medication dispensing units) and teamwork (e.g., team members monitor performance and call a "time out" should they feel patient safety is in jeopardy). In addition, a number of macro-level patient safety initiatives have been taken, including executive walk rounds (e.g., Thomas, Sexton, Neilands, Frankel & Helmreich, 2005), Comprehensive Unit-based Safety Program (CUSP), and crisis resource management training (e.g., Howard, Gaba, et al., 1992). Each of these serves the purpose of demonstrating management support for safety, and thus promoting a safety culture within organizations. At the micro-level, teams in the health care community that may be considered high reliability teams include (but are not limited to) surgical teams and emergency room teams, or any set of two or more team members who consistently and effectively work interdependently towards a shared goal in a complex environment (i.e., high risk environments). In the next section, a discussion of how the macro and micro levels of the organization relate to safety culture in organizations.

HRT and Safety Culture

As previously mentioned, there is a set of core values which sets HROs apart from other organizations—sensitivity to operations, reluctance to simplify interactions, preoccupation with failure, commitment to resilience, and deference to expertise (Weick & Sutcliffe, 2001). The first three values aid in anticipating and becoming aware of the unexpected, as these organizations recognize that "human fallibility is like gravity,

weather, and terrain, just another foreseeable hazard" (Reason, 1997, p. 25). In addition, they enlist two further values—commitment to resilience and deference to expertise—to contain and mitigate the unexpected. Taken together these values combine to "induce a state of collective mindfulness that creates a rich awareness of discriminatory detail and facilitates the discovery and correction of errors" (Weick et al., 1999, p. 81). While these values are not directly observable, they manifest themselves throughout the organization (i.e., safety culture) and are thus translated to management and staff attitudes and actions.

In this section, a discussion is provided regarding the research conducted on safety culture and climate, using the values posited by HRT as a framework. It is recognized that these values do not operate independently within organizations, however, the discussion attempts to categorize pockets of the literature under just one category for succinctness. Furthermore, while this dissertation is focusing on the healthcare industry, a thorough discussion of safety culture in the community is lacking. Therefore, the search was broadened to both HRO and non-HRO communities beyond healthcare to provide a complete picture of the research that has been conducted (see Table A.1 in APPENDIX A: SUMMARY OF SAFETY CULTURE LITERATURE).

Sensitivity to Operations

Sensitivity to operations is evident within HROs by their concern with the unexpected, attention to the operational environment and those on the front line, and the acknowledgement that the cause of an accident is often complex (i.e., not the result of a

single, active error) (Weick & Sutcliffe, 2001). Building from Reason's (1990) Swiss Cheese Model regarding accidents, these organizations acknowledge that many errors remain latent, embedded within the operational system until just the right combination of errors occur which lead to an adverse event (Roberts & Bea, 2001; Maurino, Johnston, Reason, & Lee, 1995). Sensitivity to operations is promoted in HROs through supervisor and management support of day to day activities. Its purpose is to set the tone in the organization and its work units by continuously monitoring and discussing events as they occur so as to promote patient safety. Success depends on maintaining a clear picture of what is going on (i.e., situation awareness) and filtering this information to all levels of the organization.

Supervisors and organization management can promote a sensitivity to operations by supporting error detection, providing feedback to employees regarding errors, and communicating about how these errors can be prevented in the future. Research has indicated that management commitment to safety in manufacturing-type industries is an indicator of a positive safety culture (e.g., Rundmo, 1994; Zohar, 1980; 2000), and its approach to safety has been linked to a reduction in incidents in three studies. For example, Katz-Navon, Naveh, & Stern (2005) found that management support for safety (i.e., safety placed as a priority) moderated the relationship between safety procedures and number of treatment errors in healthcare. Similarly, O'Toole (2002) found that upper management's approach to safety was a significant factor in the reduction of mining and construction injury rates. Finally, Zohar (2000) found that supervisor actions and expectation were significant predictors of minor injuries in a metal processing plant.

These studies suggest that how management approaches and promotes safety has a significant effect on incidents.

Other research suggests that a positive safety culture is associated with a commitment from upper level management that supports and encourages safety policies and procedures. For example, Zohar (1980) found that management commitment to safety was a major factor influencing success of safety programs in a number of industrial factories. In 2000, Zohar also found that perceptions of positive supervisor expectations towards safety resulted fewer lost-days due to accidents. Zacharatos, Barling and Iverson (2005) investigated the relationship between management practices and occupational safety. They found that the two were related and the relationship was mediated by safety climate and trust in management. Likewise, Cox and Flin (1998) found in 13 manufacturing companies that management actions for safety was the strongest predictor employee actions. Margolis (1973, as cited in Coyle et al., 1995) found similar results. Forgaty and Shaw (2003) found that management attitudes and group norms were significant predictors of violation behavior in aircraft maintenance workers. Finally, additional research suggests that a lack of management commitment leads to lack of trust, poor communication, and a lack in confidence in management (Cooper & Phillips, 1994 as cited in Clark, 1999; Dedobbeleer & Beland, 1991). These studies indicate the importance of supervisor support in a safety culture in a number of industries, and possibly in reducing incidents (e.g., errors).

Hypothesis 1. Supervisor expectations about patient safety are significantly related to incidents, specifically positive perceptions of supervisor expectations will result in fewer incidents.

Hypothesis 2. Supervisor expectations about patient safety are significantly related to overall perceptions of safety, specifically positive perceptions of supervisor expectations will result in higher levels of overall perceptions of safety.

Hypothesis 3. Supervisor expectations about patient safety are significantly related to patient safety grade within units, specifically positive perceptions of supervisor expectations will result in a higher patient safety grade.

Hypothesis 4a. Hospital management support is significantly related to number of events reported, specifically when hospital management supports patient safety a greater number of events will be reported.

Hypothesis 4b. Willingness to report events partially mediates the relationship between hospital management support for safety and number of events reported.

Hypothesis 5a. Hospital management support is significantly related to unit reporting rates, specifically when hospital management supports patient safety there will be a higher ratio of events reported to patient days within units.

Hypothesis 5b. Willingness to report events partially mediates the relationship between hospital management support for safety and unit reporting rates.

Hypothesis 6. Hospital management support for safety is positively related to overall perceptions of safety.

Hypothesis 7. Hospital management support for safety is positively related to patient safety grade.

Related to setting appropriate expectations regarding safety, management must also provide feedback to employees on their safety performance. Without support from those said to be enforcing safety, employees will have little motivation to adhere to the safety policies and procedures. Research suggests that reinforcing positive safety behaviors through feedback and praise may lead to improved safe practices (e.g., Hopkins et al., 1986; Komaki, Barwick, and Scott, 1978; Sulzer-Azaroff, Loafman, Merante, & Hlavacek, 1990; Komanki, Collins, & Penn, 1982). For example, research conducted by Komanki and colleagues (1980; 1982) indicates that consequent feedback rather than antecedent feedback results in performance improvements. In addition, it was found that feedback provided directly to employees versus their supervisors was more effective in reducing injuries and illness (Saari & Näsänen, 1989). Similarly, Laitinen and Ruohomaki (1996) found that providing weekly feedback regarding safety to workers at Finnish building construction sites led to higher safety levels in the workplace. Finally, Cooper (2006) found that management support and feedback were significantly related to behavioral safety performance. These studies indicate that the more that employees feel that management is committed to safety and their use of safe practices, as demonstrated by providing feedback for example, the more likely that employees' attitudes will become more positive and performance will improve. However, like that of supervisor expectations, the relationship between feedback and communication about errors to safety and behaviors has not been made in healthcare. However, it is expected that when

greater feedback is provided, employees will be more likely to follow safe care practices, including reporting errors when they occur.

Hypothesis 8a. Feedback and communication about errors is positively related to overall perceptions of safety.

Hypothesis 8b. Organizational learning partially mediates the relationship between feedback and communication about errors and overall perceptions of patient safety.

Hypothesis 9a. Feedback and communication about errors is positively related to patient safety grade within units.

Hypothesis 9b. Organizational learning partially mediates the relationship between feedback and communication about errors and patient safety grade.

Hypothesis 10. Feedback and communication about errors will be positively correlated with supervisor expectations about patient safety.

Reluctance to Simplify

There is a desire in organizations to want to simplify a situation in order to increase predictability and reduce complexity. HROs recognize that when simplified too much this tact can be harmful to the organization and information may be lost. Often when things are simplified the human in the loop tends to assume that there are limited ways to achieve a certain goal or end state. These inflexible expectations can lead to disconfirming or novel evidence being ignored or misinterpreted for once the cognitive

structures containing expectations are created, they are very resistant to change. HROs exhibit a reluctance to simplify by supporting and promoting (through management attitudes and actions) those working at the front line (i.e., the sharp end), specifically by promoting and encouraging interaction between people who have diverse expectations and backgrounds (Weick & Sutcliffe, 2001). This interaction also helps the organization to expect the unexpected and remain adaptive by providing different viewpoints on the same problem or environmental cue. These interactions may include coordinating with providers within the same department or unit (e.g., physicians with nurses) or coordinating across units (e.g., nurses with pharmacists). HROs recognize the importance of effective communication and coordination strategies. Communication and coordination in HROs may include coordinating within the same department (e.g., between nuclear power plant operators) or across departments (e.g., coordination in air traffic control between ground controllers and local air controllers). Similarly in healthcare, communication and coordination (i.e., teamwork) must occur not only within units but also across units, where different policies and procedures may be in place adding additional challenges. For example, within hospital units, patients are handed off from one shift to the next. It is important that team members of shift A fully communicate all critical information regarding a patient to team members of the oncoming shift B. Teamwork is also needed across units; for example, as patients are transferred from one unit to the next or when a procedure or medication is requested from another department (e.g., laboratory or pharmacy, respectively). Therefore, the importance of effectively communicating and coordinating is of the utmost importance.

Teamwork in healthcare

HROs encourage teamwork on the front line as the first line of defense in detecting errors (Baker, Day & Salas, 2006), and JCAHO is following suit (JCAHO, 2002). The importance of teams in healthcare is being recognized as physicians, nurses, technicians, pharmacists and other healthcare providers must communicate, coordinate and cooperate in an effort to ensure quality patient care (Salas, Wilson, Murphy, King & Salisbury, in press). Each member brings his/her own expertise to the table and a proper 'check and balance system' encourages team members to question the actions and decisions of each other (i.e., the "collaborative care model"; JCAHO, 2002). The purpose of this model is to encourage decision making, problems solving, goal setting and sharing of patient care responsibilities through teamwork behaviors such as briefing (e.g., surgical team briefs a procedure prior to surgery), performance monitoring and back up behavior (e.g., a nurse recognizes that a patient is allergic to the medication a physician has prescribed), assertiveness (e.g., a nurse calls a 'time out' due to a concern for patient safety), and leadership (e.g., the resident on call sets the tone for the night shift in the emergency department) (Wilson et al., 2005). However, failures in teamwork continue to occur, primarily communication, and are a leading cause of patient harm (JCAHO, n.d.). In a study by Lingard and colleagues (2004), 36.4% of communication failures in the operating room resulted in an observable effect on patient care (e.g., inefficiency, team tension, resource waste, care delay). In another study, Thomas, Sexton, Lasky, Helmreich, Crandell and Tyson (2006) found correlations between teamwork behaviors

and perceptions of overall quality in neonatal care (e.g., resuscitation, labor and delivery). Specifically, communication (i.e., information sharing and inquiry) and leadership (i.e., assertion, intentions shared, evaluation of plans and leadership) were significantly correlated with nurses' rating of overall quality of care. In addition, communication and management (i.e., workload management and vigilance) were significantly correlated with compliance with the Neonatal Resuscitation Program's (NPR) steps for administering care.

Also within the realm of teamwork is communication and coordination during handoffs, an area which has been studied in a number of HRO communities. For example, Patterson, Roth, Woods, Chow and Gomes (2004) observed 21 handoff strategies in four high consequence domains—space shuttle mission control, nuclear power, railroad dispatch and ambulance dispatch. A majority of strategies observed across disciplines included improving handoff efficiency and effectiveness, increasing access to data, improving coordination with others and enabling error detection and recovery. Like HROs, healthcare organizations consist of a number of tightly coupled work units (e.g., emergency room, intensive care units, surgical department), however, healthcare organizations are more loosely coupled when referring to interactions across units (Pinelle & Gutwin, 2006). This loose coupling makes it difficult to share information across units and increases the likelihood of errors. For example, Flin and colleagues (2003) found that more than 50% of operating room personnel who participated in their study indicated that they feel uncomfortable telling team members from other disciplines that they need to take some sort of action. Other breakdowns occur

during handoffs between shifts within the same unit or when transitioning a patient to another unit. A notable example of this type of breakdown occurred when a physician failed to follow up on test results of a patient which led eventually to a misdiagnosis and death of the patient (Gandhi, 2005). Cited was a failure of providers to clearly establish primary responsibility for following up on such tests (i.e., diffused responsibility). In another case, a patient, Willie King, had the incorrect leg amputated after the surgery pool nurse failed to alert the surgery shift nurse during the handoff that the incorrect leg was inputted by the clerk for amputation (Cook, Woods, & Miller, 1998, as cited in Patterson et al., 2004). Gandhi et al. (2006) found that handoffs contributed to approximately 20% of errors in ambulatory settings.

New communication techniques are being promoted by hospital management. For example, the SBAR technique was introduced in 2004 and is being implemented in hospitals nationwide as a means to improving communication during handoffs and transitions (Leonard, Graham, & Bonacum, 2004; Carroll, 2006). SBAR stands for Situation (i.e., "what is going on with the patient?"), Background (i.e., "what is the clinical background, or context?"), Assessment (i.e., "what do I think the problem is?") and Recommendation (i.e., "what would I do to correct it?") (Leonard et al., 2004, p. i86). The goal of these techniques is to improve teamwork so as to reduce the risk of incidents.

The research described in the preceding sections supports the notion that supervisor and management support for patient safety and frontline staff teamwork both impact performance. However, it is unlikely that supervisor support and teamwork

operate independently. One influences the other and research shows that this influence starts at the top and trickles down to lower levels. However, the relationship between supervisor and management support, teamwork and outcomes has yet to be studied. It is, thus, argued here that teamwork will mediate the relationship between supervisor and management support for patient safety and patient safety outcomes.

Hypothesis 11. Teamwork partially mediates the relationship between supervisor expectations and incidents.

Hypothesis 12. Teamwork partially mediates the relationship between supervisor expectations and overall perceptions of safety.

Hypothesis 13. Teamwork partially mediates the relationship between supervisor expectations and patient safety grade.

Hypothesis 14. Teamwork partially mediates the relationship between hospital management support and incidents.

Hypothesis 15. Teamwork partially mediates the relationship between hospital management support and overall perceptions of safety.

Hypothesis 16. Teamwork partially mediates the relationship between hospital management support and patient safety grade.

Preoccupation with Failure

As HROs are characterized by the minimization of error, they have fewer learning opportunities than most organizations. However, HROs remain preoccupied with their

failures, no matter how big or small, and even minor mishaps serve as learning opportunities (Weick & Sutcliffe, 2001). Rather than dismissing an error that did not result in failure as a stroke of bad luck, they view these events as a signal that something may be wrong in the system. HROs preoccupation with failure can be seen in the frequency of incident reviews, the reporting of errors no matter how inconsequential, and an obsession with the liabilities of success (e.g., complacency, temptation to reduce safety margins). HROs combat potential liabilities of success through the recognition that human error is inevitable and do not let their guard down. Preoccupation with failure can be promoted by encouraging staff to report errors when they occur, and shifting from a culture of blame to a culture of learning so that errors can be prevented in the future.

Culture of learning and error reporting

Within the healthcare community, there is a tendency "to turn medical mistakes resulting in death into tragedies calling for criminal investigation" (Holbrook, 2003, p. 1119). Furthermore, "punishment drives reporting of errors underground, preventing the very systems examination that is needed to discover and correct the underlying causes" (Leape, 2000, p. 2). This fear of punishment, without a doubt, encourages providers to cover up their mistakes. When evidence exists that negligence was involved, the punishment must fit the crime. What about those instances when faulty systems lead to a tragic event? When a series of inconsequential mistakes (in isolation) line up just perfectly to create a fatal outcome—what then? Should these mistakes be punished? Who

do we blame? After all, we know that human error is inevitable. But, humans are at the sharp end and in general are the last line of defense in preventing (or contributing to) a tragedy. Therefore, they are often easiest to blame and usually are.

But not all errors lead to a tragic ending, contributing to the mentality of 'no harm, no foul'. These errors are covered up to avoid persecution. Unfortunately, it is likely these same errors that on another day may lead to a more severe outcome. However, if we do not know what is broken, how can we fix it? How can we prevent these errors from occurring? In many HROs, the likelihood of a reportable error is few and far between. Therefore, HROs encourage the reporting of errors in which no harm has been committed. This is accomplished through a culture of learning, one in which employees are encouraged to learn from their mistakes, not hide them and cover them up. HROs do not attempt to hide the fact that human error is inevitable. However, they seek to avoid, trap, or mitigate the consequences of such errors by encouraging employees to routinely check for errors (Helmreich, Merritt, & Wilhelm, 1999). This encouragement starts at the top levels of the organization (i.e., management) and filters down to the sharp end. The purpose is not to place blame and point fingers when an error occurs (Hofmann & Stetzer, 1998; Westrum, 1987, as cited in Pidgeon & O'Leary, 1994). Rather, the cause of the error(s) is investigated (not just the outcome of the incident) and when its cause is determined, the whole organization learns from it (Barling & Zacharatos, 1999).

In light of the above discussion, it is no surprise that most individuals do not want to admit their mistakes. In the past, errors in healthcare have often justified and rationalized due to the complex and subjective nature of medicine (Pietro et al., 2000). To

further complicate the issue, healthcare providers are not obligated to report errors that do not meet certain criteria. In a study that looked at the impact of mandatory, non-confidential error reporting systems, it was found that these systems highly discouraged error reporting (Weissman et al., 2005). Reasons provided for not disclosing or further investigating errors are risk of negative publicity and legal actions, high costs, lack of standards for what is an unacceptable error, and lack of justification to conduct such an investigation (Pietro et al., 2000). However, in a study conducted by Carroll and Edmondson (2002), it was found that teams who were able to openly discuss adverse experiences that occurred in the operating room excelled at learning over teams who faced communication barriers. Mohr, Abelson, & Barach (2002) suggest that a culture of learning is a useful intervention for improving patient safety. In other words, in environments where there was a fear of retribution for reporting an error (i.e., a lack of a non-punitive culture), employees will tend not to report errors that aren't deemed 'reportable' (e.g., where patient harm occurred), therefore resulting in lost data points from which to learn. Given what we know regarding the influence of upper level management, it is expected that hospital management support for patient safety initiatives would be highly related to whether or not a non-punitive culture is in place.

To overcome these barriers, one HRO community (i.e., aviation) has encouraged a culture of learning by utilizing an anonymous, voluntary reporting system. The Aviation Safety Reporting System (ASRS) was developed by the National Aeronautics and Space Administration (NASA) for the aviation community, allowing general and commercial aviation pilots and/or crewmembers to report errors and unsafe acts that

occurred during a flight without providing discernible information about themselves. The aviation industry has been extremely successful since its inception and receives more than 32,000 reports each year (Orlady & Orlady, 1999). The data collected from ASRS has allowed the aviation community to react to errors proactively by incorporating critical incidents that occur frequently into training (Sexton, Thomas, & Helmreich, 2000). The data is not only useful for training purposes, but it is also provides an awareness to other aviation professionals via publication in periodicals and the Internet. The success of ASRS has led to the development of similar systems in other organizations, for example the healthcare, nuclear and petrochemical domains (e.g., Kohn, Corrigan, & Donaldson, 1999; Helmreich, 2000). This is encouraging given the high number of errors that occur each year, especially in healthcare.

Hypothesis 17. Hospital management support for safety is positively correlated with a non-punitive response to error.

Hypothesis 18a. A non-punitive response to errors will be significantly related to number of events reported, specifically when a non-punitive culture is in place employees will report more events they observe.

Hypothesis 18b. Willingness to report events partially mediates the relationship between a non-punitive response to errors and number of events reported.

Hypothesis 19a. A non-punitive culture will be significantly related to unit reporting rates, specifically when a non-punitive culture is in place there will be a higher ratio of events to patient days within units.

Hypothesis 19b. Willingness to report events partially mediates the relationship between a non-punitive response to errors and unit reporting rates.

Commitment to Resilience

Most organizations focus almost to exclusion on anticipating unexpected events. While HROs anticipate where possible, they also recognize that within complex environments the ability to perfectly predict the unexpected is almost impossible due to weak signals and uncertain environments (Weick & Sutcliffe, 2001). Therefore, in addition to anticipation HROs promote a commitment to resilience or the ability to recover from errors. Whereas anticipation seeks to perfectly predict and therefore avoid unexpected events, resilience is concerned with containing or managing those unexpected events that have already happened.

Building off the work of Wildavsky, resilience has been defined as being "mindful about errors that have already occurred and to correct them before they worsen and cause more serious harm" (Weick & Sutcliffe, 2001, p. 67). While the concept of resilience admits to the fact that organizations may have to play 'catch up', a strategy which balances anticipation with resilience is safer than one that relies on anticipation alone. Specifically, it has been argued that an organizational strategy which commits solely to anticipation is dangerous within complex environments for it presumes a level of understanding that is impossible to obtain and provides a false sense of security (Weick & Sutcliffe, 2001). Commitment to resilience can be promoted in healthcare

through management support for patient safety (e.g., appropriate resources, such as adequate staffing) and the development of a learning culture (see above discussion). As a discussion of the importance of a learning culture has already been discussed, here a discussion of the importance of adequate resources, specifically staffing, in HROs is provided.

Staffing

Staffing in organizations, especially healthcare, is of the utmost importance. After all, it is the front line staff that has direct contact with the patient. Furthermore, staff members are the last line of defense in mitigating errors that can lead to adverse consequences. The research examining staffing and safety culture has studied the relationship from a number of perspectives. While some have looked at characteristics of the staff, including age, tenure and staff position, others have looked at staffing levels. For example, Castle and colleagues (2006; 2007) found that nursing homes with higher levels reported higher safety culture scores. Staffing can be measured in terms of adequate staff members to handle workload, minimize amount of overtime required, and limited temporary staff.

Hypothesis 20. Staff turnover will be correlated with perceptions of staffing, overall perceptions of safety and patient safety grade.

Hypothesis 21. Staffing will partially mediate the relationship between hospital management support for safety and overall perceptions of safety.

Deference to Expertise

The last characteristic that enables HROs to contain, as well as identify, the unexpected is a deference to expertise. Within the predominant number of mainstream organizations, authority is closely tied to organizational hierarchy and rank. HROs are not bound by this norm. HROs teach members to value expertise wherever it might lie, as well as training organizational members to recognize expertise (Weick & Sutcliffe, 2001). This enables the organization to use and recombine its resources (i.e., personnel and knowledge) in the most efficient manner possible. Organizations can foster a deference to expertise by encouraging openness of communication between all levels of the organization. As it may not always be senior team members (e.g., surgeon) who have the most expertise in a given situation, it is important for less senior members (e.g., nurse) to feel comfortable speaking up and offering their expertise. Along the same line, members within HROs share common goals (e.g., patient safety) and therefore are more willing to provide and receive feedback to meet these goals. Therefore, HROs encourage team members to speak up (i.e., assert themselves by clearly, directly, and respectfully communicating their concerns, ideas, etc.) when an error has been detected regardless of who committed the error.

Communication openness and errors

Within the aviation community, a lack of communication openness (or assertiveness) among crew members has led to a number of accidents. A review by the

National Transportation Safety Board (NTSB) of 37 major air carrier accidents revealed that in more than 80% of the accidents, the first officer failed to adequately monitor and/or challenge actions taken by the captain (NTSB, 1994). Had the first officer done so, it is possible that these accidents could have been prevented. Assertiveness training has proven successful among team members within the aviation community, which has shown to reduce the risk of errors (Jentsch, 1997; Smith-Jentsch, Jentsch, Payne & Salas, 1996). Assertiveness has also been deemed a critical skill for crew resource management (CRM) and management is supporting assertiveness by its incorporation into a number of training programs (see Salas, Wilson, Burke, Wightman & Howse, 2006). In a study conducted by Orasanu and colleagues (1999), it was found that pilots differentiate between situations that relate to safety and those that do not. In situations in which the safety of the flight is in jeopardy, all pilots (regardless of position) will assert themselves. When non-safety related issues are at hand (e.g., CRM issues), crew member position does play a role. Specifically, first officers and flight engineers (i.e., junior positions) recognize that in these situations it may not be appropriate to intervene. Captains, on the other hand, are more likely to intervene regardless of the issue.

While deference to expertise is one area in which the healthcare domain has struggled due to its strict hierarchy and professional culture, it is nevertheless critical for patient safety and must be promoted from the top down. In 1967, Stein (as cited in Zwarentstein & Reeves, 2002) outlined the 'rules' of the 'doctor-nurse game'. Specifically, it was stated that the physicians (i.e., the 'dominant male') are responsible for issues surrounding diagnosing, operating, and prescribing patient care, whereas nurses

(i.e., females) are responsible for less clinical tasks such as housekeeping and patient service. While many doctors and nurses used to assume the aforementioned roles, much has changed in healthcare. Almost 25 years later, Stein and colleagues (1990) wrote a follow up to his original article in which it was found there has been somewhat of an equalization of the sexes and professions, where nurses and physicians have more open lines of communication. Although there has been significant improvements, the research continues to indicate that barriers do exist. For example, research by the Agency for Healthcare Research and Quality (AHRQ) has indicated that approximately 60% of healthcare workers agree that communication openness exists in their hospitals (AHRQ, 2007). This indicates that a significant number of employees (40%) still feel uncomfortable speaking up to those of more authority. Despite this, assertiveness among the ranks has been deemed critical in the operating room, especially for anesthetists (e.g., Greaves & Grant, 2000; Fletcher, Flin, McGeorge, Glavin, Maran, & Patey, 2003; Flin, Fletcher, McGeorge, Sutherland, & Patey, 2003). In a study by Flin et al. (2003), only 6% of participants believed that junior team members should not question decisions of senior personnel in the operating room. While the research on assertiveness in healthcare has primarily focused on the operating room, the importance of assertiveness should not stop there—it is important in all units, especially when patient safety is threatened. Supervisors and management must encourage providers to speak up in a polite yet persistent manner, rather than hint and hope, until their concern is heard (Leonard et al., 2004). This support will in turn lead to greater openness among the ranks and reduce the risk of incidents. In sum, deference to expertise allows teams within HROs to take full

advantage of the potential synergy available within the team in any given situation, regardless of rank, in order to reduce the risk of incidents and improve patient care.

Hypothesis 22. Communication openness partially mediates the relationship between supervisor expectations and incidents.

Hypothesis 23. Communication openness partially mediates the relationship between supervisor expectations and overall perceptions of safety.

Hypothesis 24. Communication openness partially mediates the relationship between supervisor expectations and patient safety grade.

Hypothesis 25. Communication openness partially mediates the relationship between hospital management support and incidents.

Hypothesis 26. Communication openness partially mediates the relationship between hospital management support and overall perceptions of safety.

Hypothesis 27. Communication openness partially mediates the relationship between hospital management support and patient safety grade.

Summary

While the above discussion focuses on safety culture across all industries, a closer look will be taken to understand patient safety culture in healthcare. A majority of the literature found has focused on predictors of safety culture or has looked at safety culture in general as a mediator between management actions and safe practices. For example, higher levels of teamwork (Rudman et al., 2006), units with higher levels of registered

nurses on staff (Castle, 2006), greater situation awareness (Galvan, Bacha, Mohr, & Barach, 2005), and greater exposure to risk (Lymer, Richt & Isaksson, 2004) leads to more positive safety cultures in healthcare organizations. Few articles were found that examined the impact of safety culture on patient safety outcomes. For example, it was found that overall safety climate is significantly related to medication errors.

Within other industries beyond healthcare, research suggests that safety culture is related to an organizations' safety level (e.g., Zohar, 1980; Diaz & Cabrera, 1997). This research suggests that a positive safety climate improves worker attitudes which leads to a motivation to perform safe behaviors and ultimately safety in the organization. Additionally, it has been found that management commitment to safety greatly influences the success of a safety program (e.g., DePasquale & Geller, 1999; Smith, Cohen, Cohen, and Cleveland, 1978). For example, employees' perceptions of management's commitment to safety (e.g., support of training) have resulted in fewer injuries on the job (e.g., Zohar, 2000). Another significant finding indicates the benefits of employee involvement in safety practices (e.g., training; DePasquale and Geller, 1999). Employee involvement was shown to lead to greater trust within the organization between management and coworkers. Finally, research suggests that compliance with safety policies and procedures is influenced by employee knowledge and motivation (Neal, Griffin, and Hart, 2000), enforcement (Halter & Drury, 2002), and possibly adherence by other employees (Hong, Kim, Kritkausky, and Rahid, 1998).

The research available in the literature is useful in that it informs us that safety culture is important in organizations and we understand what influences it. However,

many of these studies focus on safety culture or climate in general rather than examining which factors of safety culture or climate impacted those outcomes. This dissertation seeks to address this issue by gathering data by diagnosing perceptions of safety culture along multiple dimensions and examining the impact of these perceptions on patient safety outcomes.

SECTION 3 - METHOD

Materials and Measures

AHRQ Hospital Survey on Patient Safety Culture

The data used as a part of this research was a part of a previously administered safety culture survey, specifically the AHRQ Hospital Survey on Patient Safety (HSOPS). The HSOPS survey consists of 44 items related to 14 dimensions within a hospital (see APPENDIX B: HOSPITAL SURVEY ON PATIENT SAFETY). The 14 dimensions are further categorized as relating to safety culture dimensions at the unit level, safety culture dimensions at the hospital level, and safety culture outcomes. Previous testing of the AHRQ survey indicated good psychometric properties. Cronbach alpha for each of the dimensions ranged from .63 to .84.

Participants were asked to indicate the extent to which they agree or disagree with each item. Responses were on a 5-point Likert scale from strongly agree (5) to strongly disagree (1), or always (5) to never (1), depending on the dimension. In addition, there were two single-item questions on the scale asking participants to report the number of events they have reported in the last 12 months and to give their work unit an overall patient safety grade (A-F). A majority of the survey was unit based, such that respondents completed the survey with respect to their experiences in a particular unit or patient care area. Several items asked participants to focus on the hospital as a whole. The survey also collected data related to hospital campus, primary work area/unit, and staff position, as

well as demographic items (e.g., age, sex). The HSOPS thus provided feedback grouped at a variety of levels, including hospital, unit, and staff position. The time to complete the survey was approximately 10-15 minutes.

Reliability Analysis

Reliability of the HSOPS was assessed by running internal consistency tests on the 44 items to determine the Cronbach's alpha coefficient for each of the 14 dimensions. Likewise of previous studies demonstrating the reliability of the scale, moderate to high alpha coefficients were found (see Table 5). Given this, items were collapsed into their respective dimensions and mean scores were calculated for each of the 14 dimensions for each participant.

Dependent Variables

Patient safety grade

This variable is measured as a part of the AHRQ HSOPS. It is a one item question in which participants were asked to "Please give your work area/unit in this hospital an overall grade on patient safety". Response choices ranged from a grade of A to F.

Overall perceptions of safety

This variable is also measures as a part of the AHRQ HSOPS. It is calculated based on the mean responses to a set of four items—(1) Patient safety is never sacrificed to get more work done, (2) Our procedures and systems are good at preventing errors from happening, (3) It is just by chance that more serious mistakes don't happen around here (reverse worded) and (4) We have patient safety problems in this unit (reverse worded). Participants were asked to respond to these statements on a 5-point Likert scale ranging from strongly disagree (1) to strongly agree (5). A mean closer to five indicates more positive perceptions of safety in a particular unit.

Number of events reported

Number of events reported is a third outcome measure collected using the AHRQ HSPOS. It is a one item question asking participants to indicate the number of events that they have reported in their unit over the last 12 months. Response choices were none, one to two, three to five, six to 10, 11 to 20, and 21 or more.

Unit reporting rates

Unit reporting rates were collected independent of the HSOPS by the hospital's Risk Management department. Unit reporting rates were calculated based on the number of events reported per patient days in a particular unit over a period of 12 months.

Incidents

Incidents were also collected independent of the HSOPS by the hospital's Risk Management department and categorized by the type of incident that occurred. An event is considered an incident if it meets the federal and state regulations for reporting (i.e., unexpected occurrence of or risk thereof death or serious physical or psychological injury to a patient). Incident data was collected by each unit over a 12 month period.

Staff turnover

Staff turnover data was collected by the hospital, independent of the patient safety survey administered as a part of this research. Staff turnover is based on the number of staff who separated or were acquired by a unit. Staff turnover is presented as a percentage of the separation (or accession) number divided by the total number of staff in that unit. This data was gathered over a 12 month period.

Table 5

Safety culture dimensions measured by HSOPS survey, associated survey items and reliabilities.

Safety Culture Dimensions (Unit Level)						
Supervisor Expectations about Safety	**Organizational Learning**	**Communication Openness**	**Teamwork Within Hospital Units**	**Feedback and Communication about Error**	**Non-punitive Response To Error**	**Staffing**
α= .77	**α= .67**	**α= .73**	**α= .79**	**α= .74**	**α= .76**	**α= .63**
My supervisor/ manager says a good word when he/she sees a job done according to established patient safety procedures.	We are actively doing things to improve patient safety.	Staff will freely speak up if they see something that may negatively affect patient care.	People support one another in this unit.	We are given feedback about changes put into place based on event reports.	Staff feel like their mistakes are held against them. (r)	We have enough staff to handle the workload.
My supervisor/ manager seriously considers staff suggestions for improving patient safety.	Mistakes have led to positive changes here.	Staff feel free to question the decisions or actions of those with more authority.	When a lot of work needs to be done quickly, we work together as a team to get the work done.	We are informed about errors that happen in this unit.	When an event is reported, it feels like the person is being written up, not the problem. (r)	Staff in this unit work longer hours than is best for patient care. (r)
Whenever pressure builds up, my supervisor/ manager wants us to work faster, even if it means taking shortcuts. (r)	After we make changes to improve patient safety, we evaluate their effectiveness.	Staff are afraid to ask questions when something does not seem right. (r)	In this unit, people treat each other with respect.	In this unit, we discuss ways to prevent errors from happening again.	Staff worry that mistakes they make are kept in their personnel file. (r)	We use more agency/ temporary staff than is best for patient care. (r)
My supervisor/ manager overlooks patient safety problems that happen over and over. (r)			When one area in this unit gets really busy, others help out.			We work in “crisis mode”, trying to do too much, too quickly. (r)

Safety Culture Dimensions (Hospital Level)		
Teamwork Across Hospital Units	**Hospital Management Support for Patient Safety**	**Hospital Handoffs & Transitions**
α= .78	**α= .78**	**α= .80**
There is good cooperation among hospital units that need to work together.	Hospital management provides a work climate that promotes patient safety.	Things "fall between the cracks" when transferring patients from one unit to another. (r)
Hospital units work well together to provide the best care for patients.	The actions of hospital management show that patient safety is a top priority.	Important patient care information is often lost during shift changes. (r)
Hospital units do not coordinate well with each other. (r)	Hospital management seems interested in patient safety only after an adverse event happens. (r)	Problems often occur in the exchange of information across hospital units. (r)
It is often unpleasant to work with staff from other hospital units. (r)		Shift changes are problematic for patients in this hospital. (r)

Outcome Measures			
Patient Safety Grade	**Overall Perceptions of Safety**	**Frequency of Event Reporting**	**Number of Events Reported**
Single item response	**α= .77**	**α= .85**	**Single item response**
Please give your work area/unit in this hospital an overall grade on patient safety.	Patient safety is never sacrificed to get more work done.	When a mistake is made, but is caught and corrected before affecting the patient, how often is it reported?	In the past 12 months, how many event reports have you filled out and submitted?
	Our procedures and systems are good at preventing errors from happening.	When a mistake is made that could harm the patient, how often is it reported?	
	It is just by chance that more serious mistakes don't happen around here. (r)	When a mistake is made that could harm the patient, but does not, how often is it reported?	
	We have patient safety problems in this unit. (r)		

Note: r = item is reverse worded

Procedure

The survey was distributed through an online link available via an email sent to all hospital employees as well as the hospital's intranet in June 5-July 9, 2006 (see APPENDIX B: HOSPITAL SURVEY ON PATIENT SAFETY). In addition, English and Spanish paper-based surveys were made available to employees not wishing to complete the survey online. Participants were informed that responses were anonymous. A waiver of informed consent and HIPAA authorization was granted through Florida Hospital's and UCF's Institutional Review Boards. All employees were invited to participate in the survey; however, for the purposes of this study, only critical areas in the hospital were examined. Completed survey data was sent to the author as a consultant hired by the hospital, who also completed subsequent data analyses for the hospital. Incidents (i.e., categorized by type of incident) and unit reporting rates (i.e., number of events reported per patient days in unit) were gathered independently of the survey data over a one year time period—January 2006 – December 2006. This study was approved by the UCF Institutional Review Board (APPENDIX C: UCF INSTITIONAL REVIEW BOARD APPROVAL LETTER).

Power Analysis

A power analysis was done to determine the minimum number of sites and participants within sites needed to find desired effects sizes. The conventional power level of .80 and alpha level of .05 were used. Raudenbush and Liu (2000) was used to gauge appropriate effect size for this study, who suggest 0.05, 0.10, and 0.15 as small,

medium and large effect sizes, respectively. Selecting a medium effect size, it is suggested that 20 sites with 20 participants in each site be used to gain sufficient power. Theoretically, the 5 (units) x 7 (campus) nature of the design led to the potential that 35 unit by location sites would be available, well above that as recommended by Raudenbush and Liu (2000). However, given the fact that not all units are located at each site, this number of groups used in this study is slightly smaller. In addition, sites with less than 20 participants were excluded from the data analysis. Twenty-three sites were thus included in this study (see Table 6).

Table 6
List of sites (location and unit type) included in research and number of participants at each site

Site ID	Location	Unit Type	N
1	Altamonte	Intensive Care Unit	23
2	Altamonte	Emergency Department	66
3	Altamonte	Perinatal	24
4	Altamonte	Surgery	55
5	Apopka	Emergency Department	51
6	Celebration	Intensive Care Unit	30
7	Celebration	Emergency Department	56
8	Celebration	Perinatal	28
9	Celebration	Surgery	26
10	East Orlando	Intensive Care Unit	34
11	East Orlando	Emergency Department	114
12	East Orlando	Surgery	38
13	East Orlando	Pediatrics	27
14	Kissimmee	Emergency Department	38
15	Orlando	Intensive Care Unit	174
16	Orlando	Emergency Department	93
17	Orlando	Perinatal	38
18	Orlando	Surgery	149
19	Orlando	Pediatrics	250
20	Winter Park	Emergency Department	44
21	Winter Park	Perinatal	41
22	Winter Park	Surgery	34
23	Winter Park	Pediatrics	28
		Total:	1461

Respondent Characteristics

Survey respondents are 1461 employees of a large central Florida hospital. The average response rate for all hospital employees was approximately 35%. This is a significant improvement over 11% collected in 2005, indicating that participants are more willing to provide feedback to the hospital. Respondents range in age from 17 to 70 with a mean age of 40 years. Furthermore, 61.9% of respondents were registered nurses and 82.5% female. The respondents come from 23 units located at seven hospital campuses located across central Florida. Responses per unit by campus ranged in size from 23 to 250 staff with an average response of 64 members per unit. The staff positions of participants include registered nurses (N= 903), physician assistants/nurse practitioners (N= 19), LVN/LPN (N= 29), patient care assistant/health aide/care partner (N= 101), attending/staff physician (N= 42), pharmacist (N= 3), dietician (N= 4), unit assistant/clerk secretary (N= 86), respiratory therapist (N= 33), physical/occupational/speech therapist (N= 4), technician (N= 34), and administration/management (N= 52). In addition, 148 participants marked the "other" category or did not specify their staff position.

SECTION 4 - RESULTS

Data Analysis

All analyses were performed using Statistical Package for the Social Sciences (SPSS) for Windows version 12.0. Unless otherwise noted, an alpha level of .05 will be used in all analyses. Data were screened for normality and outliers prior to analysis. To test the hypotheses, a mixed model approach was used and variables of interest were entered in as either factors or covariates, fixed or random, depending on the data.

Description of Analysis Strategy: Hierarchical Linear Modeling

Life dictates that individuals are embedded within groups which are embedded in organizations. In healthcare settings, the hierarchical structure exists such that individuals are nested within units which are nested in hospitals. And lower levels are influenced by factors at higher levels. Conventional statistics (e.g., ordinary least square), however, often fail to address the nested structure adequately (Raudenbush & Bryk, 2002) by aggregating lower level data to a higher level or disaggregating higher level data to a lower level (Hofmann, Griffin, & Gavin, 2000). On the other hand, hierarchical linear modeling (HLM) takes the nested structure into account and offers a more powerful statistical method to study the impact of attitudes and perceptions towards safety of individuals nested within units nested within hospitals on clinical outcomes by taking into consideration the within group variance. HLM is also a useful technique when size is not equal across groups, which is to be expected in field-based studies.

All hypotheses predicting direct and mediating relationships were tested with HLM with the exception of those predicting a relationship with the group level variables incidents, unit reporting rates, and staff turnover (i.e., H1, H5a-5b, H11, H14, H19a-19b, H20-22, and H25) and those predicting correlations (i.e., H10, H17 and H20). Mediating relationships were tested using the method suggested by Baron & Kenny (1986). To demonstrate a mediating relationship, the following steps must be established: (a) a significant relationship between the predictor and criterion variables, (b) a significant relationship between the mediating variable and both the predictor and criterion variables, and (c) a reduction of the relationship between the predictor and criterion variables, such that the relationship is less (partial mediation) or no longer (complete mediation) significant when the mediator is included (Baron & Kenny, 1986).

For the data collected, individuals are nested within units which are nested in hospital campus. A fourth variable was created that combined unit and location data to a single site ID to allow the data to be analyzed at just two levels (see Table 6). In sum, the relationship between safety attitudes and patient safety outcomes was calculated at two levels—Level 1: individual perceptions of patient safety and Level 2: site ID (unit type by campus). Results presented next are organized around the dependent variable tested. Table 7 provides an overview of hypotheses tested and if support was found or not.

Table 7

Overview of hypotheses tested

	Prediction	Supported	
	Patient Safety Grade		
Hyp 3	Supervisor expectations about patient safety are significantly related to patient safety grade within units, specifically positive perceptions of supervisor expectations will result in a higher patient safety grade.	√	F (1,1420) = 86.41, p < .001
Hyp 7	Hospital management support for safety is positively related to patient safety grade.	√	F (1,1419) = 201.76, p < .001
Hyp 9a	Feedback and communication about errors is positively related to patient safety grade within units.	√	F (1,1414) = 485.79, p < .001
Hyp 9b	Organizational learning partially mediates the relationship between feedback and communication about errors and patient safety grade.	√	Feedback: F(1,962)=32.64, p < .001; Org learning: F(1,963)=25.36, p < .001
Hyp 13	Teamwork partially mediates the relationship between supervisor expectations and patient safety grade.	√	Sup expect: F(1,960)=22.30, p < .001; Teamwork: F(1, 959)=30.90, p < .001
Hyp 16	Teamwork partially mediates the relationship between hospital management support and patient safety grade.	√	Hosp mgmt: F (1,960) = 48.14, p < .001; Tmwk across: F(1,955)=12.35, p < .001; Tmwk within: F (1,958) = 31.79, p < .001
Hyp 24	Communication openness partially mediates the relationship between supervisor expectations and patient safety grade.	√	Sup expect: F(1,957)=19.85, p < .001; Comm: F(1,954)=11.44, p < .01
Hyp 27	Communication openness partially mediates the relationship between hospital management support and patient safety grade.	√	Hosp mgmt: F(1,960)=48.14, p < .001; Comm: F(1,959)=18.32, p < .001
	Overall Perceptions of Safety		
Hyp 2	Supervisor expectations about patient safety are significantly related to overall perceptions of safety, specifically positive perceptions of supervisor expectations will result in higher levels of overall perceptions of safety.	√	F(1,1425)=60.99, p<.01
Hyp 6	Hospital management support for safety is positively related to overall perceptions of safety.	√	F (1,1426) = 413.22, p < .001
Hyp 8a	Feedback and communication about errors is positively related to overall perceptions of safety.	√	F (1,1439) = 411.72, p < .001
Hyp 8b	Organizational learning partially mediates the relationship between feedback and communication about errors and overall perceptions of patient safety.	√	Feedback: F(1,962)=15.18, p < .001; Org learning: F(1,961)=60.84, p < .001

	Prediction	Supported	
Hyp 12	Teamwork partially mediates the relationship between supervisor expectations and overall perceptions of safety.	X	Sup expect: $F(1,958)=10.26$, $p < .01$; Teamwork: $F(1,959)=3.44$, $p = .064$
Hyp 15	Teamwork partially mediates the relationship between hospital management support and overall perceptions of safety.	partial	Hosp mgmt: $F(1,956) = 71.65$, $p < .001$; Tmwk across: $F(1,960)=14.08$, $p < .001$; Tmwk within: $F(1,960) = 2.78$, $p = .10$
Hyp 21	Staffing will partially mediate the relationship between hospital management support for safety and overall perceptions of safety.	√	Hosp mgmt: $F(1,981)=71.93$, $p < .001$; Staffing: $F(1,911) = 131.21$, $p < .001$
Hyp 23	Communication openness partially mediates the relationship between supervisor expectations and overall perceptions of safety.	√	Sup expect: $F(1,956)=8.80$, $p < .01$; Comm: $F(1,952)=4.76$, $p < .05$
Hyp 26	Communication openness partially mediates the relationship between hospital management support and overall perceptions of safety.	√	Hosp mgmt: $F(1,958)=70.24$, $p < .001$; Comm: $F(1,959) = 7.01$, $p < .01$
	Number of Events Reported		
Hyp 4a	Hospital management support is significantly related to number of events reported, specifically when hospital management supports patient safety a greater number of events will be reported.	√	$F(1,1368) = 22.52$, $p < .001$
Hyp 4b	Willingness to report events partially mediates the relationship between hospital management support for safety and number of events reported.	partial	$F(1,738) = .278$, $p = .598$
Hyp 18a	A non-punitive response to errors will be significantly related to number of events reported, specifically when a non-punitive culture is in place employees will report more events they observe.	X	$F(1,1347) = .044$, $p = .833$
Hyp 18b	Willingness to report events partially mediates the relationship between a non-punitive response to errors and number of events reported.	X	Not tested
	Unit Reporting Rates		
Hyp 5a	Hospital management support is significantly related to unit reporting rates, specifically when hospital management supports patient safety there will be a higher ratio of events reported to patient days within units.	√	$R^2 = .016$, $\beta = .045$, $F(2,1343)=10.71$, $p < .001$
Hyp 5b	Willingness to report events partially mediates the relationship between hospital management support for safety and unit reporting rates.	√	Hosp mgmt: $\beta = .076$, $p < .05$; Willingness: $\beta = .095$, $p < .01$; $R^2 = .020$, $F(2,909)=9.42$, $p < .001$

	Prediction	Supported	
Hyp 19a	A non-punitive culture will be significantly related to unit reporting rates, specifically when a non-punitive culture is in place there will be a higher ratio of events to patient days within units.	√	R^2 = .016, *F* (2,1343) = 10.71, *p* < .001
Hyp 19b	Willingness to report events partially mediates the relationship between a non-punitive response to errors and unit reporting rates.	√	Non-punitive: β= .127, *p* < .001; Willingness: β= .084, *p* < .05; R^2= .030, *F*(2,908)=13.98, *p* < .001
	Incidents		
Hyp 1	Supervisor expectations about patient safety are significantly related to incidents, specifically positive perceptions of supervisor expectations will result in fewer incidents.	**X**	*F*(2,1437) = 2.05, *p* = .129
Hyp 11	Teamwork partially mediates the relationship between supervisor expectations and incidents.	partial	*F*(2,1437) = 2.05, *p* = .129
Hyp 14	Teamwork partially mediates the relationship between hospital management support and incidents.	**X**	Not tested
Hyp 22	Communication openness partially mediates the relationship between supervisor expectations and incidents.	**X**	Not tested
Hyp 25	Communication openness partially mediates the relationship between hospital management support and incidents.	**X**	Not tested
	Staff Turnover		
Hyp 20	Staff turnover will be correlated with perceptions of staffing, overall perceptions of safety and patient safety grade.	partial	Staffing: r = -.044 Overall perceptions: r = -.080, *p* < .01 PS grade: r = -.048
	Correlations		
Hyp 10	Feedback and communication about errors will be positively correlated with supervisor expectations about patient safety.	√	r = .526, *p* < .01
Hyp 17	Hospital management support for safety is positively correlated with a non-punitive response to error.	√	r = .366, *p* < .01

Table 8 lists the means, standard deviations and intercorrelations for the 11 safety culture dimensions and eight outcome variables. Hypotheses 10, 17, and 20 predicted correlations between variables. Specifically, Hypothesis 10 stated that feedback and communication about errors would be positively correlated with supervisor expectations about patient safety. This hypothesis was supported at both the individual and group level, .526 and .697, $p < .01$, respectively. Likewise, Hypothesis 17 stated that hospital management support would be positively correlated with a non-punitive response to errors. This hypothesis was supported at both the individual and group level, .366 and .686, $p < .01$, respectively. Finally, Hypothesis 20 predicted negative correlations between staff turnover and staffing, overall perceptions of safety and patient safety grade. Support, however, was not found between staff turnover and staffing or patient safety grade (at the individual or group levels). A negative relationship was found, however, between staff turnover and overall perceptions of safety at the individual level (r= -.080, $p < .01$), but not at the group level.

Table 8

Means, standard deviations and intercorrelations for safety culture dimensions and outcome variables.

Dimension	Mean	SD	1.	2.	3.	4.	5.	6.	7.	8.
1. Teamwork within units	3.97	.75	—							
2. Organizational learning	3.72	.68	.485**	—						
3. Non-punitive response to errors	2.95	.86	.349**	.377**	—					
4. Supervisor expectations about safety	3.89	.77	.452**	.542**	.418**	—				
5. Feedback and communication about errors	3.56	.82	.364**	.512**	.328**	.526**	—			
6. Communication openness	3.58	.80	.443**	.474**	.456**	.545**	.571**	—		
7. Willingness to report errors	3.61	1.00	.246**	.349**	.316**	.342**	.488**	.417	—	
8. Hospital management support for safety	3.54	.85	.346**	.525**	.366**	.517**	.516**	.455**	.360**	—
9. Teamwork across units	3.27	.79	.365**	.365**	.332**	.367**	.406**	.372**	.250**	.562**
10. Handoffs and transitions	3.14	.85	.334**	.315**	.365**	.374**	.362**	.361**	.287**	.463**
11. Staffing	3.24	.82	.356**	.328**	.423**	.405**	.265**	.340**	.277**	.440**
12. Overall perceptions of safety	3.37	.86	.438**	.547**	.442**	.516**	.489**	.485**	.432**	.630**
13. PS grade	3.69	.91	.491**	.530**	.402**	.540**	.530**	.487**	.451**	.600**
14. Number of events reported (individual)	1.89	1.10	.024	-.028**	.002	-.008	-.112**	.005	.023	-.108**
15. Number of events reported (unit)	294.44	205.71	.050	.031	-.027	.038	-.036	.029	.028	-.009
16. Medication events	131.12	146.52	.139**	.078**	.012	.099**	-.016	.069**	.068*	.044
17. Non-medication events	163.32	103.96	-.097**	-.049	-.07**	-.065**	-.048	-.042	-.047	-.081**
18. Unit reporting rates	1.48	1.33	.028	.090**	.096**	.050	.055*	.067*	.124**	.116**
19. Staff turnover	.067	.108	.035	-.021	.012	.024	-.026	.018	-.046	-.030

*$p < 0.05$ (2-tailed). **$p < 0.01$ level (2-tailed).

Dimension	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
1. Teamwork within units										
2. Organizational learning										
3. Non-punitive response to errors										
4. Supervisor expectations about safety										
5. Feedback and communication about errors										
6. Communication openness										
7. Willingness to report errors										
8. Hospital management support for safety										
9. Teamwork across units	—									
10. Handoffs and transitions	.647**	—								
11. Staffing	.352**	.392**	—							
12. Overall perceptions of safety	.490**	.464**	.583**	—						
13. PS grade	.474**	.434**	.480**	.697**	—					
14. Number of events reported (individual)	-.110**	-.148**	.008	-.105**	-.085**	—				
15. Number of events reported (unit)	.028	.002	.177**	0.045	0.04	.012	—			
16. Medication events	.085**	.062*	.273**	.138**	.119**	.022	.879**	—		
17. Non-medication events	-.066*	-.085**	-.036	-.106**	-.091**	-.009	.740**	.330**	—	
18. Unit reporting rates	.179**	.133**	.126**	.174**	.163**	.077**	-.064*	-.002	-.124**	—
19. Staff turnover	-.010	.003	-.044	-.080**	-.048	.013	.061*	.369**	.236**	.397**

*$p < 0.05$ (2-tailed). **$p < 0.01$ level (2-tailed).

DV: Overall Perceptions of Safety

Hypotheses 2, 6, 8a, 8b, 12, 15, 21, 23 and 26 predicted relationships involving the dependent variable 'overall perceptions of safety'. These analyses were conducted at the individual level using HLM.

Supervisor Expectations about Safety and Overall Perceptions of Safety

Hypothesis 2 stated that supervisor expectations about patient safety would be significantly and positively related to overall perceptions of safety (see Table 9). As hypothesized, HLM analysis revealed a significant relationship, when controlling for hospital management support and feedback and communication about errors, F (1,1425) = 60.99, $p < .01$. Specifically, in units with higher levels of supervisor expectations regarding safety, individuals within those units had higher perceptions of safety.

Table 9
HLM analysis of supervisor expectations about patient safety and overall perceptions of safety

Model	Predictor	Criterion	Estimate	SE	t	*df*
1	Supervisor expectations about patient safety	Overall perceptions of safety	.21	.03	7.81***	1,1425
	Hospital management support		.41	.02	17.26***	1,1421
	Feedback and communication		.16	.02	6.64***	1,1423

*$p < .05$, **$p < .01$, ***$p < .001$

With support found for the positive relationship between supervisor expectations and overall perceptions of safety (Hyp 2), hypotheses 12 and 23 predict partial mediation of this relationship. First, Hypothesis 12 stated that teamwork partially mediates the relationship between supervisor expectations and overall perceptions of safety (see Table 10). The relationship between supervisor expectations and teamwork, using hospital management support as a covariate, also indicated a positive relationship, F (1,1434) = 40.70, $p < .001$. Additional support was also found for the relationship between teamwork within units and overall perceptions of safety, F (1,963) = 4.36, $p < .05$. Finally, although the previous relationships were significant, the mediation predicted in the hypothesis is not supported (supervisor expectations: F (1,958) = 10.26, $p < .01$; teamwork within units: F (1,959) = 3.44, $p = .064$).

Table 10

HLM analysis predicting teamwork within units as a mediating variable between supervisor expectations and overall perceptions of safety

Model	Predictor	Criterion	Estimate	SE	t	*df*
1	Supervisor expectations about patient safety	Overall perceptions of safety	.21	.03	7.81***	1,1425
	Hospital management support		.41	.02	17.26***	1,1421
	Feedback and communication		.16	.02	6.64***	1,1423
2	Supervisor expectations	Teamwork within units	.35	.03	13.22***	1,1435
	Hospital management support		.15	.02	6.38***	1,1434
3	Teamwork within units	Overall perceptions of safety	.07	.03	2.087*	1,963
	Willingness to report errors		.14	.02	6.27***	1,963
	Staffing		.37	.03	13.69***	1,893
	Communication openness		.12	.03	3.95***	1,959
	Organizational learning		.33	.04	9.01***	1,964
4	Supervisor expectations	Overall perceptions of safety	.11	.03	3.20**	1,958
	Teamwork within units		.06	.03	1.85	1,959
	Willingness to report errors		.13	.02	6.10***	1,959
	Staffing		.36	.03	13.07***	1,903
	Communication openness		.09	.03	2.79**	1,952
	Organizational learning		.29	.04	7.65***	1,960

*$p < .05$, **$p < .01$, ***$p < .001$

As previously discussed, Hypothesis 2 was supported (supervisor expectations are positively related to overall perceptions of safety). Hypothesis 23 stated that communication openness will partially mediate this relationship (see Table 11). The direct relationship between supervisor expectations and communication openness was tested first. Using hospital management support as a covariate, results showed that supervisor expectations is positively related to communication openness, F (1,1285) = 279.78, $p < .001$. Next, HLM analysis also revealed a positive relationship between communication openness and overall perceptions of safety when using covariates, F

(1,960) = 10.79, $p < .01$. Finally, as predicted, a partially mediating relationship was found (supervisor expectations: F (1,956) = 8.80, $p < .01$; communication openness: F (1,952) = 4.76, $p < .05$).

Table 11
HLM analysis predicting communication openness as a mediating variable between supervisor expectations and overall perceptions of safety.

Model	Predictor	Criterion	Estimate	SE	t	*df*
1	Supervisor expectations about patient safety	Overall perceptions of safety	.21	.03	7.81***	1,1425
	Hospital management support		.41	.02	17.26***	1,1421
	Feedback and communication		.16	.02	6.64***	1,1423
2	Supervisor expectations	Communication openness	.44	.03	16.73***	1,1285
	Hospital management support		.22	.02	9.17***	1,1342
3	Communication openness	Overall perceptions of safety	.09	.03	3.00**	1,957
	Teamwork within units		.04	.03	1.17	1,960
	Teamwork across units		.21	.03	7.51***	1,961
	Willingness to report errors		.13	.02	6.04***	1,959
	Staffing		.33	.03	12.30***	1,903
	Organizational learning		.30	.04	8.44***	1,960
4	Supervisor expectations	Overall perceptions of safety	.10	.03	2.97**	1,956
	Communication openness		.07	.03	2.18*	1,952
	Teamwork across units		.21	.03	7.58***	1,958
	Willingness to report errors		.13	.02	5.89***	1,956
	Staffing		.32	.03	12.07***	1,908
	Organizational learning		.28	.04	7.80***	1,956

*$p < .05$, **$p < .01$, ***$p < .001$

Hospital Management Support and Overall Perceptions of Safety

Hypothesis 6 stated that hospital management support for safety is positively related to overall perceptions of patient safety (see Table 12). As predicted, higher levels

of hospital management support leads to greater overall perceptions of patient safety, F (1,1441) = 800.94, $p < .001$. A significant effect of group membership was also found (p = .006). Using supervisor expectations as a covariate, this hypothesis was further supported in that hospital management support uniquely contributes to overall perceptions of patient safety, F (1,1426) = 413.22, $p < .001$.

Table 12
HLM analysis of hospital management support and overall perceptions of safety

Model	Predictor	Criterion	Estimate	SE	t	*df*
1	Hospital management support	Overall perceptions of safety	.46	.02	20.34***	1,1426
	Supervisor expectations about patient safety		.27	.03	10.68***	1,1429

*$p < .05$, **$p < .01$, ***$p < .001$

With support found for the positive relationship between hospital management support and overall perceptions of safety (Hyp 6), hypotheses 15, 21 and 26 predict partial mediation of this relationship. Hypothesis 15 stated that teamwork partially mediates this relationship (see Table 13). HLM analysis revealed a positive relationship between hospital management support and both teamwork within units (F (1,1445) = 189.87, $p < .001$) and teamwork across units (F (1,1441) = 617.36, $p < .001$). Using covariates, teamwork across units contributed uniquely to overall perceptions of safety (F (1,961) = 56.33, $p < .001$), however, teamwork within units did not (F (1,960) = 1.379, p = .241). Next, hospital management support was entered into the analysis to test for partial mediation. This hypothesis was partially supported as hospital management support and teamwork across units were significant, but teamwork within units was not

(hospital management support: F (1,956) = 71.65, p < .001; teamwork across units: F (1,960) = 14.08, p < .001; teamwork within units: F (1,960) = 2.78, p = .10).

Table 13
HLM analysis predicting teamwork as a mediating variable between hospital management support for safety and overall perceptions of safety

Model	Predictor	Criterion	Estimate	SE	t	*df*
1	Hospital management support	Overall perceptions of safety	.41	.02	17.26***	1,1421
	Supervisor expectations about patient safety		.21	.03	7.81***	1,1425
	Feedback and communication		.16	.02	6.64***	1,1423
2	Hospital management support	Teamwork within units	.15	.02	6.38***	1,1434
	Supervisor expectations		.35	.03	13.22***	1,1435
3	Teamwork within units	Overall perceptions of safety	.04	.03	1.17	1,960
	Teamwork across units		.21	.03	7.51***	1,961
	Willingness to report errors		.13	.02	6.04***	1,959
	Staffing		.33	.03	12.30***	1,903
	Communication openness		.09	.03	3.00**	1,957
	Organizational learning		.30	.04	8.44***	1,960
4	Hospital management support	Overall perceptions of safety	.24	.03	8.38***	1,958
	Teamwork across units		.12	.03	4.02***	1,961
	Willingness to report errors		.11	.02	5.19***	1,960
	Staffing		.30	.03	11.33***	1,888
	Communication openness		.07	.03	7.45**	1,959
	Organizational learning		.25	.03	2.65***	1,960

*p < .05, **p < .01, ***p < .001

Similarly, Hypothesis 21 predicted that staffing would partially mediate the previously supported relationship between hospital management support and overall perceptions of safety (see Table 14). First, the relationship between hospital management support and staffing was tested. HLM analysis indicated a positive relationship between

the two variables, F (1,1464) = 270.38, $p < .001$. Using covariates, the relationship between staffing and overall perceptions of safety was also positive, F (1,926) = 154.74, $p < .001$. Finally, HLM analysis supported the hypothesis in that staffing mediated the relationship between hospital management support and overall perceptions of safety (hospital management: F (1,981) = 71.93, $p < .001$; staffing: F (1,911) = 131.21, $p < .001$).

Table 14
HLM analysis predicting staffing as a mediating variable between hospital management support and overall perceptions of safety

Model	Predictor	Criterion	Estimate	SE	t	*df*
1	Hospital management support	Overall perceptions of safety	.41	.02	17.26***	1,1421
	Supervisor expectations about patient safety		.21	.03	7.81***	1,1425
	Feedback and communication		.16	.02	6.64***	1,1423
2	Hospital management support	Staffing	.35	.02	16.44***	1,1464
3	Staffing	Overall perceptions of safety	.33	.03	12.44***	1,926
	Communication openness		.09	.03	3.04**	1,980
	Teamwork within units		.04	.03	1.19	1,984
	Teamwork across units		.21	.03	7.60***	1,984
	Willingness to report errors		.13	.02	6.11***	1,982
	Organizational learning		.30	.04	8.54***	1,983
4	Hospital management support	Overall perceptions of safety	.24	.03	8.48***	1,981
	Staffing		.30	.03	11.46***	1,911
	Communication openness		.07	.03	2.68**	1,982
	Teamwork across units		.12	.03	4.08***	1,984
	Willingness to report errors		.11	.02	5.24***	1,983
	Organizational learning		.25	.03	7.54***	1,983

*$p < .05$, **$p < .01$, ***$p < .001$

Hypothesis 26 predicted that communication openness would mediate the relationship between hospital management support and overall perceptions of safety (see Table 15). The relationship between hospital management support and communication openness was tested first, and HLM analysis showed a significant positive relationship when using supervisor expectations as a covariate, F (1,1342) = 84.09, $p < .001$, although no significant group effect was found (p = .442). Next, using covariates, the relationship between communication openness and overall perceptions of safety was analyzed, indicating that communication openness does contribute uniquely to overall perceptions of safety, F (1,957) = 9.00, $p < .01$. Finally, HLM analysis revealed a partial mediation, fully supporting this hypothesis (hospital management support: F (1,958) = 70.24, $p < .001$; communication openness: F (1,959) = 7.01, $p < .01$).

Table 15

HLM analysis predicting communication openness as a mediating variable between hospital management support and overall perceptions of safety

Model	Predictor	Criterion	Estimate	SE	t	*df*
1	Hospital management support	Overall perceptions of safety	.41	.02	17.26***	1,1421
	Supervisor expectations about patient safety		.21	.03	7.81***	1,1425
	Feedback and communication		.16	.02	6.64***	1,1423
2	Hospital management support	Communication openness	.22	.02	9.17***	1,1342
	Supervisor expectations		.44	.03	16.73***	1,1285
3	Communication openness	Overall perceptions of safety	.09	.03	3.00**	1,957
	Teamwork within units		.04	.03	1.17	1,960
	Teamwork across units		.21	.03	7.51***	1,961
	Willingness to report errors		.13	.02	6.04***	1,959
	Staffing		.33	.03	12.30***	1,903
	Organizational learning		.30	.04	8.44***	1,960
4	Hospital management support	Overall perceptions of safety	.24	.03	8.38***	1,958
	Communication openness		.04	.03	2.65**	1,959
	Teamwork across units		.12	.03	4.02***	1,961
	Willingness to report errors		.11	.02	5.19***	1,960
	Staffing		.30	.03	11.33***	1,888
	Organizational learning		.25	.03	7.45***	1,960

*$p < .05$, **$p < .01$, ***$p < .001$

Feedback and Communication about Errors and Overall Perceptions of Safety

Finally, Hypothesis 8a stated that feedback and communication about errors would be significantly related to overall perceptions of safety (see Table 16). As predicted, HLM analysis indicated a positive relationship, F (1,1439) = 411.72, $p < .001$. Hypothesis 8b stated that organizational learning would partially mediate this relationship (see Table 16). Using covariates, this relationship was supported (feedback and

communication: F (1,962) = 15.18, $p < .001$; organizational learning: F (1,961) = 60.84, $p < .001$).

Table 16
HLM analysis predicting organizational learning as a mediating variable between feedback and communication about errors and overall perceptions of safety

Model	Predictor	Criterion	Estimate	SE	t	*df*
1	Feedback and communication	Overall perceptions of safety	.16	.02	3.64	1,1423
	Supervisor expectations		.21	.03	7.81	1,1425
	Hospital management support		.41	.02	17.26	1,1421
2	Feedback and communication	Organizational learning	.42	.02	22.04***	1,1414
3	Organizational learning	Overall perceptions of safety	.33	.04	9.01***	1,964
	Willingness to report errors		.14	.02	6.27***	1,963
	Staffing		.37	.03	13.69***	1,893
	Communication openness		.12	.03	3.95***	1,959
	Teamwork within units		.07	.03	3.09*	1,963
4	Feedback and communication	Overall perceptions of safety	.12	.03	3.90***	1,962
	Organizational learning		.29	.04	7.80***	1,961
	Willingness to report errors		.11	.02	4.93***	1,961
	Staffing		.37	.03	13.73***	1,891
	Communication openness		.08	.03	2.48*	1,957
	Teamwork within units		.06	.03	1.98*	1,963

*$p < .05$, **$p < .01$, ***$p < .001$

DV: Patient Safety Grade

Hypotheses 3, 7, 9a, 9b, 13, 16, 24, and 27 predicted relationships involving the dependent variable 'patient safety grade'. To test these hypotheses, HLM analyses were conducted using individual level data.

Supervisor Expectations about Safety and Patient Safety Grade

Hypothesis 3 stated that supervisor expectations are related to patient safety grade within units (see Table 17). Using hospital management support and feedback and communication about errors as covariates, the HLM analysis found support for this hypothesis, F (1,1420) = 86.41, $p < .001$, indicating that higher supervisor expectations leads to higher patient safety grade.

Table 17
HLM analysis of supervisor expectations about patient safety and patient safety grade

Model	Predictor	Criterion	Estimate	SE	t	*df*
1	Supervisor expectations about patient safety	Patient safety grade	.27	.03	9.30***	1,1420
	Hospital management support		.36	.03	14.20***	1,1419
	Feedback and communication		.25	.03	9.25***	1,1419

*$p < .05$, **$p < .01$, ***$p < .001$

With support found for the positive relationship between supervisor expectations and patient safety grade (Hyp 3), Hypotheses 13 and 24 predict partial mediation of this relationship. Hypothesis 13 predicted teamwork as the mediating variable (see Table 18). Analyses conducted as a part of hypothesis 12 demonstrated a positive relationship between supervisor expectations and teamwork. To test the relationship between teamwork and patient safety grade, HLM analysis was run. Results show, using covariates, that teamwork within units does significantly contribute to patient safety grade, F (1,963) = 34.79, $p < .001$. Unlike that of hypothesis 12, support was found for

the mediating relationship (supervisor expectations: F (1,960) = 22.30, $p < .001$; teamwork within units: F (1, 959) = 30.90, $p < .001$).

Table 18
HLM analysis predicting teamwork within units as a mediating variable between supervisor expectations about patient safety and patient safety grade

Model	Predictor	Criterion	Estimate	SE	t	*df*
1	Supervisor expectations about patient safety	Patient safety grade	.27	.03	9.30***	1,1420
	Hospital management support		.36	.03	14.20***	1,1419
	Feedback and communication		.25	.03	9.25***	1,1419
2	Supervisor expectations	Teamwork within units	.35	.03	13.22***	1,1435
	Hospital management support		.15	.02	6.38***	1,1434
3	Teamwork within units	Patient safety grade	.20	.03	5.90***	1,963
	Willingness to report errors		.17	.02	7.37***	1,964
	Staffing		.24	.03	8.33***	1,757
	Communication openness		.19	.03	5.70***	1,962
	Organizational learning		.28	.04	6.62***	1,963
4	Supervisor expectations	Patient safety grade	.17	.04	4.72***	1,960
	Teamwork within units		.19	.03	5.56***	1,959
	Willingness to report errors		.17	.02	7.12***	1,960
	Staffing		.22	.03	1.45***	1,790
	Communication openness		.14	.03	4.07***	1,956
	Organizational learning		.20	.04	4.94***	1,959

*$p < .05$, **$p < .01$, ***$p < .001$

Hypothesis 24 was analyzed at the individual level to test communication openness as a partial mediating factor of the relationship between supervisor expectations and patient safety grade (see Table 19). As proven in Hypothesis 23, supervisor support is positively related to communication openness. Therefore, the first step of this analysis was to test the relationship between communication openness and patient safety grade.

Using covariates, the relationship between communication openness and patient safety grade was tested, and a significant positive relationship was found, F (1,960) = 23.75, p < .001. Finally, as predicted, HLM analysis revealed a partially mediating relationship (supervisor expectations: F (1,957) = 19.85, p < .001; communication openness: F (1,954) = 11.44, p < .01).

Table 19

HLM analysis predicting communication openness as a mediating variable between supervisor expectations about patient safety and patient safety grade

Model	Predictor	Criterion	Estimate	SE	t	*df*
1	Supervisor expectations about patient safety	Patient safety grade	.27	.03	9.30***	1,1420
	Hospital management support		.36	.03	14.20***	1,1419
	Feedback and communication		.25	.03	9.25***	1,1419
2	Supervisor expectations	Communication openness	.44	.03	16.73***	1,1284
	Hospital management support		.22	.02	9.17***	1,1342
3	Communication openness	Patient safety grade	.16	.03	4.87***	1,960
	Teamwork within units		.18	.03	5.14***	1,960
	Teamwork across units		.20	.03	6.68***	1,959
	Willingness to report errors		.16	.02	7.14***	1,961
	Staffing		.20	.03	7.01***	1,780
	Organizational learning		.23	.04	6.01***	1,961
4	Supervisor expectations	Patient safety grade	.16	.04	4.46***	1,957
	Communication openness		.11	.03	3.38**	1,954
	Teamwork within units		.16	.03	4.84***	1,956
	Teamwork across units		.19	.03	6.56***	1,955
	Willingness to report errors		.16	.02	6.91***	1,957
	Staffing		.18	.03	6.23***	1,805
	Organizational learning		.18	.04	4.45***	1,957

*p < .05, **p < .01, ***p < .001

Hospital Management Support and Patient Safety Grade

Hypothesis 7 stated that hospital management support is related to patient safety grade (see Table 20). Using supervisor expectations and feedback and communication about errors as covariates, the HLM analysis found support for this hypothesis, F (1,1419) = 201.76, $p < .001$, indicating that higher perceptions of hospital management support leads to a higher patient safety grade.

Table 20
HLM analysis of hospital management support for safety and patient safety grade

Model	Predictor	Criterion	Estimate	SE	t	*df*
1	Hospital management support	Patient safety grade	.36	.03	14.20***	1,1419
	Supervisor expectations about patient safety		.27	.03	9.29***	1,1420
	Feedback and communication		.25	.03	9.25***	1,1419

*$p < .05$, **$p < .01$, ***$p < .001$

As support for Hypotheses 7 was found, Hypotheses 16 and 27 predict mediating relationships between hospital management support and patient safety grade. Specifically, Hypothesis 16 predicted that teamwork within and across units will partially mediate this relationship (see Table 21). Hypothesis 15 revealed a positive relationship between hospital management support and teamwork within and across units. HLM analysis also revealed a positive relationship between teamwork within units (F (1,960) = 26.40, $p < .001$) and across units (F (1,959) = 44.59, $p < .001$) and patient safety grade. To test the partially mediating relationship, hospital management support was entered into the relationship. HLM analysis found support for this hypothesis (hospital

management support: F (1,960) = 48.14, $p < .001$; teamwork across units: F (1,955) = 12.35, $p < .001$; teamwork within units: F (1,958) = 31.79, $p < .001$).

Table 21
HLM analysis predicting teamwork as a mediating variable between hospital management support and patient safety grade

Model	Predictor	Criterion	Estimate	SE	t	*df*
1	Hospital management support	Patient safety grade	.36	.03	14.20***	1,1419
	Supervisor expectations about patient safety		.27	.03	9.29***	1,1420
	Feedback and communication		.25	.03	9.25***	1,1419
2	Hospital management support	Teamwork within units	.15	.02	6.38***	1,1434
	Supervisor expectations		.35	.03	13.22***	1,1435
3	Hospital management support	Teamwork across units	.46	.02	19.70***	1,1430
	Supervisor expectations		.11	.03	4.16***	1,1432
4	Teamwork within units	Patient safety grade	.20	.03	5.90***	1,963
	Willingness to report errors		.17	.02	7.37***	1,964
	Staffing		.24	.03	8.33***	1,757
	Communication openness		.19	.03	5.70***	1,962
	Organizational learning		.28	.04	6.62***	1,963
5	Hospital management support	Patient safety grade	.22	.03	6.94***	1,960
	Teamwork within units		.19	.03	5.64***	1,958
	Teamwork across units		.11	.03	3.52***	1,955
	Willingness to report errors		.15	.02	6.41***	1,960
	Staffing		.03	.03	5.67***	1,766
	Communication openness		.03	.03	4.28***	1,959
	Organizational learning		.04	.04	4.36***	1,960

*$p < .05$, **$p < .01$, ***$p < .001$

As hypothesis 7 was supported and differences among group membership were found, Hypothesis 27 (relationship between hospital management support and patient safety grade is partially mediated by communication openness) was analyzed using HLM analysis (see Table 22). First, the relationship between hospital management support and communication openness was tested. Using supervisor expectations about safety as a covariate, results indicated that higher perceptions of hospital management support leads to higher perceptions of communication openness, F (1,1342) = 84.09, $p < .001$. Using covariates, the relationship between communication openness and patient safety grade was tested, and a significant positive relationship was also found, F (1,960) = 23.75, $p < .001$. Finally, HLM analysis revealed support for the mediating relationship (hospital management support: F (1,960) = 48.14, $p < .001$; communication openness: F (1,959) = 18.32, $p < .001$).

Table 22

HLM analysis predicting communication openness as a mediating variable between hospital management support for safety and patient safety grade

Model	Predictor	Criterion	Estimate	SE	t	*df*
1	Hospital management support	Patient safety grade	.36	.03	14.20***	1,1419
	Supervisor expectations about patient safety		.27	.03	9.29***	1,1420
	Feedback and communication		.25	.03	9.25***	1,1419
2	Hospital management support	Communication openness	.22	.02	9.17***	1,1342
	Supervisor expectations		.44	.03	16.73***	1,1285
3	Communication openness	Patient safety grade	.16	.03	4.87***	1,960
	Teamwork within units		.18	.03	5.14***	1,960
	Teamwork across units		.20	.03	6.68***	1,959
	Willingness to report errors		.16	.02	7.14***	1,961
	Staffing		.20	.03	7.01***	1,780
	Organizational learning		.23	.04	6.01***	1,961
5	Hospital management support	Patient safety grade	.22	.03	6.94***	1,960
	Communication openness		.14	.03	4.28***	1,959
	Teamwork within units		.19	.03	5.64***	1,958
	Teamwork across units		.11	.03	3.52***	1,955
	Willingness to report errors		.15	.02	6.41***	1,960
	Staffing		.16	.03	5.67***	1,766
	Organizational learning		.17	.04	4.36***	1,960

*$p < .05$, **$p < .01$, ***$p < .001$

Feedback and Communication about Errors and Patient Safety Grade

Hypothesis 9a stated that feedback and communication about errors would be significantly related to patient safety grade (see Table 23). As predicted, HLM analysis indicated a positive relationship, F (1,1434) = 515.73, $p < .001$. Hypothesis 9b stated that organizational learning would partially mediate this relationship (see Table 23). First, the relationship between feedback and communication and organizational learning was tested

and a positive relationship was found, F (1,1414) = 485.79, $p < .001$. Next, using covariates, the relationship between organizational learning and patient safety grade was analyzed. HLM analysis revealed that organizational learning does contribute uniquely to patient safety grade, F (1,963) = 43.84, $p < .001$. Finally, using covariates, the partially mediated relationship was supported (feedback and communication: F (1,962) = 32.64, $p < .001$; organizational learning: F (1,963) = 25.36, $p < .001$).

Table 23
HLM analysis predicting organizational learning as a mediating variable between feedback and communication about errors and patient safety grade

Model	Predictor	Criterion	Estimate	SE	t	*df*
1	Feedback and communication	Patient safety grade	.16	.02	3.64	1,1423
	Supervisor expectations		.21	.03	7.81	1,1425
	Hospital management support		.41	.02	17.26	1,1421
2	Feedback and communication	Organizational learning	.42	.02	22.04***	1,1414
3	Organizational learning	Patient safety grade	.33	.04	9.01***	1,964
	Willingness to report errors		.14	.02	6.27***	1,963
	Staffing		.37	.03	13.69***	1,893
	Communication openness		.12	.03	3.95***	1,959
	Teamwork within units		.07	.03	3.09*	1,963
4	Feedback and communication	Patient safety grade	.12	.03	3.90***	1,962
	Organizational learning		.29	.04	7.80***	1,961
	Willingness to report errors		.11	.02	4.93***	1,961
	Staffing		.37	.03	13.73***	1,891
	Communication openness		.08	.03	2.48*	1,957
	Teamwork within units		.06	.03	1.98*	1,963

*$p < .05$, **$p < .01$, ***$p < .001$

DV: Number of Events Reported

Hypotheses 4a, 4b, 18a and 18b predicted relationships involving the dependent variable 'number of events reported'. Number of events reported indicates the number of events reported by each participant in the last 12 months. To test these hypotheses, HLM analyses were conducted using individual level data.

Hospital Management Support and Number of Events Reported

Hypothesis 4a stated that hospital management support would be positively related to number of events reported by participants (see Table 24). The HLM analysis with the individual level data found a significant effect of hospital management support, F (1,1368) = 22.52, $p < .001$. However, the relationship found was in the opposite direction. Specifically, higher perceptions of hospital management support leads to fewer events reported by employees.

Hypothesis 4b stated that willingness to report events partially mediates the relationship between hospital management support and number of events reported (see Table 24). Using non-punitive response to errors as a covariate, the HLM analysis revealed a positive relationship between hospital management support and willingness to report errors (F (1,964) = 62.62, $p < .001$). The test of the relationship between willingness to report events and number of events reported was not significant (F (1,738) = .278, p = .598). Because of this, the test of the mediating relationship was not continued. Therefore, only part of Hypothesis 4b was supported. The reason for this

could be that hospital management support not only leads to a willingness to report errors but also leads to a safer environment (i.e., fewer errors), and while employees are willing to report errors, they don't have the opportunity.

Table 24
HLM analysis predicting willingness to report events as a mediating variable between hospital management support for safety and number of events reported

Model	Predictor	Criterion	Estimate	SE	t	*df*
1	Hospital management support	Willingness to report	.29	.04	7.91***	1,964
	Non-punitive response to errors		.23	.04	6.44***	1,964
2	Hospital management support	Number of events reported	-.18	.04	-4.95***	1,1398
	Non-punitive response to errors		.05	.04	1.42	1,1413
3	Willingness to report	Number of events reported	.02	.04	.527	1,737
4	Hospital management support	Number of events reported	-.12	.044	-2.79**	1,931
	Willingness to report		.05	.038	1.36	1,952

*$p < .05$, **$p < .01$, ***$p < .001$

Non-punitive Response to Errors and Number of Events Reported

Hypothesis 18a stated that a non-punitive response to errors would be positively related to number of event reported by participants (see Table 25). The HLM analysis with the individual level data did not reveal a significant effect of a non-punitive response to events, F (1,1347) = .044, p = .833, nor a significant effect of group membership (p = .154).

Hypothesis 18b stated that willingness to report events partially mediates the relationship between non-punitive response to events and number of events reported (see Table 25). Using hospital management support as a covariate, a non-punitive response to errors is positively related to willingness to report events (F (1,964) = 62.62, $p < .001$). In other words, when there is less retribution for making an error, employees are more likely to report them. When testing the mediating relationship, Hypothesis 18b was not supported (non-punitive response to events: F (1,913) = 1.14, $p = .285$; willingness to report events: F (1,832) = .053, $p = .818$).

Table 25
HLM analysis predicting willingness to report errors as a mediating variable between non-punitive response to errors and number of events reported

Model	Predictor	Criterion	Estimate	SE	t	*df*
1	Non-punitive response to errors	Number of events reported	.05	.04	1.42	1,1413
	Hospital management support		-.18	.04	-4.95***	1,1398
2	Non-punitive response to errors	Willingness to report errors	.23	.04	6.44***	1,964
	Hospital management support		.29	.04	7.91***	1,964
3	Willingness to report errors	Number of events reported	.02	.04	.527	1,738

*$p < .05$, **$p < .01$, ***$p < .001$

DV: Incidents

Hypotheses 1, 11, 14, 22, and 25, predicted relationships regarding incidents within units. Incidents are defined as the total number of incidents deemed reportable by the hospital in a 12 month period. Incidents include medication (e.g., wrong dosage of a

drug administered) and non-medication (e.g., wrong site surgery) type incidents. Because incident data is only available at the unit level, regression analysis was the method used to test these hypotheses.

Supervisor Expectations about Safety and Incidents

Hypothesis 1 predicted that supervisor expectations are negatively related to incidents (see Table 26). Using regression and controlling for hospital management support, this hypothesis was not supported, F (2,1437) = 2.05, p = .129. Additional analyses were run to determine if there was a relationship between supervisor expectations and incident type. Incidents were broken down into medication and non-medication incidents, and covariate used to test the relationship (see Table 26). Contrary to expectations, supervisor expectations were positively related to medication incidents, indicating an increase in medication incidents in units with higher supervisor expectations, F (3,1436) = 68.41, p < .001. As would be expected, supervisor expectations were negatively related to non-medication incidents, F (3,1436) = 66.88, p < .001, although both of these relationships were weak.

Table 26

Regression analysis testing the relationship between supervisor expectations about patient safety and incidents

Model	Predictor	Criterion	β	R^2	R^2 Δ	*p*
1	Supervisor expectations about patient safety	Incidents	.061*	.003	.003	.048
	Hospital management support		-.043			
2	Supervisor expectations about patient safety	Medication incidents	.118***	.125	.010	.000
	Hospital management support		.009			
	Non-medication incidents		.340***			
3	Supervisor expectations about patient safety	Non-medication incidents	-.068*	.123	.003	.020
	Hospital management support		-.062			
	Medication incidents		.341***			

*$p < .05$, **$p < .01$, ***$p < .001$

Hypothesis 11 stated that teamwork partially mediates the relationship between supervisor expectations and incidents. As previously discussed in Hypothesis 1, a relationship was not found between supervisor expectations and incidents. Exploratory analysis was conducted, however, to test the mediating relationship between supervisor expectations and incidents by type (medication and non-medication). Although the relationships were weak, medication incidents were positively related to supervisor expectations (contrary to expectations) and non-medication incidents were negatively related. Therefore, the test of mediation was continued to see if teamwork within units mediated either of these relationships (Hyp 14). First the relationship between teamwork within units was tested with medication and non-medication incidents. A positive relationship was found between teamwork within units and medication incidents (β =

.068. $p < .05$), whereas a negative relationship was found between teamwork and non-medication incidents ($\beta = -.117$, $p < .001$). Next, the mediation was tested. When controlling for non-medication incidents, teamwork within units was shown to partially mediate the relationship between supervisor expectations about patient safety and medication incidents. However, when additional covariates were entered, this relationship was no longer supported. Likewise results were found for teamwork within units partially mediating the relationship between supervisor expectations and non-medication incidents. Further exploration identified perceptions of staffing to strongest contributor to the variance.

As discussed in Hypothesis 1, supervisor expectations regarding safety were not related to incidents, however, further analysis revealed a relationship when incidents were broken down by type. Specifically a positive relationship was found with medication incidents whereas a negative relationship was found with non-medication incidents. Although Hypothesis 22 suggested that communication openness would mediate the relationship between supervisor expectations and incidents as a whole, the decision was made to test it as a mediating variable using medication and non-medication events. Because a positive relationship between supervisor expectations and communication openness had been previously established (Hyp 23), the first step was to test the relationship between communication openness and incidents by type. Using covariates, this relationship did not prove significant in either case (medication incidents: $\beta = -.051$, $p = .058$; non-medication incidents: $\beta = .019$, $p = .486$), and therefore, the mediating relationship was not further tested.

Hospital Management Support and Incidents

Hypothesis 14 stated that teamwork partially mediates the relationship between hospital management support and incidents. To test this relationship, the first step was to test the direct relationship between hospital management support and incidents. Controlling for supervisor expectations about safety, sequential regression did not reveal a significant relationship (β = -.043, F (2,1437) = 2.05, p = .129). Although not hypothesized, additional analyses were run to identify a potential relationship between hospital management support and medication or non-medication incidents. No significant relationship was found between hospital management support and medication incidents, when controlling for supervisor expectations and non-medication incidents (β = .009, p = .745). As would be expected, a negative relationship was found between hospital management support and non-medication incidents, when controlling for supervisor expectations and medication incidents (F (1,1436) = 66.88, p < .001). Because only the relationship between teamwork within units and non-medication incidents was significant, this variable was used to test mediation. Using covariates, in step 2 of sequential regression the relationship between hospital management support and non-medication errors was no longer significant (β = -.041, p = .163). Because of this, the test of mediation was not continued.

Table 27

Regression analysis predicting a relationship between hospital management support for safety and incidents

Model	Predictor	Criterion	β	R^2	R^2 Δ	*p*
1	Hospital management support	Incidents	-.043	.003	.001	.164
	Supervisor expectations		.061			
2	Hospital management support	Non-medication incidents	-.062*	.123	.003	.032
	Supervisor expectations		-.068*			
	Medication incidents		.341***			
3	Hospital management support	Non-medication incidents	-.029	.132	.010	.163
	Supervisor expectations		-.043			
	Medication		.368***			
	Communication openness		.001			
	Staffing		-.108***			

*$p < .05$, **$p < .01$, ***$p < .001$

Hypothesis 25 stated that communication openness partially mediates the relationship between hospital management support and incidents (see Table 31). Although no relationship was found between hospital management support and incidents, a relationship was found between hospital management support and non-medication incidents (Hyp 14). Therefore, the test of mediation was continued. The relationship between communication and openness and non-medication incidents was tested using covariates. Sequential regression did not show a relationship (β = .022, p = .439) and therefore further testing of the mediation was discontinued.

Table 28
Regression analysis predicting a relationship between communication openness and non-medication incidents

Model	Predictor	Criterion	β	R^2	R^2 Δ	*p*
1	Communication openness	Non-medication	.022	.142	.142	.439
	Teamwork within units	incidents	-.117			
	Teamwork across units		.030			
	Staffing		-.095			
	Medication incidents		.377			

$^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$

DV: Unit Reporting Rates

Hypotheses 5a, 5b, 19a and 19b, predicted relationships surrounding the dependent variable 'unit reporting rates'. Unit reporting rates are the percentage of events reported per unit per number of patient days. Because unit reporting rates are only available at the unit level, regression analysis was the method used to test these hypotheses.

Hospital Management Support and Unit Reporting Rates

Hypothesis 5a predicted that hospital management support and unit reporting rates would be positively related (see Table 32). Using non-punitive response to errors as a covariate, this hypothesis was supported, although the relationship was weak, $R^2 = .016$, β = .045, F (2,1343) = 10.71, $p < .001$. Hypothesis 5b predicted that willingness to report events would partially mediate this relationship. Regression analysis revealed that hospital management support is positively related to willingness to report errors (R^2 = .167, β = .281, F (2,966) = 97.13, $p < .001$) and willingness to report errors is positively

related to unit reporting rates (R^2= .015, β = .124, *F* (1,910) = 14.11, *p* < .001). Finally, results showed that the partially mediating relationship was supported (hospital management support: β = .076, *p* < .05; willingness to report: β = .095, *p* < .01; R^2= .020, *F* (2,909) = 9.42, *p* < .001).

Table 29
Regression analysis predicting willingness to report errors as a mediating variable between hospital management support for safety and unit reporting rates

Model	Predictor	Criterion	β	R^2	R^2 Δ	*p*
1	Hospital management support Non-punitive response to errors	Willingness to report errors	.281*** .212***	.167	.068	.001
2	Hospital management support Non-punitive response to errors	Unit reporting rates	.089** .060*	.016	.007	.001
3	Willingness to report errors	Unit reporting rates	.124***	.015	.015	.001
4	Hospital management support Willingness to report errors	Unit reporting rates	.076* .095**	.020	.008	.007

*$p < .05$, **$p < .01$, ***$p < .001$

Non-punitive Response to Errors and Unit Reporting Rates

Hypothesis 19a stated that a non-punitive response to errors will be positively related to unit reporting rates (see Table 33). When controlling for hospital management, results suggest that a non-punitive response to errors leads to higher unit reporting rates, thus supporting this hypothesis (R^2= .016, *F* (2,1343) = 10.71, *p* < .001). Hypothesis 19b

predicted that willingness to report errors will partially mediate this relationship. This hypothesis was also supported (R^2= .030, F (2,908) = 13.98, p < .001).

Table 30

Regression analysis predicting willingness to report errors as a mediating variable between non-punitive response to errors and unit reporting rates

Model	Predictor	Criterion	β	R^2	R^2 Δ	*p*
1	Non-punitive response to errors	Unit reporting rates	.060*	.016	.003	.040
	Hospital management support		.089**			
2	Non-punitive response to errors	Willingness to report	.212***	.167	.039	.001
	Hospital management support		.281***			
3	Willingness to report	Unit reporting rates	.124***	.015	.015	.001
4	Non-punitive response to errors	Unit reporting rates	.127***	.030	.006	.015
	Willingness to report		.084*			

*p < .05, **p < .01, ***p < .001

SECTION 5 - DISCUSSION

Safety culture is a 'buzz word' that receives a lot of attention in high consequence environments. Research within aviation and beyond has examined what it takes to develop a positive safety culture—management support, promotion of a learning environment, documentation of errors, rewarding safe behaviors, among others. However, little research, especially in healthcare, has linked a positive safety culture to outcomes. Areas outside of healthcare have demonstrated that a positive safety culture leads to an increase in safe behaviors and a reduction and errors. Making this link is not an easy task—it requires a commitment from the organization to supply the resources necessary. The purpose of this research was to take a first look at linking perceptions of safety culture to patient safety outcomes within five critical care units—emergency department, surgery, intensive care, perinatal and pediatrics. Specifically, the AHRQ HSOPS was chosen as the measure for this dissertation which assesses both dimensions of safety culture as well as outcome variables. In addition, objective patient safety outcome data was also gathered (e.g., incidents, unit reporting rates) to better understand this relationship. Using high reliability theory as an organizing framework, a number of hypotheses were tested to uncover this seldom studied relationship.

Sensitivity to Operations

The first organizational value exhibited by HROs is sensitivity to operations, in which the purpose is to set the tone in the organization and its work units. This is

encouraged by supervisors who continuously monitor and discuss events as they occur as a means to promoting patient safety. As predicted, supervisor expectations regarding safety, hospital management support towards safety, explicit supervisor expectations about safety, and feedback and communication about errors are positively related to overall perceptions of safety and patient safety grade (i.e., Hyp 2, 3, 6, 7, 8a, 9a and 10). Previous research examining this link in the healthcare community was not found. However, these findings are consistent with research outside of healthcare which has shown that commitment from upper level management to safety and safe practices and feedback about errors lead to more positive attitudes (e.g., Cox et al., 1998; DePasquale & Geller, 1999; O'Toole, 2002; Zohar, 1980). Executive walkrounds, safety briefings, and safety training programs are suggestions for how management at all levels can show their commitment to safety.

It was also hypothesized that this commitment from management would increase the number of events reported by employees and units (Hyp 3, 4a, 4b, 5a and 5b). A relationship was found between these predictor and criterion variables, however, employees response to the number of events that they reported in the last 12 months was in the opposite direction than predicted. Because the data also showed that employees are willing to report events when they occur, the likely explanation for these results is that management commitment to safety (i.e., support, explicit expectations, feedback about errors) leads to a safer environment and thus fewer errors to report.

Likewise, organizational learning was shown to mediate the relationship between feedback and communication and overall perceptions of safety (Hyp 9a and 9b). This

indicates that when management provides feedback about errors that have occurred within a unit, employees perceive this as a willingness of the organization to learn from what happened rather than to cover it up. This further supports research that suggests that the cause of an error should be investigated (not just the outcome of the incident) and when its cause is determined, the whole organization should learn from it (Barling & Zacharatos, 1999). Discussing errors that have occurred without placing blame allows employees to learn from these errors and to avoid, trap, or mitigate the consequences of similar errors in the future before a serious incident occurs (Helmreich, Merritt, & Wilhelm, 1999; Hofmann & Stetzer, 1998).

Limited support was found for hypothesis 1 which predicted that supervisor expectations would be negatively related to incidents. In terms of overall incidents, no relationship was found between supervisor expectations and incidents. Further analysis of this relationship revealed contradictory results—medication incidents were positively related to supervisor expectations and non-medication incidents were negatively related (as would be expected), although this relationship was weak. Additional research is needed to understand why this may be the case.

Reluctance to Simplify

Teamwork on the front lines has been promoted in healthcare as a means to improving safety (e.g., Small, 1998). However, teamwork does not just happen; it must be promoted and supported by management albeit through training, team building or other means (Weick & Sutcliffe, 2001). The previous set of hypotheses discussed

indicated that a supportive environment by management leads to more positive perceptions of safety. Furthermore, hospital management support and supervisor expectations were positively related to teamwork, and teamwork is related to overall perceptions of safety and patient safety grade. However, overall the data to support the mediating relationship of teamwork within and across units was mixed (Hyp 11-16). Based on definitions of the constructs, teamwork within units served as the mediator for relationships involving supervisor expectations, and both teamwork within and across units were mediators for relationships involving hospital management support. For example, teamwork within units fully mediated (although only partial mediation was hypothesized) the relationship between supervisor expectations and non-medication incidents (Hyp 11), as well as hospital management support and non-medication incidents (Hyp 14) (teamwork across units was not significant). As predicted, teamwork within units partially mediated the relationship between supervisor expectations and patient safety grade (Hyp 13). Teamwork within units as a mediating variable between supervisor expectations and overall perceptions of safety was not supported (Hyp 12). Teamwork within units also did not serve as a mediating variable between hospital management support and overall perceptions of safety, although teamwork across units did (Hyp 15). Finally, both teamwork within units and teamwork across units served as mediators of the relationship between hospital management support and patient safety grade (Hyp 16).

Preoccupation with Failure

HROs also demonstrate a preoccupation with failure in that, no matter how big or small, incidents that occur serve as a learning experience (Weick & Sutcliffe, 2001). To promote this, organizations encourage employees to report errors when they occur, without fear of retribution. Results of this research supported this, indicated by a significant, positive correlation between hospital management support for safety and a non-punitive response to errors (Hyp 17). Furthermore, support was found for the relationship between a non-punitive response to errors and unit reporting rates. Specifically, in units in which a non-punitive response to errors is perceived, there was also a higher number of errors reported (i.e., unit reporting rates), and employees willingness to report errors mediated this relationship, although the relationship was weak (Hyp 19a and 19b). Contrary to predictions, there was not a relationship between a non-punitive response to errors and number of events reported by each employee (Hyp 18a and 18b). It may likely be the case that while employees are willing to report errors, the safe 'environment' in which they work mitigates the consequences of errors before they become a reportable incident.

Commitment to Resilience

HROs demonstrate a commitment to resilience by containing or managing unexpected events. This commitment is promoted in organizations by ensuring adequate resources, such as staffing levels, are available. Support was found for the importance of

staffing in that perceptions of staffing served as a mediating variable between hospital management support and overall perceptions of safety (Hyp 21). This indicates that hospital management's commitment to safety through adequate staffing levels has a positive impact on overall perceptions of safety. Furthermore, it was also predicted that staff turnover would be negatively correlated with perceptions of staffing, overall perceptions of safety and patient safety grade. Only partial support was found in that staff turnover was negatively correlated with overall perceptions of safety, suggesting that when staff turnover increases, overall perceptions of safety decrease.

Deference to Expertise

Deference to expertise is the fifth characteristic exhibited by HROs to contain, as well as identify, the unexpected. It has been suggested that good information flow between management and employees will lead to a more positive safety culture (Wilson-Donnelly, Priest, Burke, & Salas, 2005). When employees feel that management is committed to safety, they will feel more comfortable communicating their ideas and opinions, and not hiding mistakes that are made. In addition, employees must feel comfortable asserting themselves to colleagues, an action sometimes discouraged in healthcare yet has a great impact on effective patient safety (e.g., Zwarenstein & Reeves, 2002). Up until this point, positive relationships have been found between hospital management and supervisor support for safety and overall perceptions of safety and patient safety grade. In line with this, communication openness was predicted to partially mediate the relationship between supervisor expectations and overall perceptions of

safety. These hypotheses were supported indicating that a commitment from management to safety will lead to greater communication openness and subsequent higher perceptions of safety (Hyp 23, 24, 26, and 27). Contrary to predictions, communication openness did not partially mediate the relationship between management commitment and incidents as a whole, or when broken down by incident type (Hyp 22 and 25).

Summary

Given these findings, the question to be answered is "Does safety culture predict clinical outcomes?" The question may not be that easy however. Indeed, perceptions of management commitment to safety in work units do influence their overall perceptions of safety in that unit. Furthermore, this commitment from management results in the willingness of staff to report errors should they occur. In addition, providing feedback about errors that occur leads to higher perceptions of organizational learning, further encouraging the reporting of errors. However, the low number of incidents that occurred in the organization examined here made it difficult to link safety culture and incidents. Although weak, a relationship does seem to exist between perceptions of safety culture and reportable (i.e., to the state) non-medication type incidents. This research is just the tip of the iceberg. Additional research is needed to better understand this relationship. Research must also focus on those incidents that occur, yet don't meet standards for reporting (i.e., near misses), as they may be more indicative as whether a relationship exists or not.

Limitations and Implications for Future Research

Several limitations to this research should be noted. First, the data collected as a part of this research was primarily self-report. Given the sensitive nature of the data, it is possible that participants may have provided socially desirable responses to the survey. In other words, respondents may have provided more positive response to questions to give the impression of greater safety in their work units.

Similarly, the generalizability of present findings may have been negatively impacted by the low response rate on the survey. Because of this, it is not possible to compare the respondents with non-respondents to determine if any systematic differences exist between these two groups. Low response rates are a common problem in organizational survey research, and some research suggests differences between respondents and non-respondents such as lower job satisfaction, greater intentions for turnover, and weaker organizational commitment (e.g., Rogelberg, Luong, Sederburg, & Cristol, 2000). Others research suggests that non-respondents are less conscientious and low agreeableness (Rogelberg, Conway, Sederburg, Spitzmüller, Aziz, & Knight, 2003). Similar conclusions may be identified in non-respondents to this research, for example, less willingness to report errors and lower perceptions of safety. As a consequence of low response, it is possible that the ranges of scores on some variables were restricted. Future research efforts should focus on expanding the respondent pool by encouraging all employees to participate as well as utilizing multiple methods (e.g., interviews, focus groups) to gather a more representative view of the organization's safety culture.

A third weakness of this research focuses on the use of a single survey to collect much of the data. One of the concerns with this type of measure is that both predictor and criterion variables are collected using the same method, with the potential of mono-method bias. However, given two of the dependent variables involve individual perceptions (i.e., patient safety grade and overall perceptions of safety). Therefore, it is not feasible to use another data source (e.g., supervisors' perceptions of employees' perceptions) to gather this data—it would not be reliable. Furthermore, while the dependent variables could have been collected at another point in time, a self-report measure of participant's perceptions would still introduce the same concerns. To help alleviate these concerns, it has been suggested that some items on the measure be reverse worded and that items for predictor and criterion variables be intermixed (e.g., Cook & Campbell, 1977). The HSOPS demonstrates both of these suggestions. To also alleviate these concerns, several additional objective criterion variables were collected from different data sources to use as a part of this research. Research in the area of safety culture must continue to gather data from multiple sources to understand the true impact of safety culture on clinical outcomes.

Finally, there are a number of difficulties for establishing a clear cause and effect between safety culture and incidents. After all, this data is difficult to collect—limited resources, fear of retribution, and low number of reportable incidents that occur in healthcare. As the results suggested, respondents are willing to report events when they occur, however, there appears to be limited opportunities to do so. Future research should consider investigating the link between safety culture perceptions and near-miss

incidents. The healthcare community is beginning to recognize the importance of near-miss incidents and the Veteran's Affairs (VA) and NASA have teamed up to develop the Patient Safety Reporting System (PSRS) (www.psrs.arc.nasa.gov). Currently this system is only available to VA hospital employees. However, some hospitals utilize internal systems to track near-misses and these incidents need to studied.

Practical Implications

This study is useful in directing attention to the understudied relationship between safety culture and clinical outcomes. The findings support previous research in that hospital management and supervisor support for safety does improve overall perceptions of safety. This research extended the literature by investigating the link between safety culture perceptions and objective outcomes—incidents.

Several hypotheses investigated as a part of this research examined the relationship between perceptions of safety culture and incidents. The results suggest that when incidents are looked at as a whole (i.e., all incidents which occurred within a unit), no relationship existed. However, when incidents were broken down by type, namely medication versus non-medication errors, interesting results were found. In fact, a more positive safety culture was linked to an increase in medication type incidents. These results initially seem counterintuitive. To suggest a positive relationship between safety culture and medication incidents on the surface detracts from the research in other domains suggesting the opposite. It could be the case that an increase in incidents leads an organization to implement additional patient safety efforts, and therefore employees

perceive a more positive safety culture. Additional research is needed to investigate this, as well as the impact of a positive safety culture on other types of incidents. For example, it remains to be seen whether a positive safety culture has a different impact on severe (i.e., life threatening) versus non-severe incidents.

In line with the above, it can not be concluded that when an incident occurs, that learning actually takes place. The data suggests that management that supports a safety culture provides feedback regarding incidents that occur, and thus employees perceive organizational learning. However, does this communication about incidents actually lead to behavioral change? For example, Desai and colleagues (2006) examined accidents in aviation and found that better learning occurred from accidents of moderate severity. The reason suggested is that these incidents were salient enough that they prompted improvement without being overly complex in which recovery efforts would face challenges. Organizations need to understand which incidents will have the greatest impact on learning. Therefore, future research needs to examine the short term and long term effects of incidents and other patient safety initiatives.

This research also has implications for safety-related behaviors. The findings suggest that in environments in which employees perceive a positive safety culture, they are also more willing to report incidents when they occur. It is likely that the positive perceptions of safety culture will translate in to other positive safe behaviors such as monitoring of team members performance, less risk taking behavior, and asking for help when overloaded, among others. Additional research should seek to uncover how a positive safety culture impacts these and other safe behaviors in the workplace.

Finally, this research used high reliability theory as a framework. While a direct cause and effect relationship can not be made between the organizational values posited by HRT (e.g., organizations promoting sensitivity to operations leads to improved patient safety), there is reason to believe that there is a link. There is notably a relationship between hospital employees' perceptions of an organization's commitment to these values and outcomes. Future research should examine the link between these values at the organizational level (i.e., patient safety activities in place to support them), safety culture and clinical outcomes.

In conclusion, it is difficult to say whether positive perceptions of safety culture lead to improved patient safety or vice versa. It is the circular cause and consequence as faced in the dilemma "which came first, the chicken or the egg?" A valid argument could be made for both. However, the research presented here indicates that there is in fact a relationship, and provides a first look at this seldom studied relationship. With this information, it is hoped that organizations will be better prepared to address specific areas of safety culture that may be contributing to poor patient safety, and thus, improve it in the future.

APPENDIX A
SUMMARY OF SAFETY CULTURE LITERATURE

Table A.1
Empirical literature examining safety culture/climate in organizations

Source	Domain	Key findings
Armstrong & Laschinger (2006)	Healthcare (40 healthcare workers at a Magnet hospital)	▪ Total empowerment significantly positively related to perceptions of patient safety culture. ▪ Patient safety climate most strongly related to access to support (feedback), informal power (strong alliances), and opportunity to learn and grow (continuous learning). ▪ Structural empowerment and Magnet hospital characteristics together are a significant predictor of staff nurses' perceptions of patient safety climate.
Brown & Holmes (1986)	Production workers in 10 manufacturing companies (n= 425, of those 200 had suffered an accident in the past year and 225 had not)	▪ Three-factor safety climate: risk, management concern, and management action found to be a better fit than Zohar's (1980) 8-factor model. ▪ Post-traumatic group's perceptions of risk, management concerns, and management actions were significantly lower than pre-traumatic group.
Brown, Willis, & Prussia (2000)	Steel industry (n= 551 workforce, 69%)Soft drink bottling factory (n= 97 employees)	▪ Safety climate was negatively related to supervisory pressure. ▪ Knowledge and motivation predict compliance and participation. ▪ Relationship between knowledge and compliance is stronger than that of knowledge and participation. ▪ Safety climate influences knowledge and motivation. ▪ Safety climate influences participation. ▪ Relationship between organizational climate and safety performance is mediated by safety climate, knowledge, and motivation.
Burns, Mearns, & McGeorge (2006)	UK gas plant	▪ Authors looked at trust as a factor related to safety culture. ▪ On explicit measures, employees trusted their coworkers, supervisors and plant managers. ▪ When implicit measures were used, trust was only found for coworkers. ▪ The authors consider that trust and distrust may be different constructs.

Source	Domain	Key findings
Carroll (1998)	Nuclear power plant (n= 130)	▪ The results of the safety culture survey and group interviews were fed back to management as part of the culture improvement process. ▪ Results showed that management behaviors were too hierarchical and the role of the supervisor was under minded, despite the findings of a healthy culture. ▪ Employees were worried about being blamed for mistakes and there was a lack of positive reinforcement for safety behaviors.
Castle (2006); Castle, Handler, Engberg, & Sonon (2007)	Healthcare (n= 1579 nurse aides at 72 nursing homes)	▪ Patient safety culture ratings at nursing homes were significantly lower than benchmark ratings at a hospital setting. ▪ In facilities with higher registered nurse staffing levels, higher safety culture scores were given.
Catchpole et al. (2006)	Healthcare (24 paediatric cardiac cases)	▪ 366 failures recorded. ▪ Cultural and organizational threats were most frequently encountered single type of threat (associated with 85 or 23% of failures). ▪ Task threats (33 or 9% of failures) often appeared in combination with patient (87 or 24%) and environmental (19 or 5%) threats. ▪ Patient threats always appeared with task threats. ▪ Environmental threats accounted for 54 or 15% of failures and another 12 or 3% of failures when combined with environmental and cultural/organizational threats.
Cheyne et al. (1998)	Multinational manufacturing (n= 915)	▪ Employee attitudes to management directly influenced safety activities and indirectly influence individual responsibilities for safety.
Cheyne et al. (1999)	Manufacturing, dairy produce, transport, workforce (n= 2429)	▪ Appraisals of commitment were strongly predicted by management actions and responsibility and less strongly predicted by quality of safety training in all samples. ▪ There was also a strong reciprocal relationship between these predictors. ▪ Attitudes to management actions were related to personal actions and responsibility in manufacturing and dairy produce, but not in

Source	Domain	Key findings
		transport. ▪ There was a weak but significant negative relationship between training and personal actions and responsibility across all 3 samples ▪ Evidence that the architecture of safety climate was not stable across industries.
Clarke (1999)	Train operating companies (train drivers: n= 186; supervisors: n= 55; senior managers: n= 71)	▪ A novel method was used to examine the degree of shared perceptions of culture between workers, supervisors, and managers. ▪ Each level was aware that shared safety priorities did not exist. ▪ In-group perceptions were not always accurate and were sometimes biased. ▪ There was partial support that workers base their perceptions of senior managers on their perceptions of local management and supervisors.
Cox & Cox (1991)	Gas company depots (n= 630)	▪ Based on the factor analysis and framework suggested by Purdham (1984, as cited in Cox and Cox, 1991), a theoretical model emphasizing the shared aspects of employee attitudes to safety is presented.
Cox et al. (1998)	13 manufacturing companies (n= 3329)	▪ Managers, supervisors, and temporary workers had generally lower perceptions than permanent workers. ▪ Management actions for safety were the strongest predictor of employee appraisals of organizational safety, followed by training and personal actions. ▪ SEM analysis found that personal actions emerged as stronger predictors than training, although there is a strong reciprocal relationship between them. ▪ Management actions were the only predictor of personal actions.
Cox, Jones, & Collinson (2006)	Nuclear and Offshore oil (2 case studies)	▪ In nuclear case, trust was critical in the development and sustainability of a safety culture based upon error reporting, individual and organizational learning, and perceived need for a 'just' culture. ▪ Individuals encouraged to take responsibility

Source	Domain	Key findings
		for safety within the organization and to develop a question and challenge culture. ▪ In offshore oil case, low levels of trust negatively impacted safety culture through poor cooperation and communication among employees and managers. ▪ Low trust reinforced a culture of blame and non-reporting of safety-related information.
Coyle et al. (1995)	Clerical and service organizations (n= 880)	▪ Safety climate factors were not stable across organizations. ▪ Glennon's (1982, as cited in Coyle et al., 1995) findings that nine factors would be universal was not supported since the factors structures of organization 1 did not match organization 2. ▪ Results also did not support Brown and Holmes' (1986) universal 3 factors.
Dedobbeleer & Beland (1991)	9 construction companies (n= 384)	▪ Attempts to validate previous research by Zohar (1980); Brown and Holmes (1986). ▪ Brown and Holmes 3-factor model was supported by the data but a new 2-factor model proved an even better fit. ▪ The 2 factors of management commitment and workers involvement were correlated .61. ▪ The questionnaire only comprised nine questions, roughly one question to represent each factor from Zohar's solution.
DeJoy, Schaffer, Wilson, Vandenberg, & Butts (2004)	Retail (n= 2208 employees at 21 retail units)	▪ Negative relationship between environmental exposures (heat, noise, lighting) and safety climate. ▪ Safety policies and programs positively and significantly contributed to safety climate. ▪ Organizational climate factors (e.g., communication, involvement) had a significant positive relationship with safety climate. ▪ Environmental exposure, safety policies and programs, organizational support, and participation-others were each significantly related to safety at work. ▪ Environmental exposures, safety policies and programs, organizational support, coworker support, and communication were each

Source	Domain	Key findings
		significant predictors of safety climate. ▪ Safety climate is not a mediator between participation-others and safety at work. ▪ Environmental conditions, safety policies and programs, and organizational climate accounted for 55% of the variance in safety climate.
Demiris, Patrick & Boren (2004)	Healthcare (n= 16 administrators and 14 health car providers from 6 rural hospitals in Missouri)	▪ 3 administrators versus 13 healthcare providers agreed that there was a timely response to adverse event reports. ▪ 8 of 16 administrators stated that the current mechanism for event reporting is appropriate and adequate for ensuring patient safety. Only 3 of 14 healthcare providers agreed. ▪ 12 of 16 administrators and 13 of 14 healthcare providers agreed that events are under reported. ▪ 10 of 14 healthcare providers believed there was no culture of blame that was regularly placed on individuals involved in medical errors.
DePasquale & Geller (1999)	20 industrial sites implementing behavior-based safety programs (BBS)	▪ Factors determined to be critical to BBS success. ▪ Allow time for employees to get used to being observed and receiving feedback. ▪ Trainers must be clear that program is not a place to blame or criticize others. ▪ Interpersonal trust is important. ▪ Continued support from management is essential. ▪ Employee involvement in training is necessary. ▪ Trust in management's ability to facilitate and support BBS is important. ▪ Steering committee must be in touch with what employees need to improve safety. ▪ Other findings: ▪ Mandatory BBS programs vs. voluntary programs use more positive feedback. ▪ Mandatory vs. voluntary demonstrate greater levels of trust in management and coworkers. ▪ Increased employee involvement leads to more trust and vice versa.

Source	Domain	Key findings
		▪ Greater experience with observation and feedback leads to more trust.
Desai, Roberts, & Ciavarelli (2006)	US Naval flight squadrons (6361 pilots, flight officers, and other aircrew in 147 squadrons)	▪ Minor or intermediately severe accidents were positively related with future safety climate scores. ▪ No effect was found for severe accidents.
Diaz & Cabrera (1997)	Aviation (166 airport personnel from 3 companies)	▪ Overall, safety climate appears to be related to general safety levels. ▪ Organizations with higher safety levels had higher safety climate scores and more positive safety attitudes. ▪ Organizational policies and practices are related to workers' global perceptions and safety climate. ▪ Likely that safety policies impact behaviors. ▪ Significantly significant relationship between safety attitudes and safety climate. ▪ Attitudes appear to be better predictor of climate than climate of attitudes. ▪ Employees perceptions regarding the importance given towards organizational philosophy is critical for productivity and safety. ▪ Specific findings: ▪ Ramp workers had significantly lower positive attitudes than non-ramp workers. ▪ Significant differences found between companies regarding safety factors.
Donald & Canter (1994)	10 chemical sites (n= 701)	▪ Strong relationship between safety climate and self-reported accidents. ▪ Correlations ranged from -.45 to -.83, $p < .05$. ▪ Attitudes toward safety reports were the only item not to correlate with self-reported accidents.
Forgaty & Shaw (2003)	Aircraft maintenance	▪ Examined the relationship between safety climate and violation behaviors. ▪ Management attitudes and group norms found to be predictors of violation behavior.

Source	Domain	Key findings
Gaba, Singer, Sinaiko, Bowen, & Ciavarelli (2003)	Naval aviation and healthcare	▪ Significant differences found between aviators and healthcare providers. ▪ Level of problematic response 12 times greater for hospital workers than aviators.
Galvan, Bacha, Mohr, & Barach (2005)	Healthcare (all pediatric cardiac surgery team members)	▪ Preliminary results from the safety survey suggest a lack of awareness to patient safety hazard as well as lack of awareness of the various ways to keep children from being harmed in the OR.
Garavan & O'Brien (2001)	Manufacturing (n= 1240 employees in 25 companies)	▪ Gender does not appear to have a significant effect on safety climate overall. Gender did have a significant effect on extent to which employees are likely to perceive that safety climate promotes ownership of and participation in safety issues, particular beliefs about people who have accidents, and strict adherence to rules and procedures; level of management commitment to safety; degree of riskiness in the job. ▪ Participation in safety training does not appear to have a significant effect on employees' perception of overall safety climate in the organization, but did have a significant effect on extent to which employees perceive that safety climate promotes ownership of and participation in safety issues, extent to which climate contains negative stereotypes about safety conscious employees, beliefs about people who typically have accidents, and perception of management commitment to health and safety. ▪ Job title had a significant effect on perceptions of overall safety climate, perceptions of ownership of and participation in safety, perceived riskiness of the job, perception of the existence of specific strategies for safety, beliefs regarding the extent of proactive approaches to safety, perception that management has sole ownership of safety, and perception of strict adherence to rules.

Source	Domain	Key findings
		▪ Age had a significant effect on extent of negative stereotypes about safety conscious employees, perceptions of proactive approaches to safety, and extent of perceptions of management commitment to safety. ▪ Organizational tenure had a significant effect on extent of negative stereotypes about safety conscious employees and level of riskiness in the job. ▪ Accident history had a significant effect on perceptions of management commitment to safety, perceived riskiness of the job, and perceived extent of strict adherence to roles for those who engage in unsafe work behavior. ▪ For employees involved in a near accident in last 12 months, this had a significant effect on perception of management commitment to safety, perceived riskiness on the job, beliefs about accident proneness, individual perceptions that specific strategies exist for safety, perception that management has sole ownership of safety and belief that employees possess the capacity to be safety conscious. ▪ Participation in safety training had a significant effect on stereotyping, ownership and participation in safety, beliefs about people who typically have accidents and perception of management commitment to safety. ▪ Age was significant in relation to engagement in preventative safety behaviors and communication of unsafe work conditions, as well as breaking safety rules (a negative behavior). ▪ Organizational tenure had a significant effect on communication of unsafe work conditions and engagement in risky behavior. ▪ Gender was significant in relation to attention to rules and procedures, good housekeeping practice, and engaging in preventative safety behavior.

Source	Domain	Key findings
		▪ Job title was significant in relation to positive response to hazardous situations, communication of unsafe work conditions, proper use of equipment, engagement in preventative safety behavior, good housekeeping practices, and attention to rules and procedures. ▪ Participation in safety training had a significant effect on safety behaviors (communication, preventive safety behavior, and attention to rules and procedures). ▪ Management commitment to safety was positively and significantly correlated with safe behaviors and negatively correlated with unsafe behaviors. ▪ Overall, when employees have more positive perceptions of safety climate, they are less likely to engage in unsafe behaviors.
Garnerin, Huchet-Belouard, Diby, & Clergue (2006)	Healthcare (case study)	▪ Used a multidisciplinary system analysis to identify care-delivery problems and contributory factors. ▪ 3 care-delivery problems were identified: patient equipped with wrong pump when transferred from ICU to surgical ward, error made when substituting pumps in order to continue treatment, and replacement of incorrect pump was delayed. ▪ Corrective actions: increase number of necessary pumps within units, train nurses on appropriate knowledge to administer pumps, clarified medical responsibilities to avoid delays.
Glendon & Litherland (2001)	Road construction	▪ No relationship found between safety climate and behaviors. ▪ Some safety climate factors may be stable across organizations and industries (adequacy of procedures, work pressure, personal protective equipment, relationships, and safety rules).
Griffin & Neal (2000)	Manufacturing and mining organizations (study 1: n= 1264 employees; study 2:	▪ Study 1: Safety climate showed a direct and positive relationship with both safety compliance and safety participation. ▪ Results suggest a difference between safety

Source	Domain	Key findings
	n= 326 employees)	compliance (e.g., uses protective equipment) and safety participation (e.g., participates in safety requirements development). ▪ Study 2 (authors suggest further investigation of these results): Safety climate is likely to influence safety participation through safety knowledge and participation motivation. ▪ Compliance motivation is negatively related to safety participation.
Harvey et al. (2001)	Nuclear (Pre safety training: n= 417; post safety training: n= 480)	▪ Managers' scores were significantly higher than shop floor employees at T1 and T2 in terms of perceived management style and communication, responsibility, commitment and involvement, job satisfaction, and risk awareness. ▪ Managers' scores increased on 5 of 6 factors between T1 and T2 but were only significant on perceived management style and communication and complacency. ▪ Shop floor employees only showed a significant change on job satisfaction between T1 and T2 and this was in the negative direction.
Harvey et al. (2002)	Nuclear (n= 1003 employees at 2 plants)	▪ Safety culture differs between shop floor and management employees. ▪ Overall, shop floor employees viewed management communication, management commitment to safety, personal responsibility for safety and being listened to, more negatively than management employees. ▪ Shop floor employees at Plant A viewed management and greater risk awareness and risk taking more positively than management. ▪ Shop floor employees at Plant B had more negative views regarding management and lower job satisfaction than management. ▪ Job satisfaction appeared to have greatest impact on perceptions of safety.
Hignett & Crumpton (2007)	Healthcare (n= 64 nurses, 4 from 16 organization)	▪ Safety culture scores ranged from 17-77% (average of 47%) (i.e., % compliance with RCN competencies). ▪ For the sitting-to-standing task, 32 participants from organizations with an

Source	Domain	Key findings
		average score of 51% chose to use the handling belt/sling, which has the lower postural risk (REBA= 3.4) than others. ▪ The average organizational score of participants choosing the manual technique, which has greater postural risk (REBA= 7.4), was 39%. The manual technique is only 20 secs faster than belt. ▪ Participants who chose the manual technique made fewer decisions and showed less evidence of problem solving than those who chose the handling belt/sling. ▪ For the repositioning-in-sitting task, participants from higher scoring organizations (56% compliance) chose the hoist, mid-scoring organizations (47%) chose the belt or manual techniques, and low scoring (33%) chose slide sheets. Hoist is the recommended method whereas manual is not accepted unless patient can take most of their weight. ▪ Overall results indicated in organizations with more positive safety culture, nurses demonstrated more complex decision making about patient handling and had lower levels of postural risk.
Hofmann & Mark (2006)	Healthcare (1127 nurses in 81 medical-surgical units in 42 hospitals)	▪ Overall safety climate was significantly related to medication errors, urinary tract infections, nurse back injuries, patient satisfaction, patient perceptions of nurse responsiveness, and nurse satisfaction.
Hofmann & Stetzer (1996)	Chemical processing (sample 21 teams and 222 individuals)	▪ Role overload, group processes, safety climate, and intentions to approach were related to unsafe behaviours. ▪ Intentions to approach mediated the relationship between group processes and unsafe behaviours. ▪ At the group level, safety climate, group processes, intentions to approach, and unsafe behaviors were related to OSHA recordable accidents.
Hofmann & Stetzer (1998)	Utility company (sample 1: 1520 workers and	▪ Supervisors made more internal attributions to accidents than workers. ▪ Groups in which safety information was

Source	Domain	Key findings
	supervisors; sample 2: 735 workers and supervisors)	openly communicated are more likely to make internal casual attributions when the worker was implicated by the evidence. ▪ Groups in which safety information was not openly communicated showed a restriction of information flow. ▪ Safety climate did not moderate the relationship between informational cues received and attributions made.
Huang (2007)	Healthcare (n= 4 ICU units)	▪ Nurses had lower scores on the SAQ when compared to physicians. However, across the board, scores were low on all six patient safety factors.
Hughes & Lapane (2006)	Healthcare (n= 367 nurses and 636 nursing assistants)	▪ Only 11% of nurses and 13% of nursing assistants gave excellent safety grades for their facility; 5% of both groups gave a failing/poor grade. ▪ Length of employment (less or more than 1 year) did not have a significant impact on safety ratings. However, those employed for more than 1 year were more likely to report that staff worked as a team and units cooperated well. ▪ Third shift employees were least likely to give their department an overall very good or acceptable grade. ▪ More nursing assistants (25% vs. 18%) indicated that reporting a safety incident seems like the person is being written up rather than the problem. More nurses (42% vs. 36%), however, indicate that the reporting of errors of another staff member was seen as a personal attack against them.
Jarvinen & Karwowski (1995)	Manufacturing (Advanced Manufacturing Systems)	▪ Individual involved (operator-67%; maintenance/ repair-20%; laborer-8%). ▪ Activity at time of accident (clearing blockage-18%; loading/unloading-16%; fault finding-15%; making adjustments-13%). ▪ Type of accident (pinch-point-75%; impact-19%; other-6%). ▪ Operating mode (automatic-55%; manual-19%; stopped, not isolated-16%). ▪ Automated equipment movement

Source	Domain	Key findings
		(programmed or normal-57%; unexpected-24%; sensor inadvertently activated-12%). ▪ Equipment safeguarding (safeguard defeated-25%; allowed access to hazard zone-22%; no or inadequate interlock-17%; no guard-16%; guard removed-11%). ▪ Factors identified as relating to accidents (improper procedures followed-44%; human error-38%; incompatible workplace layout-27%; incompatible controls-25%; lack of awareness-20%; inadequate training-16%).
Jeffcott, Pidgeon, Weyman, & Walls (2006)	Railway (N= 500+ staff and 40 senior staff)	▪ Since the 1993 privatization and organizational restructuring of the UK railway industry, there have been important repercussions for safety culture and trust relationships. ▪ Fragmentation has led to potential for tensions to develop across various organizational interfaces. ▪ Performance regime has led to an increased focus on performance and attribution of blame for underperformance has emerged. ▪ Proceduralization was primarily motivated by self-preservation within a culture focused on accountability. ▪ The principles of career advancement based upon tenure and long established apprenticeship system have been replaced with targeted recruitment, higher turnover of staff, and classroom-based learning. Concern over the loss of conceptual understandings of railway rules, procedures and operating practices in new, nonrail recruits. ▪ Accidents have formed a crucial determinant of attitudes, relationships, and culture throughout the sector. Led to a risk-based approach in favor of an overcautious one, allowing risk aversion to dominate decision making. There is also a fear of prosecution which has pressured staff to maintain exemplary levels of competence. ▪ Over reliance on formal procedures and audits of performance are felt to only foster and

Source	Domain	Key findings
		create distrust. ▪ Overall, train operating companies appear more rigid rather than flexible, have deficiencies relating to perceptions of management commitment, and lack of consistently open/ communicative environment to foster learning. ▪ Positives of privatization: improved training, improved working relationships (formal and informal), attempt to realign operating companies' goals with overall infrastructure management.
Jiang & Gainer (1987)	Organizations using robots	▪ Individual involved (operator-72%; maintenance-9%; programmers-9%). ▪ Type of accident (pinch-point-56%; impact-44%). ▪ Factors relating to cause of accidents (human error-41%; inappropriate/poor workplace design-63%; robot design-22%). ▪ Overall findings: largest causal factor of accidents was inadequate, poor, or non-existent methods to safeguard employees.
Katz-Navon, Naveh, & Stern (2005)	Healthcare (n= 632 providers in 47 hospital untis)	▪ Study found that the priority of safety moderated the curvilinear relationship between safety procedures and the number of a unit's treatment errors, and the linear relationship between managerial safety practices and the number of a unit's treatment errors. ▪ When safety was a high rather than low priority, there were fewer treatment errors when procedures were perceived as either insufficient or overly detailed.
Lee & Harrison (2000)	Nuclear (n= 70+ staff and managers)	▪ Younger workers' positive attitudes were attributed to less time on the job and begin on a positive note, and older workers have the most positive attitudes which was correlated with higher level staff positions. Most negative attitudes found in the 30-40 age range. ▪ Age had a significant influence for some job types in terms of job satisfaction, perceived empowerment, organizational risk level,

Source	Domain	Key findings
		satisfaction with contractor safety, and respect for contractors' role. ▪ Women had more positive attitudes towards safety than men, significant on 19 attitudinal variables. Women were significantly more negative in terms of personal risk than men. Women and office workers, however, don't typically work in high hazard areas. ▪ Shift workers were almost uniformly more negative than day workers, significant on 23 of 28 factors. Shift workers were significantly more positive (cautious) regarding personal risk than day workers. Shift workers are less prone to personal stress but report lower satisfaction with job relationships. Shift workers less confident in the organizational risk level and safety standards. ▪ Senior managers are reported to put the most pressure on employees and colleagues and safety reps are seen as most likely source of suggestions to improve safety. ▪ Safety attitudes were highly correlated with attention given to safety in team briefings and management style.
Lee (1998)	Nuclear reprocessing plant (n= 5296)	▪ Most factors identified discriminated between accident and non-accident groups. ▪ Nineteen factors were identified: ▪ 1 factor: safety procedures ▪ 3 factors: risks ▪ 3 factors: permit to work ▪ 4 factors: job satisfaction ▪ 2 factors: safety rules ▪ 1 factor: participation ▪ 2 factors: training ▪ 2 factors: control ▪ 1 factor: design
Lymer, Richt, & Isaksson (2004)	Healthcare (n= 9 nurses and 6 nursing assistants)	▪ When discussing things contributing to good safety culture, healthcare workers commonly referred to: people, type of work, equipment and events. ▪ In wards where patients with blood-borne pathogens are frequently treated, a more rigorous safety climate developed compared

Source	Domain	Key findings
		to other wards. Workers are constantly aware that they are at risk. ▪ When there are many patients to take care of, safe work practices are sacrificed to get the job done. Reasons cited include less time to prepare for a task and use of protective equipment takes time away from next task and next patient. ▪ 2/3 of participants had experienced a blood-exposure incident and almost all knew of someone who had. From those, only 2 reported the incident and took appropriate infection avoidance procedures although it is required. ▪ Poor reporting was related to a will to sustain a positive self-image (don't want to be considered 'clumsy' or 'unprofessional'), complicated reporting instruments, and filing papers is not considered their main task, especially when time is sparse. ▪ Socialization into infection control, routinization, stereotyping, perception of patient wishes, presence of competing values and norms, and a will of workers to solve dilemmas were reported to undermine compliant behavior and safety culture.
Makary et al. (2006)	Healthcare (n= 2135 surgical providers—surgeons, OR nurses, surgical technicians, anesthesiologists, CRNAs—from 60 hospitals)	▪ Safety climate varied widely by hospital, but not provider type. ▪ Safety climate scores in each hospital ranged from 16.3% to 100% positive. ▪ 6 of 7 safety climate items did not show significant differences across provider type. OR nurses were significantly less positive about one item "I would feel safe being treated here as a patient" than surgeons and anesthesiologists.
McCarthy & Blumenthal (2006)	Healthcare (n= 6 case studies)	▪ Sentara Norfolk General Hospital: baseline assessment suggested 4 strategies to promote safety-related behaviors: behavior-based expectations, establishment of high priority rules, conducting timely and rigorous 'root cause analysis', and simplifying policies and procedures.

Source	Domain	Key findings
		▪ Preliminary results indicate a 42% increase in use of expected communications behaviors, 84% reduction in ventilator-associated pneumonias and 63% decrease in the rate of device-associated bloodstream infections. ▪ US Department of Veterans Affairs: main components of safety program are: establishing a non-punitive and confidential approach to unintended error reporting, encouraging reporting of adverse events and close calls, training on easy to use computer aided root cause analysis tools and cognitive aids to analyze reported events, adapting a systems engineering tool to uncover system vulnerabilities and design and assess improvements, and disseminating warnings about threats and lessons learned. ▪ Results indicate nearly all root cause analyses have been able to recommend a solution, 100% increase in perceived preventability of events, shift in patient behavior and professional training to H*F* and systems issues. ▪ Kaiser Permanente: principle interventions were: multidisciplinary patient rounds, assertive and structured communication techniques, communication escalation policy, and team briefings before procedures and debriefings after. ▪ After preoperative briefings instituted, no wrong-site surgeries reported. Other reported error management behaviors increased, such as willingness to speak up about safety concerns and report and discuss mistakes, suggesting better situational awareness. ▪ Comparing safety attitudes scores, OR staff perceived improvement in safety culture and teamwork. ▪ Nurse turnover rate fell by 2/3. ▪ 1 year after safety program instituted, labor and delivery staff in all four perinatal sites rated safety culture more highly than before. ▪ Missouri Baptist Medical Center: instituted

Source	Domain	Key findings
		rapid response teams. ▪ After 2 months of full implementation, calls for rapid response teams increased to 70-80% per month, 60% decrease in emergency calls for respiratory arrest and similar crises, and 15% decrease in cardiac arrests, suggesting acute crises being averted by early intervention. ▪ Johns Hopkins Hospital: instituted the Comprehensive Unit-based Safety Program (CUSP), educating about evidenced-based infection control practices and completing a posttest, supply catheter insertion carts with standardized supplies, follow checklist for safety catheter insertion, empower nurses to intervene, and prompt ICU team on daily goals sheet to ask physicians if catheters can be removed. ▪ Daily goals sheet led to an increased self-reported understanding of goals of care from 10% to 95%. Following implementation of CUSP, average ICU length of stay fell by 1-2 days. After senior executives' involvement, documented catheter-related bloodstream infections were eliminated, preventing an estimated 43 infections and 8 deaths and saving an estimated $2 million. ▪ OS*F* St. Joseph Medical Center: to reduce errors, interviewed nurses to obtain information regarding home medication use, when patients transferred or discharged, existing medications compared with those ordered by physician to be continued, any discrepancy must be resolved within 4-24 hours, and pharmacist reviews the patient's home medication use and physician orders to detect and avoid errors. ▪ Following interventions, rate of adverse drug events dropped by 91% and the hospital's perceived safety culture improved.

Source	Domain	Key findings
McDiarmid & Condon (2005)	Healthcare	▪ Safety culture was found to help explain instances of non-compliance to hazardous drug guidelines.
McDonald, Corrigan, Daly, & Cromie (2000)	Aircraft Maintenance	▪ Safety climate differs between organizations. ▪ Safety climate differs across types of jobs (aircraft techs safety climate significantly lower than quality personnel/inspectors, planning personnel, and graduate engineers/management). ▪ Types of consequences for errors differed significantly between organizations.
McDonald, Waring, & Harrison (2006)	Healthcare (n= 14 consultant-grade surgeons, 12 consultant anesthetists, and 13 departmental mangers and administrators)	▪ Physicians expressed that day-to-day work with patients could not easily be guided by pre-determined rules. ▪ Physicians portrayed themselves as highly competent professionals, able to work without protocols or guidelines. ▪ Many physicians viewed guidelines as a tool to help new staff because as specialized consultants they already had the necessary knowledge and experience. ▪ Managers, however, were supportive of guidelines, rules and planning processes. ▪ Managers believe they may be the 'guardians' of the system, but at the end of the day they have no control over what happens in the OR. ▪ Like managers, physicians as times portray themselves as being placed in no-win situations by having to choose between unpalatable options. ▪ Physicians accepted that risk is inevitable and they would make mistakes. ▪ Mistakes were viewed as bad luck rather than inadequacies in individual performance or knowledge. ▪ Concern that if physicians see mistakes as inevitable that they are less likely to report them if the purpose of reporting is to learn from mistakes. ▪ There is a wide acceptance that there are many ways to conduct a surgery, indicating

Source	Domain	Key findings
		that physicians are unlikely to criticize colleagues for ways that they do things.
Mearns, et al. (1998)	10 offshore oil installations (n= 722)	▪ Employees who had not had an accident reported significantly more safety behaviors, job communication, and stronger attitudes towards work. ▪ These employees were also happier with accident prevention and mitigation measures than the accident group. ▪ However, there were no significant differences between accident prevention and non-accident groups for the work climate variables of work pressure or job security. ▪ There were also no differences in attitudes to the onsite managers. ▪ The accident group was more positive towards there own responsibility for safety.
Mearns, Flin, Gordon, & Fleming (2001)	Offshore oil and gas industry (13 installations; 722 workers responded to surveys)	▪ Results showed that the main predictor for accident and near-misses is 'unsafe behavior'. ▪ Perceived pressure for production was shown to be the driver of unsafe behaviors. ▪ Satisfaction with safety measures was the best predictor of feelings of safety with regard to occupational hazards; workers appeared to not feel unsafe with regards to major hazards due to Offshore Safety Case legislation.
Mearns, Rundmo, Flin, Gordon, & Fleming (2004)	UK and Norwegian offshore oil installations	▪ Significant differences found in workers' perceptions of safety between UK and Norwegian sectors. ▪ The installations themselves explained more variance than the sector did for all factors but 'safety attitudes'.
Modak et al. (2007)	Healthcare (ambulatory setting)	▪ Physicians had least favorable attitudes about management, while management had the best attitudes. ▪ Respondents had similar attitudes about teamwork climate, safety climate, job satisfaction and working conditions.
Naveh, Katz-Navon & Stern (2005; 2006)	Healthcare (n= 3 units; internal medicine, surgery, ICU)	▪ Employees who perceive procedures as suitable and safety information as available are more likely to report treatment errors. ▪ The three departments differed significantly on these factors.

Source	Domain	Key findings
Neal & Griffin (2006)	Healthcare	▪ Results found that group safety climate increased individual safety motivation. This increase in turn boosted safety behavior, in the form of participation. ▪ Group level changes in safety behaviors were related to a reduction in accidents.
Neal, Griffin, & Hart (2000)	Healthcare (n= 525 employees from 32 work groups at one hospital)	▪ Organizational climate predicted safety climate. ▪ Safety knowledge and motivation predicted safety compliance and participation. ▪ The relationship between knowledge and compliance was stronger than the relationship between motivation and participation. ▪ Safety climate influenced both knowledge and motivation. ▪ Safety climate, knowledge and motivation mediated the relationship between organizational climate and safety performance. ▪ If improvements in safety climate are to impact safety performance, must first change knowledge and employee motivation.
Nielsen, Cartensen, & Rasmussen (2006)	Industrial plants (n= 2 plants)	▪ Implemented a new incident reporting scheme at two industrial plants. ▪ The intervention worked in only one of the plants which had a higher safety climate, higher management support and also a greater willingness to report incidents.
Niskanen (1994a)	Road maintenance, workers, and supervisors (n= 193)	▪ Carelessness, being in a hurry, incorrect safety observations, and lack of safety knowledge were perceived to be important determinants of accidents. ▪ Attitudes of supervisors and co-workers and manner of instruction were predictive of safety feedback. ▪ Own actions, feedback, and safety judgments were significant predictors of safety knowledge and instructions.
Niskanen (1994b)	Road construction, 85 workplaces (workers: n= 1890; supervisors: n= 562)	▪ Supervisors and workers had slightly different factor structures. ▪ Supervisors in low accident workplaces rate safety inspections better, rate their own importance higher, emphasize safety over

Source	Domain	Key findings
		cost, and believe that accidents happen by chance less. ▪ Workers in low accident workplaces value their own roles higher, suffer more mental stress, and report increased job responsibility than their counterparts in high accident workplaces.
O'Toole (2002)	Mining and construction (n= 1414 plant employees)	▪ Most significant factor linked to the reduction of injury rates is change in upper management's approach and emphasis on safety leadership and commitment to safety. ▪ Appears to be a strong causal relationship with a reduction in injury rates.
Ostrom et al. (1993)	Nuclear energy laboratory (n= 4000 administered across 5 departments)	▪ One department had a higher number of accidents than the others and was found to have more negative attitudes towards the availability and capability of safety personnel but statistical analyses were not conducted beyond descriptives. ▪ Suggestions were made for further interpretation of the results but some tests (e.g., t-tests, chi square, correlations) were deemed too difficult to interrupt and would not be of additional use to management so were not conducted.
Richter & Koch (2004)	Manufacturing (n= 1 case study presented, but compared it to 2 others)	▪ Commonly understood that a chain of adverse events would lead to an accident. ▪ Great deal of focus on economy and productivity. ▪ Workers' ability and qualifications to prevent production problems were valued greatly by themselves and management. ▪ There were barriers (unspecified) embedded in the safety culture that limited the company from analyzing and coming up with effective safety measures. ▪ Not possible to detect a unified safety culture. ▪ Integration was a week element in safety culture; differentiation and ambiguity are much stronger. ▪ When compared to other companies, variations in safety culture could be explained by differences in job content, social relations

Source	Domain	Key findings
		and structures, combined with different impacts of macro-cultures.
Rudman, Bailey, Garrett, Peden, Thomas, & Brown (2006)	Healthcare (190 providers from 8 rural hospitals; ; Safety Attitudes Questionnaire (SAQ))	▪ Significant differences found between provider position on the teamwork collaboration factor—physicians were more positive in their attitudes towards teamwork than nurses; no differences found for other providers. ▪ When compared to urban hospitals, mean scores were higher for rural hospitals. ▪ Providers were satisfied with the quality of collaboration, felt suggestions concerning safety were acted upon by management, and felt that leadership was driving their hospitals to be safety centered.
Rundmo (1994)	8 offshore oil platforms from 5 oil companies (n= 915)	▪ Management and employee commitment and involvement in safety work was the strongest predictor of satisfaction with safety measures. ▪ Perceptions of safety vs. production goals and social support were also significant predictors. ▪ Strong positive relationship between management commitment and involvement.
Scalise (2005)	Healthcare (n= 1400 employees; survey validation)	▪ Survey is easily understandable and related to safety.
Sexton et al. (2006)	Healthcare (n= 10,843 healthcare workers; SAQ validation study)	▪ Six factors: teamwork climate, job satisfaction, perceptions of management, safety climate, working conditions and stress recognition. ▪ SAQ is highly reliable (ρ= .90) and psychometrically sound. ▪ SAQ differs from other safety climate surveys in four ways: (1) more widely used for a longer period of time, (2) more psychometric data is available, (3) maintains continuity with its predecessor (FMAQ), and (4) preserved item continuity with other high reliability industries allowing for comparisons between professionals and assists with search for universal H*F* issues across professions.
Singer et al. (2003)	Healthcare (n= 2989 healthcare	▪ Overall problematic response to survey was 18%. When adding in neutral responses,

Source	Domain	Key findings
	workers)	36.5%. ▪ Almost 52% believed that loss of experienced personnel negatively affected their ability to provide high quality care. ▪ Many indicated a lack of rewards for identifying a serious mistake (33%) and fear of punishment for making a mistake (28%). 39% witnessed a coworker do something unsafe. 8% admitted doing something unsafe for the patient in last year. ▪ The average overall problematic response across all questions varied in individual hospitals from 13% to 22%. For individual questions, the range in problematic responses varied from 6% to 38% between institutions. ▪ Clinicians, in general, were found to more likely provide problematic responses than non-clinicians. ▪ Senior managers in general were less likely to give problematic responses than non-senior managers. ▪ Clinician senior managers responded more similarly to clinicians than non-clinician senior managers (i.e., clinicians were more negative than non-clinicians regardless of management status). ▪ Among clinicians, nurses were most negative and almost always responded more negatively than non-clinicians. ▪ Overall, definite discrepancy between attitudes and experiences of senior managers Non-clinician senior managers answered more often in ways consistent with a culture of safety than did personnel who actually take care of patients.
Smith, Cohen, Cohen, & Cleveland (1978)	7 pairs of plants: wood and lumber products, metals, and manufacturing	▪ Low accident plants had: ▪ Higher management commitment to the safety program. ▪ A more humanistic approach to dealing with employees. ▪ Better communication between first-line and middle management. ▪ Closer personal relationships between

Source	Domain	Key findings
		management and workforce. ▪ Better hazard control. ▪ There were no differences between low and high accident plants with regards to training, incident investigation, and policy statements.
Thomas, Sexton, Neilands, Frankel, & Helmreich (2005)	Healthcare (n= 1119 providers, baseline; n= 1000 providers, post walk rounds)	▪ After executive walk rounds (EWRs), mean safety climate scores and percent positive scores were not significantly different in control units and EWR units. ▪ Nurses in control group had lower safety climate scores than nurses in EWR group. ▪ 5 items were hypothesized to be sensitive to EWRs. Of those 5, all were significantly different after the intervention in the EWR group but not the control group. ▪ Nurses in the EWR group exhibited more favorable evaluations of safety climate through their responses to the individual safety climate items than control group nurses on 14 of 21 items. ▪ Overall, EWR appear to have an impact on nurses' perception of safety climate.
Thompson et al. (1998)	2 aviation manufacturing samples (1992: n= 350; 1995: n= 329)	▪ Managers and supervisors play but different roles in maintaining workplace safety. ▪ Managers influence through politics of communication and have a direct impact on safety conditions. ▪ Supervisors influenced safety compliance through fairness interaction. ▪ Data collected in 1992 was used to construct a model which was confirmed with 1995 data from the same organization.
Tomas et al. (1999)	'High-risk' companies, 3 workforce samples (1: n= 123; 2: n= 182; 3: n= 124; total: n= 429	▪ Models for 2 and 3 samples showed acceptable fit to the data. ▪ Safety climate was a direct predictor of supervisors' response, and a weak non-significant predictor of work behavior and co-worker response. ▪ Supervisors' response was a central variable in the models, and linked climate with worker behavior. ▪ In turn, behavior combined with assessment of hazards to influence perceptions of actual

Source	Domain	Key findings
		risk, the only variable in the model to be directly predictive of accidents.
van Vuuren (2000)	Steel industry (2 case studies examined)	▪ Organizational failure contributed to incident causation 35 and 40% of the time. ▪ Of this, safety culture contributed to incident causation 33 and 27% of the time. ▪ Safety attitudes contributed to incident causation 67 and 85% of the time. ▪ Risk management initiatives originated from a management level and affected entire organization. ▪ Focus for improvement appeared to be on the process rather than the end product.
Williamson, et al. (1997)	7 manufacturing sites (*n*= 660, 42%)	▪ A 5-factor structure using factor analysis was revealed and comprised of: motivation, positive safety practices, risk justification, fatalism, and optimism. ▪ Workers who had experience accidents reported poorer safety practices, as well as less rationalization of the risks in the workplace. ▪ Workers who perceived dangers in the workplace also tended to justify unsafe working conditions and be more optimistic regarding risks. ▪ The results support the hypothesis that safety climate is a group-level construct.
Yassi et al. (2005)	Healthcare	▪ Results suggest that a positive safety climate is one of the highest priority factors that contribute to lowering the risk of healthcare workers contracting SARS.
Zacharatos, Barling, & Iverson (2005)	Petroleum and telecommunications industries	▪ Found that the 10 identified high-performance management practices are related to occupational safety. ▪ Safety climate and trust in management were mediators of the relationship.
Zohar (1980)	Factories (5 from each field: metal fabrication, food processing, chemical industry,	▪ Safety climate is a characteristic of industrial organizations. ▪ Safety climate is related to general organizational safety level. ▪ Management commitment and attitudes

Source	Domain	Key findings
	textile industry)	toward safety is major factor influencing success of safety programs. ▪ Perceived relevance of safety to job behavior (i.e., importance of safety training and effects of work pace on safety) is also major factor influencing success of safety programs. ▪ Other factors influencing safety climate: perceived status of safety committee (high vs. low rank); perceived status of safety officer; perceived effects of safe conduct on promotion; perceived level of risk at work place; and perceived effect of safe conduct on social status.
Zohar (2000)	Metal processing plant (*n*= 534 production workers in 53 work groups)	▪ The results support the hypothesis that safety climate is a group-level construct. ▪ Perceptions of supervisor safety practices varied between groups, but strong within group homogeneity was found. ▪ Group perceptions of supervisor action and supervisor expectation were significant predictors of minor injuries within the subunit (post-questionnaire). ▪ Lost-days accidents were negatively correlated with perceptions of supervisor expectations, but not with supervisor action.

APPENDIX B
HOSPITAL SURVEY ON PATIENT SAFETY

FLORIDA HOSPITAL

HOSPITAL SURVEY ON PATIENT SAFETY CULTURE

SAFETY is strong medicine

INSTRUCTIONS: This survey asks for your opinions about patient safety issues, medical errors, and event reporting at Florida Hospital. Please answer all questions honestly by marking the appropriate box, circling a number, or filling in the blank. Any information you provide is voluntary and will be kept strictly confidential by researchers at UCF. Your responses will not be associated with your name in any way. The survey will take about 10 to 15 minutes to complete.

- *An "event" is defined as any type of error, mistake, incident, accident, or Deviation, regardless of whether or not it results in patient harm.*
- *"Patient safety" is defined as the avoidance and prevention of patient injuries or adverse events resulting from the processes of health care delivery.*

Background and Experience Information

1. At which Florida Hospital campus do you primarily work?

- ❑ Orlando
- ❑ East Orlando
- ❑ Celebration
- ❑ Altamonte
- ❑ Kissimmee
- ❑ Winter Park
- ❑ Apopka
- ❑ Other, please specify: _____

2. What is your primary work area or unit in this hospital? CHECK ONE.

- ❑ Many different hospital units/No specific unit
- ❑ Medical Unit (non-surgical)
- ❑ Operating Room
- ❑ Cardiac Services
- ❑ Emergency Department
- ❑ CCU
- ❑ CVICU
- ❑ ICU
- ❑ CV3
- ❑ NCC
- ❑ Behavioral Health
- ❑ Rehabilitation
- ❑ Laboratory
- ❑ Surgical Unit
- ❑ Respiratory
- ❑ Radiology
- ❑ Anesthesiology
- ❑ Nutritional Services
- ❑ Oncology
- ❑ Pediatric, General Unit
- ❑ Peds PCU/ICU
- ❑ Neonatal ICU
- ❑ Newborn
- ❑ Environmental Services
- ❑ Radiation Oncology
- ❑ Pharmacy
- ❑ Orthopedics
- ❑ L & D
- ❑ Post Partum
- ❑ Material HR Unit
- ❑ Ambulatory Care
- ❑ Med/Surg Unit
- ❑ Other, please specify: _____

3. How long have you worked in your current hospital work area/unit?

- ❑ Less than 1 year
- ❑ 1 to 5 years
- ❑ 6 to 10 years
- ❑ 11 to 15 years
- ❑ 16 to 20 years
- ❑ 21 years or more

4. How many hours per shift do you typically work?

- ❑ Less than 8 hours
- ❑ 9 or more hours but less than 12 hours
- ❑ 12 or more hours but less than 16 hours
- ❑ 16 or more hours

5. What is your staff position in this hospital? Check ONE answer that BEST describes your staff position.

- ❑ Registered Nurse
- ❑ Physician Assistant/ Nurse Practitioner
- ❑ LVN/LPN
- ❑ Patient Care Assistant/Health Aide/ Sitter
- ❑ Attending/Staff Physician
- ❑ Resident Physician/Physician in Training
- ❑ Pharmacist
- ❑ Dietician
- ❑ Unit assistant/Clerk Secretary
- ❑ Respiratory Therapist
- ❑ Physical, Occupational, or Speech Therapist
- ❑ Technical (e.g., EKG, Lab, Imaging)
- ❑ Administration/Management
- ❑ Other, please specify:_____

6. In your staff position, do you typically have direct interaction or contact with patients? Check ONE.

- ❑ YES, I typically have direct interaction or contact with patients.
- ❑ NO, I typically do NOT have direct interaction or contact with patients.

7. How long have you worked in your current specialty or profession?

- ❑ Less than 1 year
- ❑ 1 to 5 years
- ❑ 6 to 10 years
- ❑ 11 to 15 years
- ❑ 16 to 20 years
- ❑ 21 years or more

SECTION A: Your Work Area/Unit

In this survey, think of your "unit" as the work area, department, or clinical area of the hospital where you spend *most* of your work time or provide *most* of your clinical services. Please indicate your agreement or disagreement with the following statements about your work area/unit. Mark your answers by circling a number.

Think about your hospital work are/unit…	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
1. People support one another in this unit	1	2	3	4	5
2. We have enough staff to handle the workload	1	2	3	4	5
3. When a lot of work needs to be done quickly, we work together as a team to get the work done	1	2	3	4	5
4. In this unit, people treat each other with respect	1	2	3	4	5
5. Staff in this unit work longer hours than is best for patient care	1	2	3	4	5
6. We are actively doing things to improve patient safety	1	2	3	4	5
7. We use more agency/temporary staff than is best for patient care	1	2	3	4	5
8. Staff feel like their mistakes are held against them	1	2	3	4	5
9. Mistakes have led to positive changes here	1	2	3	4	5
10. It is just by chance that more serious mistakes don't happen around here	1	2	3	4	5
11. When one area in this unit gets really busy others help out	1	2	3	4	5
12. When an event is reported, it feels like the person is being written up, not the problem.	1	2	3	4	5
13. After we make changes to improve patient safety, we evaluate their effectiveness	1	2	3	4	5
14. We work in "crisis mode" trying to do too much, too quickly	1	2	3	4	5
15. Patient safety is never sacrificed to get more work done	1	2	3	4	5
16. Staff worry that mistakes they make are kept in their personnel file	1	2	3	4	5
17. We have patient safety problems in this unit	1	2	3	4	5
18. Our procedure and systems are good at preventing errors from happening	1	2	3	4	5

SECTION B: Your Supervisor/Manager
Please indicate your agreement or disagreement with the following statements about your immediate supervisor/manager or person to whom you directly report. Mark your answers by circling a number.

	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
1. My supervisor/manager says a good word when he/she sees a job done according to established patient safety procedures	1	2	3	4	5
2. My supervisor/manager seriously considers safety suggestions for improving patient safety	1	2	3	4	5
3. Whenever pressure builds up, my supervisor/manager wants us to work faster, even if it means taking shortcuts	1	2	3	4	5
4. My supervisor/manager overlooks patient safety problems that happen over and over	1	2	3	4	5

SECTION C: Communications
How often do the following things happen in your work area/unit? Mark your answer by circling a number.

Think about your hospital work area/unit…	Never	Rarely	Sometimes	Most of the Time	Always	N/A
1. We are given feedback about changes put into place based on event reports.	1	2	3	4	5	0
2. Staff will freely speak up if they see something that may negatively affect patient care.	1	2	3	4	5	0
3. We are informed about errors that happen in this unit.	1	2	3	4	5	0
4. Staff feels free to question the decisions or actions of those with more authority.	1	2	3	4	5	0
5. In this unit, we discuss ways to prevent errors from happening again.	1	2	3	4	5	0
6. Staff are afraid to ask questions when something does not seem right	1	2	3	4	5	0

SECTION D: Frequency of Events Reported
In your hospital work are/unit, when the following mistakes happen, *how often are they reported?* Mark your answer by circling a number.

	Never	Rarely	Sometimes	Most of the Time	Always	N/A
1. When a mistake is made, but is *caught and corrected before affecting the patient*, how often is this reported?	1	2	3	4	5	0
2. When a mistake is made, but has *no potential to harm the patient*, how often is this reported?	1	2	3	4	5	0
3. When a mistake is made that *could harm the patient*, but does not, how often is this reported?	1	2	3	4	5	0

SECTION E: Patient Safety Grade
Please give your work area/unit in this hospital an overall grade on patient safety. Mark ONE answer.

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

SECTION F: Your Hospital

Please indicate your agreement or disagreement with the following statements about your hospital. Mark your answer by circling a number.

Think about your hospital…	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
1. Hospital management provides a work climate that promotes patient safety	1	2	3	4	5
2. Hospital units do not coordinate well with each other	1	2	3	4	5
3. Things "fall between the cracks" when transforming patients from one unit to another	1	2	3	4	5
4. There is good cooperation among hospital units that need to work together.	1	2	3	4	5
5. Important patient care information is often lost during shift changes	1	2	3	4	5
6. It is often unpleasant to work with staff from other hospital units	1	2	3	4	5
7. Problems often occur in the exchange of information across hospital units	1	2	3	4	5
8. The actions of hospital management show that patient safety is a top priority.	1	2	3	4	5
9. Hospital management seems interested in patient safety only after an adverse event happens	1	2	3	4	5
10. Hospital units work well together to provide the best care for patients	1	2	3	4	5
11. Shift changes are problematic for patients in this hospital	1	2	3	4	5

SECTION G: Number of Events Reported

<u>In the past 12 months,</u> how many event reports have you filled out and submitted? Mark ONE answer.

O No event reports
O 1 to 2 event reports
O 3 to 5 event reports
O 6 to 10 event reports
O 11 to 20 event reports
O 21 event reports or more

Please feel free to write any comment about patient safety, errors, or event reporting in your hospital.

APPENDIX C
UCF INSTITUTIONAL REVIEW BOARD APPROVAL LETTER

University of Central Florida Institutional Review Board
Office of Research & Commercialization
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: 407-823-2901, 407-882-2012 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

Notice of Exempt Review Status

From: **UCF Institutional Review Board**
FWA00000351, Exp. 5/07/10, IRB00001138

To: **Katherine A Wilson**

Date: **July 31, 2007**

IRB Number: **SBE-07-05118**

Study Title: **Does safety culture predict clinical outcomes?**

Dear Researcher:

Your research protocol was reviewed by the IRB Vice-chair on 7/30/2007. Per federal regulations, 45 CFR 46.101, your study has been determined to be **minimal risk for human subjects and exempt** from further IRB review or renewal unless you later wish to add the use of identifiers or change the protocol procedures in a way that might increase risk to participants. Before making any changes to your study, call the IRB office to discuss the changes. **A change which incorporates the use of identifiers may mean the study is no longer exempt, thus requiring the submission of a new application to change the classification to expedited if the risk is still minimal.** Please submit the Termination/Final Report form when the study has been completed. All forms may be completed and submitted online at https://iris.research.ucf.edu.

The category for which exempt status has been determined for this protocol is as follows:

4. Research involving the collection or study of existing data, documents, records, pathological specimens or diagnostic specimens, if these sources are publicly available or if the information is recorded by the investigator in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects. (*"Existing"* means already collected and/or stored before your study starts, not that collection will occur as part of routine care.)

All data, which may include signed consent form documents, must be retained in a locked file cabinet for a minimum of three years (six if HIPAA applies) past the completion of this research. Any links to the identification of participants should be maintained on a password-protected computer if electronic information is used. Additional requirements may be imposed by your funding agency, your department, or other entities. Access to data is limited to authorized individuals listed as key study personnel.

On behalf of Tracy Dietz, Ph.D., UCF IRB Chair, this letter is signed by:

Signature applied by Joanne Muratori on 07/31/2007 09:49:00 AM EDT

Joanne Muratori

IRB Coordinator

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