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MEASURING PSYCHOLOGICAL SAFETY, HIGH-RELIABILITY (HRO) PERCEPTION
AND SAFETY REPORTING INTENTIONS AMONG PEDIATRIC NURSES

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MEASURING PSYCHOLOGICAL SAFETY, HIGH-RELIABILITY (HRO) PERCEPTION
AND SAFETY REPORTING INTENTIONS AMONG PEDIATRIC NURSES

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ABSTRACT

Purpose: The purpose of this study was to explore the relationships between psychological safety, perception of working in a high reliability organization (HRO) and safety event reporting intentions among pediatric nurses working in acute care.

Background: The quality and safety of patient care is dependent upon nurses to report safety events and near-misses in order to address systems' issues and identify improvement opportunities. To encourage feedback and promote reporting, many health care organizations have adopted the high reliability framework and strategies to promote team psychological safety. A dearth of literature exists on how the pediatric nurse perceives their workplace. This study addressed this gap by measuring the pediatric nurse's level of psychological safety, perception of whether or not they work in an HRO and their safety event reporting intentions.

Methods: Using nonprobability convenience sampling, data were collected from pediatric nurses ($N=244$) during a one-time, anonymous, 10-minute web-based survey. The survey was distributed to members of the Society of Pediatric Nurses (SPN) and by members of the National Pediatric Nurse Scientist Collaborative (NPNSC) to their respective constituent groups. The online survey comprised of four sections: a demographic form, the Safety Organizing Scale (SOS), the Team Psychological Safety Scale, and the Intention to Report Safety Events Scale. A two-part statistical model was fit using logistic regression and linear regression.

Results: Psychological safety was found to have a positive and statistically significant relationship with Intention to Report Safety Events Scores ($p < 0.01$; $\beta = 0.274$). The findings also revealed that when all other variables were excluded from the statistical model, a positive and statistically significant relationship between HRO perception and safety event reporting intentions ($p = 0.034$) existed. The logistic regression model revealed that the odds of a pediatric nurse achieving the highest safety reporting intention score of 7 increased by a factor of 0.3 with each additional year of practice.

Conclusions: The findings demonstrated that a nurse's perception of whether they work in a high reliability setting and how psychologically safe they feel profoundly effects their attitude towards safety event reporting. This work advances the state of the science by demonstrating how workplace culture, and specifically psychological safety and the HRO framework, influences reporting intentions. The information gained from this study will be useful to organizational leaders and professional groups who seek to improve patient safety reporting systems, communication strategies and existing workplace cultures.

Key Words: acute care, high reliability organizations (HRO), nurse, reporting intentions, pediatric, psychological safety, safety events

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A story can serve as a powerful catalyst for change. However, this can only occur in the presence of two antecedents: a speaker who feels comfortable sharing their experience and an audience willing to listen.

By sharing their stories, nurses have the unique and powerful potential to transform the delivery of patient care and the quality and safety of their practice environments. This dissertation aims to tell one such story. The findings from this study illustrate the critical importance that psychological safety plays in establishing cultures of safety and the safety reporting intentions of nurses. This story has the potential to transform the delivery of patient care, and as the speaker, I feel both privileged and humbled to share it. I am thankful to have an audience willing to listen, reflect and act.

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CHAPTER 1

Statement of the Problem

According to the American Nurses Association (ANA), nurses have a professional and ethical responsibility to promote a culture of safety, reduce errors and protect patient health (2015). A key component for maintaining a culture of safety involves establishing supportive and trusting relationships among colleagues. All health care team members should feel psychologically safe, viewing the workplace as supportive and secure, where they are encouraged to share ideas, seek feedback, report mistakes and ask questions (Edmondson, 1999). In workplaces with high levels of psychological safety, staff see mistakes as opportunities to learn from and trust that their organizational leaders want to know when a process is not working (Edmondson, 1999). Unfortunately, many nurses work in environments where they are afraid to report safety events or speak up about concerns (Clark & Lake, 2020; Lake et al., 2018). Past research has shown that barriers to reporting errors and near misses include fear of retribution, worry about litigation, time constraints, unsupportive colleagues, and a belief that no change will result from breaking the silence (Applebaum et al., 2016; Vrbnjak et al., 2016).

Attention to patient safety is paramount to the delivery of high-quality health care. Health care organizations and professional nursing associations expect nurses to report safety events and near-misses in order to address systems' issues, improve the quality of patient care and adhere to the profession's code of conduct (ANA, 2015; The Joint Commission, 2017). In order to ensure that nurses actually do report such events, organizational leaders and all health care team members should promote an environment that fosters psychological safety.

While a few studies have explored the reporting of safety events among nurses working with adult patient populations, there remains a dearth of literature on the reporting practices of

pediatric nurses (Stratton et al., 2004; Yung et al., 2016). Pediatric patients are particularly vulnerable to safety events because of their limited communication skills, need for weight-based drug dosing involving multiple calculations, and their propensity to react to even minor errors when experiencing medication side effects or problems with associated treatments (Kaushal et al., 2001; Sears et al., 2016). Since infants and preverbal children cannot self-report, it is challenging for nurses to effectively monitor for drug and treatment side effects as well as other safety events (Ismail, 2016). Often times, the nurse must rely upon the opinion of parents or guardians to assess for safety events through their child's behaviors and subtle physiologic cues.

Past nursing research has shown that one's perception of their work environment influences their attitude towards safety event reporting (Cole et al., 2019; Sears et al., 2016; Vrbnjak et al., 2016; Yoo & Kim, 2017). Research among pediatric nurses has shown that approximately only 67% of medication errors are reported in the acute-care setting and that many nurses are fearful of reprisal (Stratton et al., 2004). In a more recent study, researchers found that 28% of pediatric nurses do not feel free to question authority and 46% feel that their mistakes are held against them (Lake et al., 2018). While there has been an increase in studies exploring the quality and safety of pediatric care over the past decade, more research is needed on how organizational culture influences safety event reporting (Brady & Goldenhar, 2012; Mueller et al., 2019; Rinke et al., 2014). Given how vulnerable the pediatric population is to potential errors, it is paramount that nurse researchers not only explore actual reporting rates but also the potential factors that both promote and inhibit their intent to report in the future (Hung et al., 2016).

In order to improve patient safety and the quality of care rendered, many pediatric hospitals have adopted the high reliability model (Chassin & Loeb, 2013). High reliability

organizations (HROs) are built upon five core principles: (1) a preoccupation with failure; (2) a reluctance to simplify observations; (3) a sensitivity to operations; (4) a commitment to resilience; and (5) a deference to expertise (Weick & Sutcliffe, 2007). Organizations that adopt the model use the five foundational principles to help establish a culture of safety—encouraging staff to look for and report even the smallest of errors and near misses (Agency for Healthcare Research and Quality, 2019a; Chassin & Loeb, 2013; Weick & Sutcliffe, 2007).

Despite the primary focus on nonpunitive event reporting in high reliability organizations, no studies have explored how psychologically safe nurses working in self-declared HROs actually feel participating in the process. In addition, current research has explored the actual reporting rates of nurses rather than their likelihood to report events in the future (Hung et al., 2015; Lee et al., 2016). By focusing solely on the frequency of past reporting, researchers overlook the critical fact that many safety events are underreported by nurses (Kim et al., 2007, Vrbnjak et al., 2016). By exploring reporting intentions instead of past behaviors, greater insight on how a nurse would likely respond to a variety of different events can be gained. This dissertation study sought to explore the potential influence that both psychological safety and HRO status has on the reporting intentions of pediatric nurses.

Purpose of the Study

The purpose of this cross-sectional, descriptive and correlational study was to explore the relationships between psychological safety, perception of working in a high reliability organization and intent to report safety events by nurses working in the acute pediatric setting.

Significance of the Problem

Two decades ago, the Institute of Medicine (now the National Academy of Medicine, NAM) published its seminal and groundbreaking report, *To Err is Human: Building a Safer*

Health System (Kohn et al., 2000). The report opens by estimating that between 44,000 and 98,000 Americans die every year as a result of medical errors. Since its publication, researchers have declared that even this startling approximation is far too low and inaccurate (Kavanagh et al., 2017). Given how complex and fragmented the U.S. health care system is, deaths caused by errors are difficult to track and are underreported (Daniel & Makary, 2016; Kavanagh et al., 2017). The absence of national data on this topic has made it difficult for researchers to approximate the number of deaths caused by a medical error. However, other experts believe that the annual number is close to 400,000—which is four times higher than the original estimate (Daniel & Makary, 2016; James, 2013). In addition, this approximation only addresses the mortality rate among patients in the United States and does not include the numerous other safety events that result in secondary morbidities.

In 2011, it was estimated that safety events cost the U.S. healthcare system between \$348 and \$913 billion dollars annually (Goodman et al., 2011). Due to inflation, this would equate to between \$400 billion and \$1 trillion dollars today (Bureau of Labor Statistics, 2019). However, even this financial estimate is likely too low as numerous safety events remain unreported across the country (Lederman et al., 2013; Throckmorton & Etchegaray, 2007).

Despite the large attention that the Institute of Medicine's report received and the series of interventions that have been trialed since, nurses have continued to express concern regarding the reporting process (Kavanagh et al., 2017; Lake et al., 2019). Many health care organizations have developed electronic reporting systems to systematically collect and analyze safety events (Agency for Healthcare Research and Quality, 2018b; Dutton, 2014). While electronic reporting systems provide a useful platform to systematically aggregate and analyze cases, like many tools, they do have several limitations. Organizational leaders have expressed concern that complex

events which unfold over time are often difficult to track using electronic reporting (Department of Health and Human Services, 2012). In addition, in order to effectively perform a root-cause analysis, the antecedents of each event need to be meticulously examined and this often requires an investigation beyond the submitted report. This process can be both time-consuming and arduous. However, without conducting the review in a rigorous fashion, there is a risk that the safety event will be viewed in isolation and contributing factors will be missed. When each event is viewed independently of one other, only a single and superficial snapshot of what happened is revealed rather than providing a deeper analysis of how the event unfolded over time (Agency for Healthcare Research and Quality, 2018b).

One important antecedent that influences the reporting process is the existing workplace culture. When a nurse submits a safety report, they are taking an interpersonal risk in the workplace (Lake et al., 2018). The decision to report can be even greater if the nurse feels that they will be penalized or viewed unfavorably by fellow staff members (Vrbnjack et al., 2016). In order to promote reporting and dialogue, leaders need to evaluate existing cultures and identify potential communication barriers (Pfeifer & Vessey, 2017).

Presently, many nurses work in unhealthy environments where they are excessively criticized, bullied and even ignored (Arnetz et al., 2019; Roberts, 2015; Vessey et al., 2010). When working in an unhealthy environment, nurses are constantly in fear of being reprimanded or humiliated and consequently will often avoid asking questions, voicing concerns, discussing mistakes or even offering new ideas (Arnetz et al., 2019; Edmondson, 1999; Pfeifer & Vessey, 2019). Nurses who work in these unhealthy environments are not psychologically safe—as they are afraid to question the status quo and often do not perceive the health care team as a safe place for interpersonal risk-taking.

For decades, health care organizations have been criticized for fostering blame cultures (AHRQ, 2019c; Vrbnjack et al., 2016). In the past, when mistakes were discovered, blame was virtually always placed on individual providers (AHRQ, 2019c). This organizational approach fails to recognize that most safety events occur not from the action of one individual but from larger issues within the system and existing culture (Oster & Braaten, 2016). In an effort to promote reporting and reduce the occurrence of a “blame culture” within health care, the National Academy of Medicine urges that organizations not punish nurses and others for reporting errors, but instead establish non-punitive environments (Kohn et al., 2000). In order to accomplish this, nurses should be assured that it is safe to report safety events and that their decision to do so will be appreciated and evaluated reasonably (Hershey, 2015; Kohn et al., 2000). Despite receiving notification and encouragement from organizational leaders to discuss safety events candidly, many nurses may still question whether they will be reprimanded for mistakes they make (Lake et al., 2019; Vrbnjak et al., 2016).

Recognizing the importance of culture in the reporting of safety events, both The Joint Commission and the Agency for Healthcare Research and Quality (AHRQ) encourage health care organizations to adopt the HRO model. According to AHRQ, high reliability is defined as “minimizing adverse events despite a complex and risky work environment” (Chassin & Loeb, 2013). Supporters of the framework, emphasize that staff members should feel valued and empowered to share their opinions, questions and concerns. Open communication serves as the foundation for the model (Chassin & Loeb, 2013). However, in order for nurses to openly communicate, they need to feel psychologically safe to do so. Nurses need to feel confident that organizational leaders and colleagues truly want them to speak up, ask questions, submit safety reports, and work towards positive change (Chassin & Loeb, 2013; Pfeifer & Vessey, 2019;

Weick & Sutcliffe, 2007). Currently, many organizational leaders who embrace the HRO framework attempt to change staff behaviors (i.e. improve reporting rates) through educational seminars and trainings (Duffey et al., 2019). Unfortunately, education alone may do little to actually change an existing culture or influence reporting intentions. In order to create a sustainable shift in culture, organizational leaders need to promote psychological safety while also working with researchers to explore the various factors that influence reporting intentions.

Research Questions/Aims/Hypotheses

The corresponding research questions and hypotheses for this study were:

1. What are the combined and unique relationships of perceived psychological safety and perception of working in an HRO on pediatric nurses' intent to report safety events?

Aim: Determine whether a pediatric nurses' intent to report a safety event is influenced by either their level of psychological safety, perception of working in an HRO or a combination of both.

H1a: Pediatric nurses who have high levels of psychological safety, will have higher intent to report safety events scores than nurses who have lower levels of psychological safety.

H1b: Pediatric nurses who perceive themselves as working in an HRO, will have higher intent to report safety event scores than nurses who do not perceive themselves to work in an HRO.

H1c: The combined effects of psychological safety and perception of working in an HRO will result in higher intent to report safety events scores among pediatric nurses.

2. What is the relationship between a pediatric nurse's perception of working in an HRO and their perceived psychological safety?

Aim: Determine if the psychological safety level of pediatric nurses is related to their perception of whether or not they work in an organization that encompasses or aspires to implement the HRO principles.

H2a: Pediatric nurses who perceive themselves as working in an HRO setting will have higher psychological safety scores.

Definitions of Terms

High reliability organization. A health care organization that promotes collective mindfulness, in which all workers look for and report small problems or unsafe conditions (AHRQ, 2019a). There are five core principles of a high reliability organization: (1) preoccupation with failure; (2) reluctance to simplify; (3) sensitivity to operations; (4) commitment to resilience; and (5) deference to expertise (Weick & Sutcliff, 2007). The Safety Organizing Scale (SOS) consists of 9 items and was used to measure the nurse's perception of whether or not their workplace functions as a high reliability organization (Vogus & Sutcliffe, 2007a).

Psychological safety. Describes individuals' perceptions about the consequences of professional risks at their workplace and consists of an individual's belief about how others will respond when they take a professional risk (e.g. ask a question, seek feedback, report a mistake, propose a new idea) (Edmondson, 2003). Operationally, psychological safety was measured using the Team Psychological Safety Survey, which consists of seven-items on which agreement is indicated using a five-point Likert scale and asks about the participant's perception of their nursing unit (Edmondson, 2003).

Safety Event. For the purpose of this study, a safety event is defined as any event that has the potential to cause harm or actually does injure a patient (Jenicek, 2010). Events consist of

adverse events, errors and near-misses (Sorra et al., 2018). Please see the definition for the *Intent to Report a Safety Event* below.

Adverse event. An unintentional, definable injury that was caused by medical/clinical management (including care that is rendered by nurses) rather than the underlying condition of the patient (Kohn et al., 2000). An adverse event is an error that was not intercepted, reaches the patient and causes harm, a prolonged hospitalization and/or produced a disability at the time of discharge (Agency for Healthcare Research and Quality, 2018a). Adverse events can be deemed either preventable or non-preventable and can result from acts of commission or omission (Jenicek, 2010).

Error. An act of commission (doing something wrong) or omission (failing to do the right thing) that leads to an undesirable outcome or significant potential for such an outcome (Agency for Healthcare Research and Quality, 2018a). For the purpose of this study, an error is defined as an event that reaches the patient, but does not end up causing harm (Agency for Healthcare Research and Quality, 2018a). Errors that cause harm were classified as adverse events.

Near-miss. For the purpose of this study, a near-miss is defined as an incident that does not reach the patient because of either an intervention or chance (Sheikhtaheri, 2014). The near miss is still a safety event, but the event was intercepted before it reached the patient.

Intent to report a safety event. For the purpose of this study, the intent to report a safety event was defined as how a nurse would most likely respond to a detected patient safety event. Operationally, nurses were asked about their intent to report safety events through three items. The development and wording of these three items were based on the *Frequency of Event Reporting Scale* (Section D) in the *Hospital Survey on Patient Safety* (SOPS™). *The Hospital*

Survey on Patient Safety Version 1.0 (SOPS™) was created by AHRQ in 2004 and the *Frequency of Event Reporting Scale* (Section D) asks participants about the extent to which mistakes of the following types are reported: (1) mistakes caught and corrected before affecting the patient (near-misses); (2) mistakes with no potential to harm the patient (errors); and (3) mistakes that could harm the patient but do not (errors) (Sorra et al., 2018). Using the theory of planned behavior as a theoretical guide, the three original items were adapted to appropriately explore reporting intentions (Ajzen, 1991). Agreement was indicated using a seven-point scale.

Assumptions

For the purpose of this study, it was assumed that higher levels of psychological safety improve the work environment and increase the likelihood that pediatric nurses will report safety events. It was also assumed that pediatric nurses who perceived that they are working in an HRO organization would have higher levels of psychological safety. Lastly, it was assumed that pediatric nurses' perceptions of psychological safety (PS), working in a high reliability organization (HRO) and intent to report a safety event (ITR) are adequate proxies to actual levels of PS, HRO and ITR.

Summary

Since the release of *To Err is Human: Building a Safer Health System*, the care rendered in pediatric acute care settings has only become more complex and intensive. Due to medical and technical advancements, children born with complex health care needs are living longer and are requiring increased services (Cohen & Patel, 2014). In order to provide safe and high-quality patient care, pediatric nurses need to feel psychologically safe to report concerns and engage in open communication exchanges. Organizations also need to consistently measure and improve the environmental conditions that contribute to safety events while also working to understand

the contextual factors that promote reporting (Agency for Healthcare Research and Quality, 2017).

Health care organizations that have aspired to adopt the HRO principles in practice emphasize the importance of communicating and the reporting of safety events. The HRO model has the potential to positively transform health care, but in order to truly understand its effects on staff perceptions of safety reporting intentions, additional research is warranted (Chassin & Loeb, 2013). This study provided greater insight into the influence that workplace culture has on reporting intentions among pediatric nurses in the acute care setting. It is anticipated that the information gained from this study will be used by organizational leaders and professional groups to improve patient safety reporting systems, communication strategies and existing workplace cultures.

CHAPTER 2

Review of the Literature

Literature pertaining to the safety of patient care in pediatrics will be presented in this chapter. The history and current state of safety reporting in nursing will be explored and several key definitions will be reviewed. The high reliability model will be explored along with its recent application in the health care arena. The construct of psychological safety will be introduced and studies that have explored the phenomenon in health care will be reviewed. Lastly, the theory of planned behavior will be reviewed along with several landmark studies showing the likely association between one's culture and intention to report future safety events.

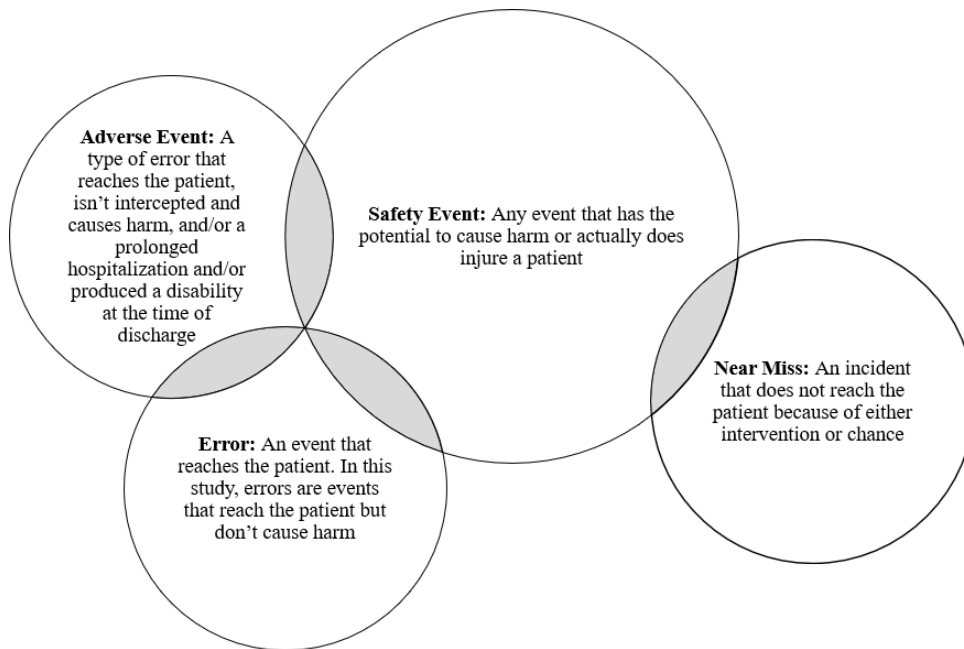
Defining Safety Events

In order to promote the uniform identification, collection and reporting of safety events it is essential that in both practice and research a set of consistent event definitions is used (Department of Health and Human Services, 2012). For the context of this study, safety events are defined based on what has been best supported in the current literature and by leading professional organizations. Safety events will be defined as any health care incident that leads to injury of a patient or poses a risk of harm (Jenicek, 2010). Safety events consist of near-misses and errors. Near-misses are incidents that do not reach the patient either due to chance or interception (Agency for Healthcare Research and Quality, 2019b). Errors are events that reach the patient either through acts of commission or omission (Agency for Healthcare Research and Quality, 2019b; Jenicek, 2010). For this study, errors that reach the patient and end up causing harm or an undesirable outcome will be classified as adverse events (Agency for Healthcare Research and Quality, 2019b). Adverse events are a type of error. Errors that reach the patient

but do not result in an undesirable or unintended outcome will simply be classified as an error (Agency for Healthcare Research and Quality, 2019b). See Figure 1.

In addition to studying the contributing factors that lead to errors and adverse events, it is critical to analyze safety events that could have resulted in harm but never reached the patient (Agency for Healthcare Research and Quality, 2019b; Hession-Laband & Mantell, 2011; Jenicek, 2010). The growing concern over the safety and quality of patient care has galvanized a movement among organizational leaders to carefully analyze near-misses as they occur 300 times more often than adverse events (Barach & Small, 2000; Wolf & Hughes, 2008). Near-misses allow organizations to examine the specific weaknesses in safety protocols or procedures that can be remedied to reduce the likelihood of the event occurring again in the future (Chassin & Loeb, 2013).

Past research has shown that the severity and type of safety event that occurs influences the nurse's decision to report (Alomari et al., 2018; Mayo, 2004; Osborne et al., 1999; Wolf & Hughes, 2008). However, in a recent systematic analysis, researchers found that the severity of reported errors are still lacking in the majority of research studies (Gates et al., 2018). Current research shows that near-misses and errors that pose a minimal risk for harm are not reported as frequently or consistently as events that reach the patient and/or are perceived as more severe by staff members (Alomari et al., 2018). All safety events—including near-misses offer a powerful opportunity for organizations to identify system hazards and develop tools to improve the delivery of safe patient care. However, in order to promote the reporting of such events, organizational researchers and leaders should first examine the contextual factors that influence the nurse's reporting intentions.

Figure 1.*Three Types of Safety Events Defined***Safety Events in Pediatrics**

Safety events in health care are associated with prolonged hospital stays, higher readmission rates, adverse outcomes, higher hospital costs and even death (Koller et al., 2016; Stockwell et al., 2018). At present, there is a paucity of research exploring the types and frequency of safety events in pediatrics. According to the Child Health Patient Safety Organization, the top ten sources of harm include: (1) ng tube misplacement; (2) unsafe MRI practices (3) retention of foreign objects; (4) miscommunications; (5) behavioral health issues; (6) missed or delayed diagnoses; (7) wrong-site procedures; (8) medication errors; (9) thermal injuries; and (10) inappropriate diabetes care management (2018). In 2018, results from a national retrospective surveillance study on adverse events in the inpatient pediatric setting revealed that rates have not improved over the past decade (Stockwell et al., 2018). Data were

collected from a retrospective surveillance study using randomly selected pediatric inpatient records from 16 teaching and nonteaching hospitals (Stockwell et al., 2018). Researchers analyzed data from 3,790 pediatric admissions and found 414 detected adverse events (representing 19 AEs per 1,000 patient days and 10.9 AEs per 100 admissions). An adverse event (AE) was defined as, “unintended physical injury (resulting from or contributed to) by medical care that required additional monitoring, treatment, or hospitalization, or that resulted in death” (Stockwell et al., 2018). The research revealed that 8% of inpatient admissions experienced one or more AEs. Of the detected events, 146 (35.3%) resulted in a temporary harm to the patient and/or prolonged their hospital stay. Five (1.2%) of the adverse events resulted in permanent harm, 42 (10.1%) were deemed life-threatening and three (0.7%) directly contributed to a patient’s death. Of the 414 adverse events, 210 (50.7%) were considered to be preventable. Patients with chronic and complex conditions were more likely to experience an adverse event during their hospitalization (Stockwell et al., 2018). Stockwell’s research also showed that teaching hospitals were more likely to have patients with at least one chronic condition in comparison to the non-teaching hospitals (50.6% vs. 30.1%). For all adverse events, teaching hospitals had higher rates of adverse events even after adjusting for chronic conditions ($P < .001$). Overall, patients with 3 or more chronic conditions had higher AE rates than patients without one (33.9 vs. 14.0 per 1000 patient days). Stockwell’s study found that children with chronic conditions also had adverse events that were higher in severity ($P < .001$). The researchers concluded that from 2007 to 2012, adverse events in the pediatric inpatient setting increased by 1.2% per 1000 patient days (Stockwell et al., 2018). Similarly, preventable adverse events and high-severity adverse events did not change during the study time period (Stockwell et al., 2018).

In 2018, AHRQ synthesized SOPS™ survey findings from 630 hospitals across the United States. Of the 630 hospitals, 260 were pediatric healthcare organizations and surveys were collected from 7,307 participants. While the report findings were not exclusive to nursing, the executive summary highlighted that 50% of all participants working in pediatrics reported at least one safety event over the past twelve months. The report also calculated the percentage of positive responses for each survey item. Participants who selected, “Strongly agree”, “Agree”, “Always”, or “Most of the Time” had their percentages combined. Of these pediatric participants, 62% had a positive response to the question: when a mistake is made, but is caught and corrected before affecting the patient, how often is this reported? 63% of participants had a positive response to the question: when a mistake is made, but has no potential to harm the patient, how often is this reported? Lastly, 77% of participants had a positive response for: when a mistake is made that could harm the patient, but does not, how often is this reported? The AHRQ continues to refine, modify and expand their utilization of the SOPS™ survey to support organizations in assessing their patient safety culture and for benchmarking purposes.

Currently, most research has explored medication errors in pediatrics as these account for the large majority of all safety events (Bates & Singh, 2018; Hughes & Ortiz, 2005). In this proposed study, participants will be asked about their intention to report any safety event—which includes but is not limited to medication errors. Given the wealth of literature on medication errors in pediatrics a synthesis was conducted and has been described below.

Medication Errors

Research has consistently shown that medication errors in pediatrics are occurring three times more often than in the adult setting and with rates between 5-36% (Chua et al., 2010; Glanzmann et al., 2015; Kaushal et al, 2001; Ozkan et al., 2011; Stockwell et al., 2018). Past

studies have demonstrated that medication errors occur more often among pediatric patients than adults with a rate of 14.80 per 1000 patient days compared to 5.66 per 1000 patient days (Stratton, et al., 2004). Details regarding several of these landmark studies are summarized below.

Kaushal et al. (2001) conducted an analysis of 10,778 medication orders in pediatric inpatient settings across two academic organizations. The research team identified 616 medication errors (5.7%), 115 potential adverse drug events (1.1%) and 26 adverse drug events (0.24%). In comparison to recent studies on error rates in the adult inpatient setting, the potential ADE rates in pediatrics was found to be three times higher ($P < .001$). While error rates were similar across most units, the neonatal intensive care unit (NICU) had significantly higher medication error and potential ADE rates than neonates in other units ($P < .001$).

Other studies have also identified that error rates in intensive care units are higher than other pediatric inpatient wards (Ross et al., 2000; Gates et al., 2018). The most common drugs involved in medication errors included anti-infective agents, analgesics, sedatives, fluids and electrolytes, and bronchodilators—all of which are routinely administered across the majority of inpatient pediatric units (Kaushal et al., 2001). Of the potential 115 ADEs, 68 (59%) were intercepted while 47 (41%) were not. Reviewers also reported that 18 (16%) of the potential ADEs could have been fatal and the most common cause was the ordering of an inappropriate dose (Kaushal et al., 2011). From this landmark study, researchers and organizational leaders identified that there were four significant factors which put pediatric patients at extreme risk for safety events: (1) the need for weight-based drug dosing involving numerous calculations; (2) the dilution of stock solutions; (3) the possession of immature physiologic buffering systems; (4) the limited ability to communicate when a side effect is experienced (Kaushal et al., 2001).

Early research has revealed that the reporting of medication errors is reliant upon what stage of the medication administration process that the event occurred. There are four stages of the medication administration process: (1) ordering/prescribing; (2) transcribing/verifying; (3) dispensing/delivering; and (4) administering (Antonow et al., 2000). While the majority of incident reports are for administration errors (51%), research shows that events during the other three stages still occur at alarming rates (Antonow et al., 2000). For the first three stages, 16% of reported errors occur during the ordering stage, 24% of errors occur during transcription/verification and 10% during the delivery/dispensing (Antonow et al., 2000). Of the errors taking place during the administration stage, 28.8% were related to incorrect timing, 26% were related to incorrect drug preparation, 16.3% were related to omission errors and 11.5% were related to an incorrect dose (Chua et al., 2010).

In 2007, pediatric researchers in Turkey conducted a mixed-methods study to identify the frequency and conditions contributing to medication errors in a university teaching hospital (Ozkan et al., 2011). Over the course of one year, researchers conducted face-to-face interviews with 25 inpatient nurses on a 52-bed inpatient unit. The researcher also collected observation data to determine the frequency, contributing factors and types of medication administration errors. The study revealed that medication errors were made in 36.5% of the 2344 doses administered by nursing staff. The most common type of errors included wrong time (40.3%) and wrong dose (34.6%). The observations supported the statements that nurse participants made during their face-to-face-interviews, highlighting that interruptions and distractions contributed the most to the occurrence of an error.

In 2010, researchers in Zurich conducted a study in a single pediatric intensive care unit (PICU) to determine the amount and type of medication errors occurring (Glanzmann et al.,

2015). The researchers found that 151 medication errors were made after analyzing a total of 1,129 orders (14% overall error rate). Errors were more likely to occur in pediatric patients with longer hospital stays, those on mechanical ventilation and receiving numerous medications (Glanzmann et al., 2015). Of the reported errors, 70% required intervention and/or resulted in patient harm (Glanzmann et al., 2015).

In a recent 2017 systematic review, data on preventable adverse events among pediatric inpatients was collected and synthesized (Gates et al., 2018). The researchers defined an adverse event as “an injury or other patient harm resulting from the use of a drug” and found that 15.2% of all medication errors resulted in a preventable adverse event (Gates et al., 2018). The analysis revealed that intensive care units have higher rates of adverse events and the majority of studies have not explored error severity (Gates et al., 2018).

A systematic review published in 2019 highlighted the prevalence and nature of medication errors and preventable adverse drug events in pediatric and neonatal intensive care studies after reviewing 35 empirical studies (Alghamdi, et al., 2019). The reviewers found that in pediatric intensive care units, the median rate of medication errors was 14.6 per 100 medication orders and between 6.4 and 9.1 per 1000 patient days. In neonatal intensive care units, medication error rates ranged from 4 to 35.1 per 1000 patient-days and from 5.5 to 77.9 per 100 medication orders. The reviewers also found that anti-infective agents are commonly involved in many of the medication errors detected.

Financial Costs Associated with Safety Events

Given the significant underreporting of safety events in health care, approximating the consequential financial costs poses a great challenge for analysts. In a recent retrospective surveillance study, it was found that 52.7% of AEs temporarily harmed the patient and required

an intervention and 35.3% resulted in a temporary harm and contributed to a prolonged hospitalization (Stockwell et al., 2018). While placing the patient at physical risk, these sequelae also are financially detrimental to the organization.

In a recent national analysis, medical errors were estimated to cost \$17.1 billion dollars and accounted for nearly 1% of the \$2.391 trillion spent on U.S. health care annually (Van Den Bos et al., 2011). Using the International Classification of Diseases, financial analysts used an actuarial approach to measure the frequency and costs of national medical errors. The analysts used 2008 population estimates from the Census Bureau to extrapolate the findings from the sample to the larger U.S. population and found that the most costly errors included post-operative infections, pressure-ulcers, mechanical complications of device/implant/graft, post-laminectomy syndrome, post-operative hemorrhages, infections due to a central line, pneumothorax and infections following a transfusion/infusion (Van Den Bos et al., 2011). According to the analysis, each postoperative infection costs the United States \$13,312 in health care dollars. The analysts found that while the most frequent medical injuries are caused by medication errors, the most costly were pressure ulcers. While illuminating, the findings did not specifically explore the costs of pediatric errors and also did not review cases covered by Medicaid (but did include Medicare).

Current Reporting Processes

In order to ascertain and analyze the causes of safety events, organizational leaders and researchers often conduct root cause analyses (Jenicek, 2010). A root cause is defined as, “an initiating cause of a causal chain that leads to an outcome of effect of interest—an element where an intervention could reasonably be implemented to change performance or prevent an undesirable outcome” (Jenicek, 2010, p. 44). By retrospectively reconstructing the events that led

to the incident, analysts can better strategize how the problem can be solved or prevented in the future. Traditional reporting mechanisms have utilized both verbal and paper-based disclosure forms (Wolf & Hughes, 2008).

Recent technological advancements in health care have enabled organizations to capture and track safety events through the use of electronic reporting systems. Electronic reporting systems are useful as they provide a systematic and standardized approach to capture key details for each event. While systems across organizations vary, the purpose for all is the same: to capture and maintain reports of patient-safety-related events documented by staff members (Department of Health and Human Services, 2012). With this collected information, organizations can identify and aggregate cases based on their severity, frequency and unit. Reporting systems can be used to identify concerning safety trends and to brainstorm strategies to reduce future occurrences. While electronic reporting systems have provided organizations with the ability to archive and analyze a large number of reports, like most technological tools, the approach does have limitations (Dutton, 2014; Rishoej et al., 2018).

The majority of electronic safety reports used in health care are reliant upon staff members to voluntarily enter in key details about the case. With voluntary reporting systems, there is a concern that the true error frequency may be many times greater than what actually is reported (Wolf & Hughes, 2008; Rishoej et al., 2018). In the busy acute-care setting, the reporter needs to have both the time and access to the electronic system to submit the form. In order to reduce the time it takes to complete each form, many electronic reporting systems now use structured fields for data entry (Gong et al., 2015). Current electronic reporting systems have reduced the amount of free text that the staff member needs to enter which can also help with data aggregation and the analytic process (Dutton, 2014). However, by relying mostly on radio

buttons and less on free-text fields, there is a risk that the staff member's observations will not be fully captured in the report (Department of Health and Human Services, 2012). Consequently, the report may only provide a superficial snapshot of the event's antecedents.

While electronic reporting systems help to capture incidents that are easily detectable (e.g. falls, single medication error), it can be harder to track more complex issues that result from a number of system failures and took place over an extended period of time (e.g. blood clots) (Department of Health and Human Services, 2012). Adding to the issue's complexity is the fact that staff members often express confusion about what constitutes a safety event (Department of Health and Human Services, 2012). Thus, the reporting of each event is dependent on the individual who witnessed it, how it was interpreted, and the accuracy of the data entered on the form. Often times, forms are submitted with missing data and are not usable for further analysis (Gong et al., 2015).

The data collected from electronic reporting systems can yield useful information to inform organizational policies and safety improvement efforts (Department of Health and Human Services, 2012; Hession-Laband & Mantell, 2011). Researchers and organizational leaders can aggregate collected data to perform root-cause analyses. However, in order to effectively conduct this review, the organization needs to have the proper resources (e.g. staff, analytic tools) in place. The reviewer also needs to have the necessary skills to go beyond the report and perform a systematic and detailed investigation on the case (Department of Health and Human Services, 2012).

Over the past two decades, a number of studies have shown that the adoption of an anonymous web-based system improves reporting rates among pediatric nurses (Taylor et al., 2007; Heisson-Laband & Mantell, 2011). In 2003, pediatric researchers compared data collected

from an electronic, anonymous reporting system to written incident reports filed in the same two nursing units during analogous 3-month periods in the preceding four years (Taylor et al., 2007). The study's results were that the rate of reporting was significantly higher for the electronic, anonymous system than the traditional approach for each of the four preceding years. The research revealed that 25.2% of the reports submitted through the electronic, anonymous system and only 12.6% of the errors submitted through traditional incident report forms were near-misses. The rate of reporting near-misses was 3 times higher when staff used an electronic, anonymous system ($P < .001$). The reporting of events that did reach the patient (errors) were also significantly more likely with the electronic, anonymous system than with the traditional reporting approach. Since this landmark study, additional research has supported that safety event reporting is improved when organizations use electronic and anonymous systems (Hession-Laband & Mantell, 2011). However, most recent research highlights that given the fast-paced and complex nature of the pediatric inpatient setting, nurses frequently do not report safety events that are perceived as minor (Alomari et al., 2018).

Reporting among Nurses

Numerous studies have shown that nurses report the majority of safety events (Harris et al., 2007; Rishoej et al., 2018; Wolf & Hughes, 2008). Given the direct contact that nurses have with patients over an extended period of time, they are in the unique position to both detect and report safety events. In order to address the barriers to reporting and develop effective prevention strategies, it is essential to explore how frontline nurses perceive their current culture and the organizational systems in place. In addition, several studies have shown that certain characteristics are associated with reporting intentions (Teng et al., 2009). There is conflicting evidence on whether or not years of professional experience influence reporting intentions. Some

studies have shown that nurses with more than five years of experience are more likely to believe that there is no value in reporting near-misses while other studies showing that those with greater experience are more likely to report an event (Evans et al., 2006; Forbes et al., 2020; Kim et al., 2007; Vogus & Sutcliffe, 2007b; Wolf & Hughes, 2008). An overview of the studies exploring safety event reporting among pediatric nurses is presented below.

Pediatric Nurses and Safety Event Reporting

While a number of studies have explored the reporting of safety events among adult-health nurses, fewer have investigated the topic in pediatrics. Several early studies conducted among pediatric nurses have shown that safety events are still vastly underreported (Antonow et al., 2000; Stratton et al., 2004). A recent systematic review which reviewed the severity and incidence of medication safety events in pediatrics highlighted the dearth of current research in this field (Gates et al., 2018). The current literature has also demonstrated that nurses are still reporting less than 10% of all near-misses despite a paradigmatic shift in health care encouraging clinicians to submit reports for all safety events regardless of whether or not it reaches the patient (Antonow et al.; Haw et al., 2014; Rishoej et al., 2018).

In the 1990's, Utah developed a statewide medication error reduction project funded by the Health Care Financing Administration, Department of Health and Human Services (Antonow et al., 2000). A medication error survey was part of the project and administered to registered nurses from a 38-bed pediatric unit. Participants were asked to indicate whether they had observed a medical error during any of the four stages of the medication process: (1) ordering/prescribing; (2) transcribing and verifying; (3) dispensing and delivering; and (4) administering. Of the 72 nurse participants, 40.3% indicated that they had observed a medical error in at least one of the four stages during the past week (Antonow et al., 2000). Respondents

indicated that most errors (62.1%) never reached the patient and that because it was intercepted, they were less likely to formally report it. The study found that near-misses accounted for less than 10% of all incident reports even though these types of safety events were the most common to occur (Antonow et al., 2000). It should also be noted that data collection for this study occurred before the release of *To Err is Human: Building a Safer Health System*. Since the publication of Antonow's research findings, the scope and significance of pediatric patient safety events have increased in national attention and focus.

In 2004, a descriptive study conducted among 57 pediatric and 227 adult hospital nurses revealed that pediatric nurses are more likely to report safety events; $P < .05$ (Stratton et al., 2004). Pediatric nurse participants estimated that 67% of all medication errors are reported in practice and that errors most likely occur due to distractions and interruptions (Stratton et al., 2004). Pediatric nurses were also more likely to agree that nurse administrators focus more on the person who made the error rather than see things from a system's perspective—although this finding was not statistically significant.

Turkish researchers further explored the perspectives of pediatric nurses regarding the causes, reporting and prevention of medication errors in 2009 (Toruner, & Uysal, 2012). Nurses responded that the primary causes of medication errors were predominantly long work hours (68.1%), high patient to nurse ratios (58.8%) and medications being supplied in dosages/forms that were inappropriate for pediatrics (56.3%). Like Stratton's research, 50% of the pediatric nurses cited distraction as a major cause of medication errors. When asked about why many safety events go unreported, 52.9% of pediatric nurses cited "potential blaming" as the primary reason. The Turkish study also highlighted that reporting rates were higher among nurses

working in intensive care units ($P < 0.01$). According to the researchers there were no statistically significant differences in reporting rates based on age, years of experience or working hours.

In a recent observational cross-sectional survey that used 2015-2016 survey data collected from 177 hospitals across four states, researchers asked pediatric nurses to provide their perspectives on patient safety culture (Lake et al., 2019). A total of 1,875 pediatric nurses participated in the study and researchers found that sixty percent rated their hospital as having a less than excellent grade on patient safety. Nineteen percent of pediatric nurses rated patient safety in their hospitals as poor. In regards to safety culture, 28% of the participants reported not feeling free to question authority and 46% felt that mistakes are held against them (Lake et al., 2019). The study also found that 21% of pediatric nurses felt that they did not receive follow-up or feedback after a safety event was reported. While this recent study is one of the first to show that work environment and safety culture in pediatric facilities are related, it did not gather information on the organization's HRO status or inquire about how likely a nurse would be to report safety events in the future.

In Denmark, the likelihood of self-reporting safety events was studied among pediatric nurses and physicians across four hospitals (Rishoej et al., 2018). Participants were asked to assess 20 scenarios and provide insight on how likely they would be to report the event in practice using a 5-point Likert scale. The study found that nurses were more likely than physicians to report safety events (63% to 55%) and that there were a number of factors associated with the likelihood to self-report (Rishoej et al., 2018). Factors associated with an increased likelihood to report included older age (>41 years) and having between 11-20 years of nursing experience. In the study, three of the twenty scenarios described a near-miss incident. The researchers found that less than 10% of participants felt that they would report these events.

The researchers also discovered that for each of the 20 scenarios, approximately 10% of all participants indicated that they were unsure about whether or not an incident should be reported. Another study conducted among pediatric nurses in Boston, Massachusetts corroborated these findings after pediatric nurses identified the primary barrier to safety event reporting as being unsure if a report is needed (Hession-Laband & Mantell, 2011). While national attention has been drawn on the importance of safety-event reporting—the research above highlights that the reporting of near-misses is still not considered as important as the reporting of adverse events. Over twenty years have passed since the groundbreaking release of *To Err is Human: Building a Safer Health System*. Despite multifarious attempts to dramatically reduce the incidence of safety events, research in pediatrics remains lacking. An overview of the literature on the various strategies used to reduce safety events will be discussed in the following section.

Strategies to Reduce Safety Events

The majority of pediatric organizations use multifaceted approaches endorsed by AHRQ in an attempt to reduce the severity and frequency of safety events (Muething et al., 2012). Recommended strategies are frequently updated on the AHRQ public website (<https://psnet.ahrq.gov/topics>) and the list currently includes over a dozen approaches. Endorsed strategies include: (1) improving communication between providers; (2) using computerized provider order entry; (3) fostering a culture of safety; (4) providing education and training to staff and families; (5) supporting error reporting and analysis; (6) emphasizing human factors engineering and standardized checklists; (7) participating in the credentialing and policy process; (8) evaluating the influence of logistical factors like nurse staffing ratios; (9) incorporating quality improvement guidelines across the organization; (10) promoting teamwork teaming; (11) incorporating technology with bar coding and computerized adverse event detection; and (12)

embracing a model built on transparency and accountability (AHRQ, n.d.). Examples of how several of these strategies have been used in current practice is provided below.

In 2006, Cincinnati Children's Hospital Medical Center (CCHMC) convened a quality improvement team to reduce the frequency of serious safety events by 80% over a four-year time period. Using a multipronged approach, the group focused on error prevention strategies, the restructuring of patient safety governance, uses of a new root cause analysis database, a transparency learning program and the development of specific interventions for high-risk units. The leaders established recognition programs to encourage all staff members to report safety events and also used simulation trainings to develop communication skills. Following these interventions, significant improvements were observed in the number of reported serious safety events ($P < 0.001$). CCHMC reported that the number of serious safety events per 10,000 adjusted patient-days decreased from a mean of 0.9 at baseline to 0.3. Following these interventions, the days between reported serious safety events also increased from a mean of 19.4 at baseline to 55.2 ($P < 0.0001$). While numerous interventions were employed, the organizational leaders attributed the program's success to their focus on the contextual factors that influenced the reporting practices of providers.

Between 2014 and 2017, a free-standing 145-bed pediatric organization developed a quality and patient safety program using many of the recommendations described by AHRQ (Phipps et al., 2018). The multifaceted approach included: 1) "safety moments" meetings, 2) leadership rounds, 3) a revised analysis plan for safety events, 4) error prevention trainings, 5) formal identification of high-priority safety events and 6) establishment of safety monitor program. The program leaders garnered support from frontline staff and after its full implementation, the rate of serious safety events declined from 0.19 in 2014 to 0.09 in 2015. The

rate then significantly declined again to 0.00 in 2016 and remained free of serious safety events for the duration of the study (Phipps et al., 2018). In addition, the central-line associated bloodstream infection, surgical site infection and catheter-associated urinary tract infection rates all significantly declined as well. While the number of high-priority safety events declined across the organization, there was an increase in event reporting among staff members. There was also an increase in the reporting of near-misses. In 2014, near misses accounted for 8.5% of all safety events while in 2015 it was 17% and in 2016 it was 30%. The organization has attributed its sustained success to the program's overarching commitment to safety mindfulness (Phipps et al., 2018).

A 2016 qualitative study conducted at Cincinnati Children's Hospital Medical Center, among 31 inpatient pediatric providers explored the factors that both promoted and inhibited the reporting of events. Transcripts from the 7 focus-groups found three overarching themes that related to the identification, communication and management of pediatric safety events (Brady & Goldenhar, 2012). One crucial component to whether a nurse would be willing to speak up was dependent upon their perception of the health care team. When nurses felt that their voice was welcome in guilds, they felt comfortable reporting patient-related observations, questioning proposed plans and suggesting alternate solutions. However, when nurses felt unfamiliar with team members or concerned that their input wasn't valued, they were less inclined to speak up. Participants also emphasized the importance of shared training and language regarding patient safety so that the team had a collective understanding of the patient's status.

In addition to evaluating the contextual factors contributing to the occurrence and frequency of safety events, organizations have developed several additional strategies to improve communication and standardize the medication process. In 2008, the Joint Commission released

a sentinel event alert, *Preventing Pediatric Medication Errors*, that provided recommendations on how medication errors can be prevented in health care. One strategy that organizations across the country have embraced is the use of computerized provider order entry (CPOE). Providers using CPOE enter and communicate treatment instructions through a computer application rather than using paper, a fax or telephone. Supporters of CPOE believe that the standardized approach ensures that each order is legible and complete (The Office of the National Coordinator for Health Information Technology, 2018; Kaushal et al., 2001). Two recent systematic reviews have provided evidence showing the positive influence CPOE has on error-prevention in pediatrics (Lambert Passos, et al., 2020; Rinke et al., 2014). According to a 2014 systematic review, 26 studies have explored the influence that CPOE has on pediatric error rates (Rinke et al., 2014). While a number of these studies revealed an overall reduction in error rates, a meta-analysis could not be conducted because of methodologic heterogeneity and nonuniform definitions used among investigators (Rinke et al., 2014). When compared to a manual order entry, several studies showed a 36% to 87% reduction in errors because of CPOE (Rinke et al., 2014).

Reporting Barriers

Research shows that there are a number of barriers that inhibit the reporting of safety events (Wakefield et al., 2001; Wolf & Hughes, 2008). The nursing profession typically attracts professionals who are motivated by internal rewards of self-actualization, achievement and participating in an overarching altruistic framework (Jackson et al., 2009). When nurses experience a safety event, they often feel so ashamed and devastated that they either conceal it or defend their actions by shifting the blame elsewhere (Wolf & Hughes, 2008). A blame culture has been defined as, “a set of norms and attitudes within an organization characterized by an

unwillingness to take risks or accept responsibilities for mistakes because of a fear of criticism or management admonishment” (Khatri et al., 2009, p.314). When nurses working in these types of environments experience a safety event, they are often quick to defend themselves, hide mistakes and ignore doubts (Khatri et al., 2009).

When frontline nurses do not trust their colleagues or superiors, they typically will not report unsafe situations or behaviors (Chassin & Loeb, 2013; Toruner & Uysal, 2012). Furthermore, if the organization punishes nurses who report a safety event, the employees’ lack of trust is reinforced and the likelihood that they will report a safety event is further reduced (Chassin & Loeb, 2013). Presently, it is believed that many nurses underreport errors due to their fear of the organization’s potential response and past experience working within a blame culture (Lederman et al., 2013; Rutledge et al., 2018; Throckmorton & Etchegaray, 2007; Wolf & Hughes, 2008). In 2012, AHRQ found that on average, 65% of surveyed hospital employees (a large majority of whom were registered nurses) from 1,128 hospitals worried that professional mistakes they had made were kept in their personnel files, and 50% felt that their mistakes were held against them by other employees (Agency for Healthcare Research and Quality, 2012). In 2019, a study of 345, revealed that 25% of nurses reported belief that retaliation might occur should they report a peer, supervisor or physician for an unsafe behavior (Cole, et al, 2019a).

Other studies have identified that many nurses do not report an event because they are unsure about what constitutes an error (Brady & Goldenhar, 2012; Hession-Laband & Mantell, 2011; Taylor et al., 2007; Wolf & Hughes, 2008). Presently, there is significant variation in how errors are defined, details on what is reported, who is involved in the reporting process and what feedback is returned to staff (Wolf & Hughes, 2008). As a result, many near-misses are

perceived as unimportant and the majority of safety events remain unreported (Kim et al., 2007; Wolf & Hughes, 2008).

In the 1990's, the first studies exploring reporting barriers among staff nurses were conducted (Wakefield et al., 1996; Wakfield et al., 2001). In 1996, Wakefield, Wakefield, Uden-Holman and Blegen conducted a mixed-methods study among 1384 staff nurses from 24 acute-care hospitals in the Midwest. The purpose of the study was to assess and analyze staff nurses' perceptions regarding why medication errors may go unreported. From the results, the researchers conducted a confirmatory factor analysis which revealed four factors in the decision-making process: (1) fear; (2) disagreement over error; (3) administrative response; and (4) reporting error (Wakefield et al., 1996). The fear subscale indicated that nurses feared being blamed for patient harm, being seen as incompetent by others and patients developing a negative attitude towards them (Wakefield et al., 1996).

Mayo and Duncan (2004) conducted a cross-sectional study to examine the perceptions of medication errors among 983 randomly selected adult-health nurses across California. The landmark study revealed that only 45.6% of nurses believe that all medication errors are reported and that nurses usually disagreed with one another on what constituted an error (Mayo & Duncan, 2004). Two of the primary reasons for not reporting events were, being "afraid of a manager's reaction" (76.9%) and "not thinking an error was serious enough" (52.9%).

In 2014, Australian researchers conducted the first stage of a participatory action research project in a large pediatric teaching hospital and identified several barriers to reporting (Alomari et al., 2018). During the first stage, the principal investigator collected data using direct observation of nursing staff during medication preparation, administration and practice audits. The identified common themes and trends were shared with staff to develop and refine questions

to explore during planned focus-group sessions. From the observation phase, the researcher found that the majority of the day, pediatric nurses spend on the medication process. However, the nurses were frequently interrupted during this process and had inadequate space and resources to safely prepare each medication. Given the acuity and complexity of the unit's primary population, nurses were frequently observed to take short-cuts or create workarounds in order to administer multiple medications to several patients over the course of the day. As a result, nurses often failed to double-check doses and patient identification bands—ignoring how potentially dangerous these actions might be. During focus-group sessions with participants, the majority reflected that while a missed dose was technically an error, it is seldom reported in practice. Nurses reflected that the “error of omission” was less significant than the “error of commission”. In addition, participants admitted that nurses often do not report medication errors if there is a minimal risk for harm. While the study was conducted outside of the United States, it highlights that incident reporting systems are not accurately reflecting the reality of medication practice or the actual frequency of errors (Alomari et al., 2018).

A systematic review published in 2016 revealed that additional research on safety event reporting barriers among nurses remains critically needed (Vrbnjak et al., 2016). The review consisted of 38 studies and revealed that fear of personal blame remains the primary barrier to safety event reporting (Vrbnjak et al., 2016). Of the included studies, 12 were conducted in the United States and 10 of these were published before 2010.

In 2018, survey results collected from staff members and patients across 535 hospitals and four states revealed that patient safety and poor work environments remain problematic (Aiken et al., 2018). The survey was conducted at two points in time (2005 and 2016) to determine the extent to which work environments improved and whether positive changes were

correlated with higher patient safety scores (Aiken et al., 2018). Data was collected from 53,699 registered nurses and findings revealed that over 50% felt that mistakes were held against them and 36% did not feel free to question authority. Only 21% of the hospitals showed sizable improvements in their work environment scores while 71% showed no change and 7% actually worsened (Aiken et al., 2018).

The Influence of Workplace Culture

How health care organizations learn from past failures and incorporate staff feedback is paramount to the delivery of safe patient care (Aiken et al., 2018; Carmeli & Gittell, 2009; The Joint Commission, 2017; Reason, 2011). When a blame culture exists in health care, the organization typically cultivates a bureaucratic management style that is highly rule-focused and compliance-driven (Khatri et al., 2009). In the blame culture, communication and collaboration are hampered because of reinforced power differentials among team members and a climate of mistrust (Khatri et al., 2009). To address systemic issues and improve the quality of patient care, organizational leaders should remain committed to utilizing the knowledge and ideas of frontline personnel (Khatri et al., 2009). According to the Joint Commission, a safety culture is “the sum of what an organization is and does in the pursuit of safety” (The Joint Commission, 2017). Safety culture has also been described as a product of individual and group beliefs, values, attitudes, perceptions, competencies, and patterns of behavior that determine an organization’s commitment to health and safety (The Joint Commission, 2017; Reason, 2011).

Through collective learning and a commitment to excellence, organizational leaders have taken great strides to improve the quality and safety of patient care (Reason, 2011). In order to establish a safety culture, four key components are necessary: (1) reporting culture; (2) just culture; (3) flexible culture; and (4) learning culture (Reason, 2011). A reporting culture

examines how an organization's environment can both inhibit and promote safety event reporting. In order to promote a reporting culture, leaders need to emphasize that, "valid feedback on the local and organizational factors promoting errors and incidents is far more important than assigning blame to individuals" (Reason, 2011, p. 198). In order to analyze and address safety issues, staff members need to feel safe in the reporting process. When staff members work in a just culture, they are rewarded for speaking up about safety events, but also take accountability for unsafe practice (The Joint Commission, 2017). Staff members recognize that safety events are inevitable but that a difference exists between human error and reckless behavior (Agency for Healthcare and Research Quality, 2019c). The high reliability framework is an example of promoting a flexible culture in health care. A flexible culture involves "shifting from the conventional hierarchical mode to a flatter professional structure" (Reason, 2011, p. 196). Leaders in a flexible culture recognize that the health care environment is complex, high-risk and dependent upon effective communication and teamwork (Agency for Healthcare and Research Quality, 2019c). The fourth component is the establishment of a learning culture (Edmondson & Roloff, 2008). Staff members across the learning culture are committed to making major reforms and challenging the status quo in order to improve the delivery of safe patient care (Edmondson & Roloff, 2008; Reason, 2011). In the learning culture, divergent perspectives are welcomed and team members are dedicated to the quality improvement process (Khatri et al., 2009).

Magnet[®] Designation

Since 2005, the American Nurses Credentialing Center (ANCC) has promoted the Magnet[®] Model across the health care industry (ANCC, n.d.). However, despite strong evidence supporting the model, only 8% of all hospitals across the country have Magnet[®] accreditation

(ANCC, 2019). The model provides a roadmap to nursing excellence and focuses on transformational leadership, structural empowerment, exemplary practice and the generation of new knowledge. Several studies have shown that organizations that receive Magnet[®] accreditation have improved perceptions of safety culture, nursing satisfaction and patient outcomes (Anderson et al., 2018; McHugh et al., 2013; Petit & Regnaud, 2015). Recently, researchers examining national patient outcomes for over 993 hospitals revealed that patients treated in Magnet[®] organizations are 7.7% less likely to die within thirty days following a surgical procedure and also 8.6% less likely to experience post-operative complications (Friese, et al., 2015). Like the HRO model, organizations that embrace the Magnet[®] framework seek to empower frontline nurses to become engaged in quality improvement initiatives, speak up about concerns and report patient safety events (Aiken et al., 2018; Hession-Laband & Mantell, 2011; McHugh et al., 2013). These studies provide evidence that the promotion of positive workplace cultures that emphasize the participation of staff in the decision-making process does influence patient and staff outcome measures.

The High Reliability Model

In November 2019, the President and Chief Executive Officer of the Joint Commission, Mark Chassin, published a blog post on the observations and lessons learned since the release of *To Err is Human: Building a Safer Health System* twenty years ago (Chassin, 2019). Chassin identifies the importance of using the high reliability framework to improve the safety and quality of patient care. The post calls for organizations to embrace three strategies: (1) a commitment to zero harm; (2) an overhaul of existing cultures; and (3) the adoption of highly effective process improvement methods. The blog post is only one example of the many articles and white papers released by the Joint Commission promulgating support for the HRO

framework. Over the past fifteen years, AHRQ and The Institute for Healthcare Improvement (IHI) have also urged health care organizations to embrace the HRO framework to improve the safety and quality of patient care (AHRQ, 2019a; Chassin & Loeb, 2013; Nolan et al., 2004).

While the focus on mindful organizing in health care is new, the framework comes from an evolving body of work first described in the field of aviation in the 1990's (Vaughn, 2016; Weick & Sutcliffe, 2015). In 1984, three organizational researchers joined together to explore how performance and outcomes are influenced by an organization's structure and culture (Rochlin, 1996). After studying employee practices in U.S. air traffic control systems, a large-scale electric power generation and distribution system and on two nuclear aircraft carriers, the researchers found that each organization's character was established through, "pervasive patterns of complexly related, tightly-coupled technical and social relationships" (La Porte, 1996, p. 63). The study of high reliability was expanded upon after the launching and crash of NASA's space shuttle, the Challenger, in 1986 (Vaughn, 2016). After a six-year investigation into the accident, Vaughn, found no evidence of rule violation by NASA employees. Instead, Vaughn found evidence that the accident resulted from organizational misconduct. Vaughn concluded that errors are inevitable in complex organizations due to the intricate connections between powerful actors and the high-risk environments in which they operate. Moreover, an individual's actions within the environment is constrained by institutional forces shaped by larger and overarching cultural beliefs (Vaughn, 2016). Prior to the Challenger's launch, several NASA engineers expressed concern over the shuttle's safety but were silenced by upper administration (Vaughn, 2006). NASA had become so focused on its culture of production that deviations from safety protocols became normalized and concerns from frontline staff were commonly ignored (Vaughn, 2006).

By analyzing tragedies and failures, organizational researchers identified the key elements that both contributed and hindered the event's occurrence. In 2001, Weick and Sutcliffe published, *Managing the Unexpected: Sustained Performance in a Complex World*. The authors assert that successful organizations in high-risk industries are able to overcome challenges through mindful organizing. Mindful organizing represents a dynamic process comprising of specific continuous actions rather than an enduring fixed set of organizational characteristics (Vogus & Sutcliffe, 2012). An HRO, "derives its ability to successfully manage trying conditions of complexity, dynamism, and error-intolerance from organizational mindfulness" (Vogus & Sutcliffe, 2012, p. 723). Mindful organizing is a social process and reliant upon open communication and the involvement of frontline staff. HROs engage in nearly error-free operations over an extended period of time despite the error-prone nature of the work.

Despite the recent push for health care organizations to embrace the HRO framework, there remains a dearth of literature on how to ensure effective implementation (Chassin & Loeb, 2013; Christianson et al., 2011; The Health Foundation, 2011; Veazie et al., 2019). Unlike the Magnet[®] model, organizations do not achieve designation through a credentialing center. Health care organizations seeking to implement the HRO framework rely upon the guidelines provided by the Joint Commission and AHRQ—but have the option to choose from several different implementation programs. Each program varies in terms of the depth, type and amount of training that is required (Veazie et al., 2019). The absence of a standardized evaluation and accreditation process means that any health care organization can declare "HRO" status. As a result, even organizations that claim to be an "HRO" may not actually operate as one. Moreover, the lack of oversight also means that an accurate count on the number of self-declared HROs in health care remains lacking. In order to determine whether an organization truly embodies the

five overarching principles of the HRO framework, it needs to be tested (Chassin & Loeb, 2013). By using tools with strong psychometric properties, organizations can assess their current state of HRO maturity while also identifying areas that need improvement.

Measuring HRO Perception in Health Care

While many organizations have embraced the HRO framework, there are few tools to assess the extent to which an organization is actually behaving like an HRO (Chassin & Loeb, 2013). Over the past decade, several instruments have been developed to measure safety culture among health care workers (The Health Foundation, 2011; Singer et al., 2003). After reviewing the psychometric properties of these tools along with their conceptual underpinnings, the Safety Organizing Scale (SOS) was chosen as the most appropriate instrument for this proposed study.

While many organizations conduct staff surveys to assess existing safety cultures, only one has used the five HRO principles in the theoretical development of survey items (T. Vogus, personal communication, July 18th, 2019). According to the instrument's developer, high-reliability organizations are successful because personnel are encouraged to embrace collective mindfulness (Singer & Vogus, 2013; Weick & Sutcliffe, 2007). Mindful organizing empowers staff members to collect, analyze and disseminate information about errors in a transparent way while also remaining in constant pursuit for ways to improve current practice (Vogus & Sutcliffe, 2007b). By using the HRO framework as a theoretical guide, the developers mapped each survey item to the five processes of collective mindfulness (Vogus & Sutcliffe, 2007b). The developers further established content validity by meticulously examining past case studies of high-reliability organizations, consulting with leading experts and conducting qualitative fieldwork (Vogus & Sutcliffe, 2007b).

Past Safety Organizing Scale (SOS) Studies in Health Care

In 2003 and 2004, a total of 1,033 registered nurses and 78 nurse managers across ten acute-care hospitals in Indiana, Iowa, Maryland, Michigan and Ohio participated in a study exploring safety organizing, reported medication errors, managerial trust, use of care pathways, and RN characteristics (Vogus & Sutcliffe, 2007b). The researchers conducted a cross-sectional analysis of medication errors reported to the hospital incident reporting system for six months following the survey administration. Using the SOS as one of the primary tools, the researchers found that a nurse's perception of safety organizing (and whether or not their unit functions as an HRO) and their level of trust in leadership had a significant, negative relationship with reported medication errors ($\beta=-0.68$, $P<0.001$). This negative relationship contrasts the studies exploring psychological safety and the reporting of safety events (Appelbaum et al., 2016; Leroy et al., 2012). Other variables that controlled for the findings included years of nursing experience and unit type (Vogus & Sutcliffe, 2007b). Both of these characteristics will be used as control variables for this study.

Researchers at the Department of Veterans Affairs (VA) conducted a mixed-methods study across 3 intensive-care units to explore nurses' perceptions of their workplace cultures using the SOS. Researchers chose the instrument as the 9 items ask specific questions regarding communication exchanges among providers (Manojlovich et al., 2011). Responses were collected and analyzed from 66 nurse-participants and revealed significant differences between the 3 units ($p=0.02$). The SOS was found to be a reliable tool ($\alpha=0.93$) and a principal factor analysis demonstrated a single component solution. The results from the SOS survey corroborated the qualitative findings from nurse-interviews and unit observations. The unit with the lowest safety culture scores on the SOS also expressed greater concerns with provider communications during the qualitative interviews. The findings demonstrate the importance of

contextual factors on communication exchanges and teamwork. While the study was not conducted among pediatric nurses, the research supports the use of the SOS in acute-care—highlighting its validity in measuring safety culture and effective communication exchanges.

Following these landmark studies, Vogus and Iacobucci conducted a study among 1685 registered nurses and 95 nurse managers across ten hospitals. One of the main hypotheses the researchers sought to support was that there is a negative relationship between unit-level mindful organizing (SOS scores), medication errors and patient falls (Vogus & Iacobucci, 2016). The researchers used the SOS to measure mindful organizing and found that the scale demonstrated excellent reliability ($\alpha=0.88$). The researchers were able to support their hypothesis by demonstrating that mindful organizing (SOS scores) was associated with fewer medication errors ($P<0.05$) and fewer patient falls ($P<0.01$). A one-unit increase in mindful organizing scores was associated with 25% fewer medication errors and 37% fewer patient falls. The researchers estimated that the reduced rate of medication errors and falls could save hospitals between \$264,000 and \$585,000.

Health Care and the HRO Framework

Leaders supporting the HRO model propose that through training and reinforced education, there can be a change in organizational culture (Chassin & Loeb, 2013). High reliability organizations are reliant upon an overarching atmosphere of collective mindfulness—meaning that all staff members are in constant pursuit of finding small failures and near misses (Chassin & Loeb, 2013). Through collective mindfulness and the fostering of psychological safety, potential deficiencies can be identified and safety processes can be improved.

The HRO framework emphasizes that all humans make mistakes and that these events should be viewed as learning opportunities. Rather than feeling shame for the event's

occurrence, staff are encouraged to see each incident as an educational opportunity to inform future practice and drive quality improvement projects. By recognizing the diverse nature of nursing units and the existing power hierarchies that influence speaking up, organizations that embrace the HRO framework recognize how important workplace culture is on team learning (Edmondson & Roloff, 2008). The model acknowledges that lower-status team members are less likely to share their concerns and speak up about system issues out of fear (Edmondson & Roloff, 2008). By encouraging all team members to participate in the decision-making process, organizations that embrace the HRO model provide the structure necessary for learning while mediating the unit culture so that all staff feel safe taking risks and addressing concerns (Edmondson & Roloff, 2008; Sarin & McDermott, 2003). The HRO model's five overarching principles: (1) preoccupation with failure; (2) reluctance to simplify; (3) sensitivity to operations; (4) deference to expertise; and (5) commitment to resilience are discussed below.

A preoccupation with failure means that staff are consistently focused on finding near-misses and potential failures. Nurses and other staff members are encouraged to be vigilant at all times, serving as organizational watchdogs for potential safety events. When a potential event is caught (a near-miss), nurses are rewarded for the catch. A reluctance to simplify means that staff are expected to question the status quo and to never feel embarrassed to seek clarification or ask questions. Staff are praised for raising their hands during team meetings and for brainstorming unconventional approaches to improve patient care. Sensitivity to operations indicates that there are appropriate resources and knowledgeable personnel available to staff members should a safety event take place. Nurses should know whom to contact if a question or concern arises and be able to find help when needed. Deference to expertise means that all staff members, regardless of their position, are viewed as valuable and contributing members of the health care

team. When a problem arises, the staff members with the most knowledge and experience working with similar situations are called upon. Thus, when a patient issue arises, organizational leaders call upon frontline staff to better understand daily operations and brainstorm potential solutions. HROs do not default to organizational leaders with the highest rank or seniority to address systems' issues but instead empower frontline staff to participate in the decision-making process (Chassin & Loeb, 2013). A commitment to resilience means that the organization is dedicated to the pursuit of knowledge acquisition. Staff members are encouraged to advance themselves professionally and are also provided with the tools and resources needed to do so.

While there is growing interest in exploring the relationship that the HRO model may have on the reporting of events and quality improvement measures, few studies have been conducted, none of which have been in pediatrics. The most current research suggests that organizations who adopt the high reliability framework may reduce the number of reported serious safety events while also improving the reporting behaviors of staff (Lyren et al., 2016). A review of several of the health care studies that have been conducted in self-declared HROs is provided below.

Health Care Research in Self-Declared HROs

In 2014, a large prospective, descriptive study compared 3 groups of registered nurses in a single nonprofit academic teaching hospital with Magnet[®] status. Details regarding the types of reported adverse events was collected six months before and six months after staff participated in an educational program on high reliability (McFarland & Doucette, 2019). Three units participated in the study which included 52 registered nurses from the neurosurgical intensive care unit (NSICU), 29 registered nurses from the neuro-intermediate care unit (NIMC) and 21 registered nurses from the neurosurgical/medical unit (NSMU). The intervention consisted of a

four-hour class on high-reliability. Baseline data from the three units were collected from the reporting system on the number of adverse events, severity of the events and reported near-miss cases. The same data were collected six months after the staff participated in the high-reliability course. After the intervention, there was a 14.7% increase in adverse event reporting across all three units, though this result was not statistically significant. There was no impact on the reporting of near-miss events following the intervention. While this study did not demonstrate statistically meaningful results, it did suggest that nurses may be more likely to report when they work in an environment that encourages them to do so. However, it is important to recognize that this study was conducted only among registered nurses working with the adult population and in one hospital. The researchers also did not use an instrument to assess the participants' perspective of whether or not their unit promoted the high-reliability framework in daily practice.

Between July 2008 and January 2011, the Ohio Children's Hospital Association (OCHA) collected baseline serious safety event data from eight pediatric tertiary care hospitals across the state (Lyren et al., 2016). Following this collection, OCHA invited a consulting company specializing in HRO practices to develop task forces to reduce the overall rates of serious safety events by 50% in 2012 and 75% in 2015. In consultation with the HRO quality improvement specialists, five task forces were created: (1) the error prevention task force; (2) the leadership methods task force; (3) the cause analysis task force; (4) the lessons learned task force; and (5) the safety governance task force. In addition to receiving advanced education and specific training on HRO practices, organizations increased transparency by sharing information about serious safety events across institutions and safety leaders routinely joined staff members on rounds and safety huddles (Lyren et al., 2016). Following these sustained efforts, the Association reported a 55% reduction in serious safety events in 2016. This reduction translates to 70 fewer

patients experiencing a serious safety event each year. These improved rates occurred across all of the participating hospitals and the Association has since invited an additional 25 pediatric hospitals to participate in the initiative.

In 2017, researchers from a Texas long-term acute care hospital investigated whether or not there was a change in the number of reported safety events following their organization's high reliability training (Duffey et al., 2019). Six months prior to the program's implementation, 36 safety events were reported in the organization; 7 of these events were near-misses. The program consisted of staff receiving education on the HRO model through a series of online modules, in-person lectures, discussions and role play. Six months after the program's implementation, data on the number and types of reported safety events were collected again. During this time, 30 safety reports had been submitted and 2 of these were near-misses. While there was no statistically significant difference in the severity of events reported, there was a significant difference in the number of clinical process errors reported ($P < 0.003$). Interestingly, more errors were reported before the program's implementation. While this study is one of the first to explore the influence that an organization's self-declared HRO status might have, the sample size was small and the results cannot be generalized outside of the study. It is important to note that while the organization may have self-declared itself as an HRO and offered education on the model to staff, it is difficult to determine whether or not these actions alone can actually create a change in reporting behaviors.

Psychological Safety

Over the past century, the health care industry has become increasingly complex, technical and highly reliant upon transdisciplinary teamwork (Edmondson, 1999). Health care's growing reliance on teamwork has led to an increased interest in ways to enhance

communication and collaboration designed to improve the quality of patient care. In order to understand how staff-members participate in the feedback process, many organizational leaders have turned to the early work of Schein and Bennis. In 1965, Schein and Bennis first coined the term psychological safety in the book, *Personal and Organizational Change through Group Methods: The Laboratory Approach*. Across several years, industries and positions, the organizational researchers studied how staff members engage in group learning and respond to feedback (Schein & Bennis, 1965). Their work led to several important conclusions. First, “in undertaking any planned social change, legitimacy for the change must be gained through obtaining the support of the key people” (Schein & Bennis, 1965, p. 229). Schein and Bennis proposed that staff members need to participate in the change-process and feel that their perspectives are welcomed. With staff ‘buy-in’ and support, an implemented change is more likely to be perceived as valuable, worthwhile, realistic and sustainable. Schein and Bennis also found that in order to garner the support of staff members, participants need to be willing and comfortable in revealing their feelings, without being afraid of how others may react. In other words, staff members need to feel psychologically safe in order to fully participate on the team.

In the 1980s, organizational researchers further explored these key concepts in health care. Researchers observing nurses in the operating room at a large teaching hospital in Michigan found that despite being under severe time pressure, lower-status members on surgical teams were rarely asked to provide their opinion or feedback on work processes (Hackman, 1990). Surgical nurses voiced that they often felt ignored by surgeons and administrators despite having extensive experience and expertise. The existing hierarchy contributed to a palpable tension among colleagues and an “ongoing battle” between nurses and higher-status organizational

members (i.e. surgeons, administrators). Nurses felt that their knowledge was overlooked and consequently they were not psychologically safe to speak up in the workplace (Hackman, 1990).

In 1996, Edmondson conducted a landmark study on hospital patient care teams to explore how willing staff members were to discuss concerns, ask for help and admit to mistakes (Edmondson, 1999). Using a comparative nonexperimental research design, eight hospital units were randomly selected from two urban hospitals in the United States (Edmondson, 1996). Using a prior instrument designed to measure the organizational performance of cockpit crews as a theoretical guide, Edmondson developed a survey to assess the team member's perception of their workplace (Edmondson, 1996). The refined survey included items on observed leadership behaviors, organizational context (i.e., education, resources), team characteristics (i.e., quality of relationships, stability) and individual satisfaction. During the study, researchers collected data on four dependent variables related to adverse drug events: (1) non-preventable adverse drug events, (2) preventable adverse drug events, (3) potential adverse drug events, and (4) intercepted adverse drug events. In addition to collecting survey data on participants, a research assistant blinded to the responses observed the eight nursing teams for several days over a 2-month period. The assistant interviewed all nurse managers, several nurses and support staff across the eight units using a semi-structured approach to gather descriptions on how teams felt that mistakes were handled and perceived within the workplace. Edmondson discovered significant differences in staff members' beliefs about the social consequences of reporting medication errors across the units. Unexpectedly, the researchers found that higher reported error rates were strongly associated with higher scores on direction-setting and coaching by the nurse manager, perceived unit performance outcomes and the quality of unit relationships (with $P < 0.03$ for each relationship). The observational and interview data corroborated survey findings and suggested

that high-functioning teams were not committing more errors—but were more willing to discuss them. Edmondson concluded that, “detected error rates are a function of at least two influences—actual errors made and unit members’ willingness to report errors” (1996, p. 79). Edmondson concluded that the unit climate significantly influenced an individual’s perception of whether or not it was safe to discuss mistakes ($P < 0.05$).

Following this groundbreaking first study, Edmondson proposed that the teams who perceived their workplace as open to discussing mistakes were actually describing the concept of psychological safety. In a follow-up, three-phase mixed-methods study in a large manufacturing company, Edmondson used a combination of qualitative and quantitative methods to further define and operationally measure the concept of psychological safety.

During the first phase, Edmondson conducted interviews and observations across eight teams. The interview questions were developed based on Edmondson’s previous research in the field and the theoretical constructs highlighted in the literature. During phase two, quantitative data for all 51 teams ($N=427$ individuals) were collected after the administration of two surveys. Following these two phases, Edmondson developed preliminary survey items designed to operationally measure the construct. Discriminant validity was established during a factor analysis and all of the original survey items were retained (Edmondson, 1999). To establish criterion validity, Edmondson conducted testing on eight hypotheses and found that team psychological safety, team efficacy and team membership were significantly related to team learning behavior ($P < 0.001$). The third phase of the study consisted of interviewing and observing seven of the same manufacturing teams based on the survey results. Teams were selected according to the survey results as to whether or not they exhibited high or low learning behaviors on the preliminary survey questions. Following the development of the Team

Psychological Safety Scale, psychometric testing has demonstrated excellent internal reliability ($\alpha = .82$) and supported the use of a single-level factor (Edmondson, 1999). The psychometric properties of the instrument are further described in Chapter Three.

Following Edmondson's work in the 1990's, research on psychological safety in the health care arena has continued to expand. In 2002, Tucker, Nembhard and Edmondson conducted an empirical study of organizational learning in neonatal intensive care units (NICUs). In this mixed-methods study, data were collected from 23 NICUs that had been working to implement quality improvement projects. Surveys were administered to staff members in the units and data were collected from 1,400 participants. The research team found that one particular learning activity, classified as 'learn-how', mediated the effect of psychological safety on implementation success (Tucker et al., 2007). According to the researchers, a learn-how activity involves tailoring protocols to meet each team's specific needs while also customizing programs to ensure their success and sustainability (Tucker et al., 2007). The research demonstrated a positive correlation between psychological safety and learn-how activities ($P=0.008$). In addition, psychological safety predicted perceived implementation success for NICU staff members ($P=0.01$). In a review of the findings, the researchers concluded that learn-how activities, like experimentation and collaborative problem-solving, involve interpersonal risk. In order to participate fully in the learning process and be comfortable with this risk, staff members need to feel psychologically safe with their colleagues (Tucker et al., 2007).

Between 2009 and 2010, researchers in the Veterans Health Administration (VHA), conducted a mixed-methods study to explore the psychological safety of staff members and to assess its relationship with willingness to report a medical error (Derickson et al., 2015). Using

data collected from a census survey sent to all VHA employees ($n=27,754$), researchers found a significant relationship between race and psychological safety scores. Findings indicated that the mean of minority employees' responses was significantly lower than the mean for white employees ($P<0.05$). During the second phase of the study, researchers conducted follow-up interviews with 180 participants in two separate VHA hospitals. The two hospitals were chosen based on the organizational scores from the census survey data, with one identified as being psychologically unsafe and the other as psychologically safe. During the interviews, researchers asked about how willing a participant would be to report an error at work. Of those at the identified psychologically unsafe hospital, 57 of the 80 participants (71%) said they would report and 10 (13%) said that they would not report a medical error. 91 of the 100 participants at the identified psychologically safe hospital stated that they would report and no participants said that they would not an error; several individuals provided unclear or indirect responses to the question. Severity of error-type was not assessed during the interview. Details regarding participants' position and role in each organization also were also not ascertained.

In 2011, a similar study exploring psychological safety was conducted using data from 28,998 staff members across 141 Veterans Health Administration medical centers (Edmondson et al., 2016). More than 1,700 physicians and 7,600 nurses were included in the sample. The goal of the research study was to further investigate the concept of psychological safety in health care while simultaneously exploring its relationship with organizational hierarchy, perceived leadership effectiveness and work-type. The study found that those with greater hierarchical status had significantly higher levels of psychological safety ($P<0.001$). Perceptions of leadership correlated significantly with psychological safety—highlighting the impact that workplace culture has on staff behaviors ($P<0.001$). Lastly, researchers found that work type has

a significant relationship with psychological safety levels—with physicians having higher overall mean scores in comparison to nurses ($P < 0.001$). The researchers recommended that future studies explore the impact that workplace culture has on psychological safety across a variety of healthcare settings and positions.

Since the 1990's, research has shown a positive and significant correlation between team psychological safety and reported safety events (Alingh, et al., 2018; Applebaum et al., 2016; Leroy et al., 2012). Researchers in Belgium conducted a cross-sectional and descriptive study using survey data from 54 nursing teams across 4 hospitals. The researchers found that perceived behavioral integrity for safety was positively related to team psychological safety ($P < 0.01$). Team psychological safety was also positively related to reported treatment errors ($P < 0.02$). The findings revealed that when nurses perceive their team leaders to be honest and committed to shared safety values, they feel more psychologically safe (Leroy et al., 2012). Leroy's international research provided clear and strong support for how influential workplace culture and leadership style are for staff members when deciding whether or not to report a safety concern.

In 2014, researchers at the Virginia Commonwealth University School of Medicine, hypothesized that psychological safety mediates the positive relationship between leader inclusiveness and intention to report safety events, as well as the negative relationship between power distance and intention to report events (Applebaum et al., 2016). Leader inclusiveness was defined as, “the availability and accessibility by leaders, focuses on followers’ perceptions that leadership acknowledges their contributions” (Applebaum et al., 2016, p. 345). Power distance was described as the, “extent to which an individual perceives unequal distributions in status and power within institutions and organizations” (Applebaum et al., 2016, p. 345). Using

psychometrically sound and well-tested instruments, 106 medical residents from eight different programs participated in the study. The researchers found that perceived power distance was negatively correlated with psychological safety ($P < 0.01$) and reporting intentions ($P < 0.05$). Leader inclusiveness was positively correlated with psychological safety ($P < 0.01$) and reporting intentions ($P < 0.05$). Psychological safety was positively correlated with reporting intentions ($P < 0.01$). With every one unit increase on one's psychological safety score, intention to report an adverse event increased by 0.34 units. The researchers also noted that the department type and professional tenure status did not have a relationship with the study variables.

Using a cross-sectional survey, data from 980 nurses and 93 nurse managers were collected from 334 hospital units across the Netherlands (Alingh et al., 2018). The aim of the study was to explore the relationships between control-based and commitment-based safety management, climate for safety, psychological safety and nurses' willingness to speak up. The study's findings were that nurses' tenure status and level of psychological safety had a significant impact on their willingness to speak up about a safety concern ($P < 0.05$).

In 2020, researchers explored how new graduate registered nurses described their development of psychological safety in practice (Lyman et al., 2020). Four major themes were identified as being supportive factors: (1) Building credibility; (2) Feeling supported; (3) Making personal connections; and (4) Seeking safety. In the interviews, participants described being scared to make a mistake and the importance of seeing seasoned staff members normalize safety event reporting (Lyman et al., 2020). Psychological safety was also enforced when new graduate nurses worked in settings where questions were encouraged and staff members felt comfortable discussing clinical weaknesses and concerns over competencies.

A recent systematic review conducted by O'Donovan and McAuliffe (2020) highlighted that the fostering of psychological safety should occur on an organizational, team and individual level. Four of the 36 studies analyzed in the review demonstrated connections between workplaces that emphasize continuous improvement and psychological safety among team members (O'Donovan & McAuliffe, 2020). However, to date, no studies have explored the potential relationship between psychological safety and the reporting intentions of pediatric nurses.

Theory of Planned Behavior

There is significant research in social psychology that the general attitudes and personality traits of an individual influence their behaviors (Epstein, 1983). However, their influence is also greatly attenuated by the presence of more immediate and contextual factors (Ajzen, 1991). In order to both predict and explain the variability of human behavior in different contexts, Ajzen developed the theory of planned behavior (Ajzen, 1991). A recent systematic review consisting of over 78 studies on social-cognitive theories has concluded that the theory of planned behavior is the most appropriate framework to explain intention and predict behaviors of clinicians (Hoffman et al., 2013). According to theory, the performance of a behavior is a result from both intentions and perceived behavioral control. Intentions are, “assumed to capture the motivational factors that influence a behavior; they are indications of how hard people are willing to try, of how much effort they are planning to exert, in order to perform the behavior” (Ajzen, 1991, p. 181). The stronger the individual's intent, the more likely they will be to perform the behavior.

There are three conceptually independent determinants of intent: (1) attitude toward the behavior itself; (2) the subjective norm; and (3) the perceived behavioral control. An individual's

attitude is shaped by the outcomes and potential costs that may occur as a result of the behavior. As a result, individuals favor behaviors that have desirable consequences and form unfavorable attitudes towards behaviors associated with negative outcomes. For example, if a nurse perceives that the submission of a safety event will be judged fairly and may improve the future of patient care they may be more likely to report.

An individual's intention is also shaped by the normative beliefs that surround them. According to the theory, "normative beliefs are concerned with the likelihood that important referent individuals or groups approve or disapprove of performing a given behavior" (Ajzen, 1991, p. 195). If the individual does not perceive a behavior to be valued within that specific context, their intention to perform will diminish. Thus, nurses who are working in organizations that support and promote safety event reporting may be more likely to discuss past mistakes, voice concerns and review safety events.

The theory also postulates that one's perceived behavioral control also influences whether or not the individual performs the behavior. For example, in order for a nurse to report a safety event, they need to have an established system in place to submit it. The individual's perceived behavioral control also refers to their perception of how easy or difficult it will be to perform the behavior. For example, if the nurse needs to log into several different electronic systems in order to reach the safety event reporting system on the computer, they may be less likely to submit a report than if the system was streamlined. Lastly, these beliefs are shaped by the individual's past experience with the behavior, the resources made available to them, and the opportunities that exist.

The theory of planned behavior serves not only to explain and predict behavior across specific contexts, but also to provide researchers with the foundation needed to explore how

future interventions can be developed. According to the theory, “intention, perception of behavioral control, attitude toward the behavior, and subjective norm each reveals a different aspect of the behavior, and each can serve as a point of attack in attempts to change it” (Ajzen, 1991, p. 206). Thus, it is essential that researchers explore the various factors that influence one’s intention if they intend to improve future behavior.

In this study, it is proposed that one’s level of psychological safety and perception of working in an HRO organization are external factors that influence the nurse’s attitude toward reporting behaviors.

Theory of Planned Behavior and Safety Event Reporting Intentions

Several past studies have found that nurses may fail to report safety events and errors due to fear of reprisal (Osborne et al., 1999). Consequently, it is highly likely that most nurses underreport safety events and do not disclose errors to their colleagues. The majority of research conducted on safety reports among nurses have focused on the nurse’s perception of how often particular safety events occur on their work unit. By asking nurses about the frequency of reporting among all staff members on a unit, the researcher neglects to recognize that the individual perception of the nurse does not accurately capture the reality of what is happening at the work place. It is highly likely that individual nurses do not know about the majority of reported safety events on their unit, as colleagues often avoid sharing the information with others in order to protect their professional reputation (Throckmorton & Etchegaray, 2007). In 2007, Throckmorton and Etchegaray found that only 67.8% of nurses would share information about an event that caused no harm with their colleagues. This highlights that many nurses are not openly sharing safety events with fellow colleagues. In addition, by asking nurses about reporting history, the researcher is only able to explore past behaviors that transpired.

By focusing on reporting intentions, this research study aims to explore how a nurse would likely behave in the future if a safety event occurred. Behavioral intention is defined as the hypothetical action a nurse would intend to choose if a specific event took place. Behavioral intentions have been found to be a valid proxy measure for actual behavior among clinicians (Eccles et al., 2006; Kiesewetter et al., 2018).

Throckmorton and Etchegaray (2007) developed an intent to report instrument by using five sets of two questions related to the types of events reported in the literature: (1) events that cause no harm; (2) events that cause minor injury; (3) events that cause moderate to severe injury; (4) events that cause severe injury; and (5) events that cause death. When taking the survey, nurses are asked to respond based on the premise that no one else knows that an error has occurred. Each set of questions asks the participant if they would formally report the event and/or if they would tell anyone else about it. Content validity for the instrument was established based on a literature review and evaluation by a panel of nursing experts. The panel consisted of two advanced practice nurses, one clinical nurse, one co-chair on the peer review committee and one expert on state practice acts. The panel reached 100% agreement on the survey items ultimately used in the study. The research team found that 55.5% of participants would report errors that were made but did not cause harm to the patient. The results also showed that while 99% of participants would report events that caused either moderate injury, severe injury or death, only 94.7% of participants would report an event that caused a minor injury. Of the participants, 67.8% reflected that if they made an error that caused no harm to the patient, they would share this information with a colleague. In addition, 89% said that they would share information if an event caused minor harm; 93.3% would share information if an event caused moderate harm; 92.8% would share information if an event caused severe harm and 93% would

share information if an event caused a patient's death. Past studies have also shown that the disclosure of safety events among health care providers is largely dependent upon if the patient experienced harm (Muller & Ornstein, 2007; Kiesewetter et al., 2018).

Similar instruments using the theory of planned behavior as a conceptual guide have been conducted in Taiwan, Italy and Australia. All have demonstrated that the theory of planned behavior can explain the mechanisms behind a nurse's intention to report safety events. Using the theory of planned behavioral as a guide, 322 Taiwanese nurses across 56 units participated in a cross-sectional study exploring professional commitment, perceived effect of reporting, obeying rules and intention to report (Teng et al., 2009). The study found that a nurse's perception toward reporting and their professional commitment were related to their intention to report future safety events ($P < 0.05$). The researchers did not find relationships between gender, age, and education with reporting intentions (Teng et al., 2009). The researchers developed a nine-point scale to measure reporting intentions using Fishbein and Ajzen's theoretical work and after reviewing similarly published instruments. While their study was solely conducted in one geographic location, in the Chinese language, and among adult nurses, the findings revealed that the reporting intention scale demonstrated satisfactory reliability ($\alpha = 0.92$) while also demonstrating the importance of attitudes and social norms on reporting behaviors (Teng et al., 2009).

In 2013, a study of 596 staff nurses in Taiwan explored whether the effects of attitudes and intentions regarding medication administration error reporting was associated with actual reporting behaviors. Using the theory of planned behavior as its guiding framework, the researchers found that 45% of variance in nurses' behavioral intentions can be explained by their attitude and the attitude possessed by fellow colleagues (i.e. existing social norm). This study

was an important first step in highlighting the importance of organizational culture on the disclosure of medication errors among nurses. However, the instruments used were developed and solely used in Chinese and focused entirely on medication administration errors and not all safety events.

In 2014, Italian researchers found that nurses' intention to report adverse drug reactions was significantly predicted by attitudes, subjective norms, and perceived behavioral control ($R^2=0.16$). The researchers also discovered that past reporting behaviors did not significantly influence the nurse's intention to report safety events in the future (DeAngelis et al., 2017). In the study, most of the variance in reporting intentions was explained by the subjective norms—highlighting that the attitudes and beliefs that colleagues have about reporting greatly influences the nurse. The items used to measure reporting intentions for the study were developed and tested in Italian and the instrument has not undergone extensive psychometric testing.

In 2015, a study exploring health professional students' safety reporting intentions was conducted with 65 participants in Australia (Lapkin et al., 2015). After conducting a thorough literature review, the research team collected data from 12 focus groups involving 68 participants. A thematic analysis of the data was conducted and used to develop the initial Theory of Planned Behaviour-Medication Safety Questionnaire (TPB-MSQ). The content validity of the instrument was tested by an expert panel of 14 researchers and interprofessional clinicians. Panel members judged each scenario using a 4-point Likert scale with responses ranging from irrelevant to highly relevant. Following this review, the expert panel eliminated 12 items and made appropriate revisions to the clinical scenarios presented. Ultimately, the TPB-MSQ consisted of four parallel, profession specific scenarios and 56 items focusing on attitude, perceived behavioral control, subjective norms, behavioral intentions, decision difficulty and

demographics. Based on the recommendations of Ajzen, seven-point rating scales were used for items involving predictor components on the scale. The four items focusing on intention were scored using binary response options (“yes” or “no”). Following the instrument’s development, the researchers examined the predictive utility of the tool to measure intentions as a proxy for actual behavior. The instrument was distributed to 65 participants in health care and found that attitude, subjective norm, and perceived behavioral control accounted for 46% of the variance in reporting intentions. Attitude was found to be the strongest predictor of intention behaviors accounting for over 32% of behavioral intentions ($P < .001$). Overall, the instrument was found to have a good internal consistency ($\alpha = 0.844$). While the tool has future promise to help predict reporting intentions among nurses, researchers concluded that additional testing with a larger sample size would be beneficial.

While the Theory of Planned Behavior was not directly identified, several international studies have explored the relationship between perceived safety culture and reporting intentions research among nurses (Chegini et al., 2020; Kim, 2010; Ko & Yu, 2017). In 2010, Kim developed a three-item scale to measure safety reporting intentions. Participants are asked to answer questions using a 10-point numerical rating scale ranging from zero (never) to 10 (always). The scale was subsequently tested and used in two Korean studies and demonstrated excellent internal reliability ($\alpha = 0.83-0.85$; Kim, 2010; Ko & Yu, 2017). Perceived patient safety culture was found to be a statistically significant predictor of reporting intentions for both studies.

Using the three-item developed by Kim and the SOPS™ Survey to measure patient safety culture, Iranian researchers further explored safety reporting intentions among 256 Emergency Department Nurses (Chegini et al., 2020). Data was analyzed using multiple linear regression

analysis and revealed a positive and significant relationship between patient safety culture and reporting intentions ($p < 0.05$). However, the three-item scale demonstrated weaker internal reliability in comparison to the reported psychometric results from similar Korean studies ($\alpha = 0.76$). The three-item reporting intentions scale developed by Kim was reviewed as a potential instrument to measure reporting intentions in this study. The scale was originally developed and tested among Korean nurses. The English translation of the items was reviewed and highlighted concerns regarding the instrument's ability to adequately measure the construct under investigation.

Chapter Two Summary

According to the most recent policy statement released by the American Academy of Pediatrics, in order to determine if one's workplace culture influences reporting behaviors and patient safety, rigorous research using valid and reliable tools is needed (Mueller et al., 2019). It is critical for stakeholders to encourage, persuade, and demand that health care leaders assess the culture within their organizations and strive to eliminate patient harm (Chassin & Loeb, 2013). This proposed study is an important and necessary first step. It is intended that the information gleaned from this study will provide organizational leaders with recommendations on how to promote healthy work environments and address barriers to safety event reporting.

CHAPTER 3

Methodology

Working from a postpositivist perspective, this cross-sectional, descriptive and correlational web-based study gathered data using an electronic survey. The survey measured pediatric staff nurses' perceptions on whether their unit functioned as a High Reliability Organization (HRO), their level of psychological safety and their personal intent to report safety events. This chapter presents the methodological details and research procedures germane to this study.

Sample and Sampling

The participants for this study were pediatric staff nurses and advanced practice nurses working in acute care hospitals across the United States. Using both nonprobability convenience sampling and network (snowball) sampling, 284 participants met eligibility criteria, consented to the protocol and completed the survey. Data collection for the survey took place over seven weeks, beginning on June 5th, 2020 and ending on July, 24th 2020.

Members of the Society of Pediatric Nurses (SPN) were sent three separate invitational emails. The email was also posted on the organization's discussion forum/blog. The content and language of the invitational email were provided by SPN and approved by the IRB at Boston College. SPN was asked to participate in the study as it has over 3,500 pediatric nurse members (Society of Pediatric Nurses, n.d.). The Society represents 28 pediatric specializations and provides members with educational resources, news and networking opportunities (Society of Pediatric Nurses, n.d.). Participants come from diverse professional backgrounds including Magnet[®] and non-Magnet[®] facilities as well as union and non-union organizations. It was originally estimated that of the 3,500 members, 1,200 serving as staff nurses would be eligible to

participate (A. Embury, personal communication, June 11th 2019). Access to the organization's 3,500 members was approved after a formal application was submitted to SPN's Clinical Practice and Research Committee. An average response rate for web-based surveys is 34% (Cook et al., 2000). It was originally anticipated that 408 SPN members would consent and participate in the study. In consultation with the biostatistician serving on the dissertation committee, it was determined that 186 participants would be required for adequate power to be achieved. Greater detail regarding the power analysis is provided in the latter half of this chapter.

The study protocol was also introduced to the National Pediatric Nurse Scientist Collaborative (NPNSC) in April 2020. NPNSC was established in 2012 and has 161 members. The goal of the collaborative is to promote and support nurse-led research across the country. After being reviewed by the NPNSC Advisory Committee, an overview of the study was distributed to the NPNSC email list-serv. In the email, NPNSC members were asked to connect with the principal investigator if their organization was interested in participating in the study. Two members of NPNSC connected with the principal investigator and agreed to widely distribute the survey to pediatric staff nurses in their respective organizations (Cook Children's Hospital and Seattle Children's Hospital).

In order to ensure that a large and diverse sample was ascertained, the principal investigator requested and received approval from the BC IRB to include network sampling in the recruitment plan. Following this approval, the dissertation committee distributed the survey invitation to professional contacts and networks during the third week of data collection. Each email recipient was reminded that participation was voluntary and that all responses would remain anonymous.

By using a multi-modal recruitment approach, the target enrollment goal was met by the seventh week of data collection (July 24th, 2020). The final sample size consisted of 284 participants.

Inclusion Criteria

1. The registered nurse was actively employed by an acute-care pediatric hospital on a per-diem, part-time or full-time status.
2. The registered nurse was willing and able to provide consent for the study.
3. The registered nurse provided direct patient care as either a staff nurse or advanced practice nurse (APRN).

Exclusion Criteria

1. Registered nurses who were hired on a contract or temporary basis by the participating institution.

Instruments

The survey administered comprised of four different instruments that measured the key research variables under investigation. The overall survey had a total of 42 items. The key variables and the corresponding tools used for measurement are listed in Table 1.

Table 1.*Instrument Overview*

Tool	Variable	Number of Items	Response Format	Reliability
Demographic Worksheet	Professional and Personal Background Information	23	Free-text, Multiple choice, Drop down	N/A
The Safety Organizing Scale (SOS)	HRO perception	9	Numerical response options from 1-7 using Likert- scale	$\alpha = 0.88$
Team Psychological Safety Scale (PSS)	Psychological Safety	7	5-point scale to measure frequency, ranges from never to always, Likert- scale	$\alpha = 0.77-0.82$
Reporting Intentions (ITR)	Intent to Report Future Safety Events	3	7-point scale ranging from (1) definitely will to (7) definitely won't, Likert- scale	$\alpha = 0.85^{*1}$
Total Number of Items for all tools combined		42		

Demographic Questionnaire

A demographic questionnaire collected background information regarding the participant.

Information included: 1) the participant's state of residency; 2) age; 3) ethnicity; 4) race; 5)

¹ *The reported reliability coefficient is based on the SOPS™ survey and past reporting behaviors. While the wording used on the ITR scale for this study is similar to the SOPS™, it aimed to explore reporting intentions and not past behaviors.

gender; 6) educational background; 7) years of professional practice and; 8) the average hours spent with patients on a weekly basis. In addition, the participant was asked to provide details regarding their experience at the workplace, including: 1) average nurse-to-patient ratio; 2) organizational type (e.g., free-standing hospital); 3) type of unit/specialty; 4) whether or not the organization had declared itself a “high reliability organization”; 5) the organization’s union status and; 6) Magnet[®] status. Four of the nursing characteristics asked about in the demographic questionnaire were used as covariates in the final linear regression models

Safety Organizing Scale

The nurse’s perception of whether or not they were working in a high reliability organization was measured using the Safety Organizing Scale (Vogus & Sutcliffe, 2007a). Permission to use the scale for the study was granted by the instrument developer (T. Vogus, personal communication, July 18th, 2019). The tool was developed in 2007 and is a unidimensional measure of safety-related behaviors in hospital settings. The nine-scale items are scored from not at all (1) to a very great extent (7). Survey items were developed based on the theoretical literature on HROs and reflect that safety performance can be established through five key processes: (1) a preoccupation with failure; (2) a reluctance to simplify; (3) a sensitivity to operations; (4) a commitment to resilience; and (5) a deference to expertise. Higher scores are reflective of a greater perception of working in a culture that emphasizes collective mindfulness and the HRO framework (Vogus & Sutcliffe, 2007a, 2012). The first two scale items assess the nurse’s perception of the unit’s preoccupation with failure. The third scale item assesses the nurse’s perception of the unit’s reluctance to simplify. The nurse’s perception of the unit’s sensitivity to operations is measured using items four and five on the scale. Items six and seven measure the nurse’s perception of the unit’s commitment to resilience and items eight and nine

measure their perception of the unit's deference to expertise. A final composite score is calculated after averaging all responses (T. Vogus, personal communication, October 15th, 2019). These five facets make up the individual's overall perception of working in a safety culture.

To establish content validity, the survey items were reviewed by seven experts in HROs (Vogus & Sutcliffe, 2007a). Researchers revealed a single underlying factor after conducting a confirmatory factor analysis (CFI=0.964, incremental fit index=0.964, root mean square error of approximation=0.055, standardized root mean square residual=0.033). Discriminant validity was established by conducting pair-wise tests of two other theoretically related constructs: employee commitment and trust in management (Vogus & Sutcliffe, 2007a). To establish criterion validity the scale developers hypothesized the following: (1) trust in management would be positively associated with the safety organizing scale score; (2) the number of patients assigned to each nurse would be negatively associated with the safety organizing scale score; (3) the safety organizing scale score would be negatively associated with reported medication errors; and (4) the safety organizing scale score would be negatively associated with number of patient falls (Vogus & Sutcliffe, 2007a). All four of these hypotheses were supported during the validation of the tool using the results from over 1685 nurses across thirteen hospitals ($P < .001$). The internal consistency (Cronbach's alpha) was determined to be 0.88 for the entire scale. Since the initial validation of the tool, several researchers have further tested its psychometric properties and have found the instrument to be both a valid and reliable scale to measure safety culture (Alsalem et al., 2018; Ausserhoffer et al., 2013).

Team Psychological Safety Scale

The Team Psychological Safety Scale was developed by Edmondson in 1999 to assess the social and organizational properties of hospital units. The scale consists of seven items which

are scored using a five-point scale with “1” = “Never” to “5” = “Always”. The final score is calculated based on the composite average from these seven items. The survey items were developed using the key findings drawn from a mixed-methods study conducted by Edmondson in 1999. Edmondson interviewed seventeen members from eight different manufacturing teams to develop survey items that reflect the breadth of content that define the construct under investigation—Team Psychological Safety (Edmondson, 1999). Following the instrument’s development, 427 members from 51 different teams completed the survey and additional psychometric testing was conducted (Edmondson, 1999). The seven original survey items all positively contributed to a strong internal reliability ($\alpha = .82$). Through a factor analysis using principal components and varimax rotation, discriminant validity was established. During this analysis, Edmondson found that items for the team learning behavior and team psychological safety surveys distinctly loaded as two separate factors (Edmondson, 1999).

Since its original development, subsequent psychometric testing has supported the reliability and validity of the scale. Past research has shown that psychological safety is significantly and positively correlated with high-quality relationships ($r=.63$; $P<.001$) while also demonstrating high internal consistency (Carmeli & Gittell, 2009). In 2014, researchers at the Virginia Commonwealth University School of Medicine, performed a principal components analysis with varimax rotation. The factor analysis supported a one-factor solution, with factor loadings ranging from 0.33 to 0.76. This result supports the argument that the scale measures a unidimensional psychological safety construct and lends support to the use of a single scale score for measuring levels of this construct (Applebaum et al., 2016). Prior to this study, psychological safety had never been explored among pediatric nurses. However, previous research has demonstrated that psychological safety can predict safety reporting intentions

among medical residents and registered nurses working with the adult population (Applebaum et al., 2016; Derickson et al., 2015).

Intention to Report Safety Events Scale

One of the most well-known instruments that measures patient safety is the “Hospital Survey on Patient Safety” (SOPS™) developed by the Agency for Healthcare Research and Quality (AHRQ). The instrument was first released in 2004 and is designed to specifically ask staff about the existing culture of safety within their hospital (Sorra et al., 2018). The instrument was developed by researchers at AHRQ following a comprehensive literature review and evaluation of existing instruments (Sorra & Dyer, 2010). From the review, key dimensions of patient safety culture were identified and items were developed and tested by researchers and hospital administrators. In 2003, 21 hospitals across six states pilot-tested the instrument. The pilot study’s psychometric results were reviewed and several items were eventually dropped.

The final instrument consisted of 42 items that are grouped into 12 composite measures and was tested using data from 50,513 participants across 331 hospitals (Sorra & Dyer, 2010). For this study, only one composite measure from the SOPS™ Survey Version 1.0 was used. The composite, “Frequency of events reported” consists of three items in the survey and asks the participant about the frequency of reporting past mistakes that are: (1) caught and corrected before reaching the patient; (2) reach the patient but do not cause harm; and (3) reach the patient and could potentially cause harm. Response options include: (1) never; (2) rarely; (3) sometimes; (4) most of the time; and (5) always. The Cronbach’s alpha was .85 for this composite (Sorra & Dyer, 2010).

For use in this study, slight changes were made to the original three items to capture the participant’s likelihood to report a future safety event instead of the participant’s actual past

reporting behaviors. The original three items were adapted using the theory of planned behavior as a theoretical guide (Fishbein & Ajzen, 2010). According to the theory, the most sensitive approach to exploring intentions is done by using a 7-point bipolar scale. Participants were asked to select the number that best described the response they would most likely take. Response options ranged from “1” (definitely will) through “7” (definitely won’t). Previous studies that have explored safety reporting intentions among medical residents have demonstrated high internal consistency ($\alpha=0.72$) (Applebaum et al., 2016). Exploratory psychometric testing on this scale was conducted and findings are discussed in Chapters Four and Five.

Procedures

Participant Recruitment

Prior to recruitment, this study was reviewed and approved by the Boston College Institutional Review Board (IRB). Participants were recruited using both convenience sampling and network sampling. Both SPN and NPNSC reviewed and approved the study before distributing the research details and study link to members. In an effort to improve participant response rates and ensure a robust and diverse sample size was met, the invitational email was also forwarded to professional contacts by committee members. All participants were reminded that their responses would remain anonymous.

Data Collection

A modified Dillman approach was used to maximize the participant response rate (Dillman et al., 2009). During week two and week three, reminder emails were sent to SPN members. The survey invitation was only sent to NPNSC members once. After receiving IRB approval to incorporate network sampling into the research design, committee members were also approved to forward the invitational email to professional colleagues. Prior to starting the

survey, participants were asked to read and electronically consent to the study. The contact information for the principal investigator and dissertation chairperson was provided so that participants could make outreach with questions, issues and concerns. After consenting, participants completed an electronic survey using Qualtrics®. Qualtrics® is a web-based data management system that is widely used by researchers across the globe (Boston College, 2018; Qualtrics, 2019). The email sent to participants also had the URL survey link that could be copied and pasted into a web browser should the embedded link not work directly. The data collection period lasted a total of seven weeks.

At the end of the survey, participants were asked if they were interested in submitting their contact information for a raffle draw. The collected names of interested participants were pooled and five were randomly selected to receive a \$50 gift card to Amazon. Copies of the invitational emails, reminder emails, the consent form and survey can be found in the Appendix.

Data Management Plan

The collected survey responses were automatically deidentified through Qualtrics® to maintain confidentiality. Collected data was then be downloaded as an “sav.” file and analyzed using the Statistical Package for the Social Sciences (SPSS®).

Data Analysis

Data was collected using Qualtrics® and then exported to Statistical Package for the Social Sciences (SPSS) for further analysis using Windows 10 and SPSS version 27. SPSS was first released in 1968 and continues to be one of the most widely used statistical analysis programs in social science research. Descriptive statistics (mean, standard deviation, range, frequency) was conducted to examine the characteristics of research participants, to identify general trends, to confirm normality and identify outliers. Each survey was also reviewed for

missing data. It was anticipated that the amount of missing data would be low for this study (less than 5%) and that listwise deletion could be used (Graham, 2009). Ultimately, this strategy was able to be used as the total missing data was less than 4%.

Power Analysis

In this study, the unit of analysis consisted of individual nurses who are employed by various pediatric acute care settings across the United States. To ensure methodological rigor, a power analysis was calculated using a conservative approach. The power analysis was calculated using an F-test in G-Power with power set at 85%, the level of significance set at 0.05, and assuming a small-to-medium effect size of 0.08. The power analysis indicated that a sample of 186 participants was necessary (Table 2).

Past research has revealed that e-mail response rates may only approximate 25% to 30% without follow-up and additional reinforcements (Fincham, 2008). In order to ensure an adequate sample size, the PI sent the invitational email to all eligible 1200 SPN members and the 161 members in NPNSC. Given that the analyses remained consistent for all four hypotheses, only one power analysis was conducted.

Table 2

Required Sample Size Based on Effect Size and Power

Effect Size	Power	Sample Size
0.02	0.80	647
0.02	0.90	830
0.08	0.80	166
0.08	0.85	186
0.08	0.90	212
0.15	0.80	92
0.15	0.90	116

Research Questions and Modeling

Hypothesis 1a, 1b and 1c were tested using a two-part model. Hypothesis 1a stated that when psychological safety (PS) scores increase, the intent to report safety events (ITR) scores would also increase. Hypothesis 1b stated that pediatric nurses who have higher HRO perception scores would have higher intent to report safety event (ITR) scores than those who had lower HRO perception scores. Hypothesis 1c stated that the combined effects of psychological safety (PS) and perception of working in an HRO would result in higher intent to report safety event scores (ITR) among pediatric nurses.

A non-normal distribution was observed in review of the ITR scores. As a result of this finding, a two-part statistical model was fit using logistic regression and linear regression. This step was employed to see if there were differences between the full sample (N=244) and participants who had scored below a 7 on the scale (n=165). The ITR scores for the 165 participants scoring below a 7 had a distribution that while skewed was closer to normal than the results for the full sample. All statistical models were then performed for both the complete dataset (N=244) and the subsample with a more normal distribution of scores (n=165).

For all three hypotheses, the outcome variable remained the same (ITR scores). The predictor variables were PS scores, HRO scores and the combined effect of PS and HRO scores. In addition, four other covariates from the demographic questionnaire were used to control for outcome effects (years of nursing experience, unit type, Magnet[®] designation, HRO status). A relationship between the predictor and the response variables were concluded if significance was less than 0.05. The parameter estimates provided details regarding the estimates of magnitude, direction and order of the effects. Multicollinearity was checked by screening for inflated standard errors and variance inflation scores (VIF) above 2.

Figure 2*Combined Linear Regression Model for H1a, H1b, H1c*

$$\hat{Y}(HTR) = \beta_0 + \beta_1(PS) + \beta_2(HRO) + \beta_3(PS * HRO) + \beta_4(YEARSRN) + \beta_5(UNITTYPE) + \beta_6(MAGNETSTATUS) + \beta_7(HROSTATUS)$$

Hypothesis 2a stated that pediatric nurses who perceive themselves as working in an HRO setting (higher SOS scores) would have higher psychological safety (PS) scores. The outcome variable was actual PS scores. Predictor variables included HRO scores and the four demographic covariates in a linear regression model. A relationship between the predictor and the response variable would be concluded if significance was less than 0.05. All model assumptions were verified through an examination of the residuals. During data analysis, it was determined that no assumptions had been violated.

Figure 3*Linear Regression Model for H2a*

$$\hat{Y}(PS) = \beta_0 + \beta_1(HRO) + \beta_2(YEARSRN) + \beta_3(UNITTYPE) + \beta_4(MAGNETSTATUS) + \beta_5(HROSTATUS)$$

Control Variables

Four variables from the demographic questionnaire were used in the multiple linear regression models: (a) Years of nursing experience; (b) Unit type; (c) Magnet[®] designation; and (d) HRO Status. These four variables were selected based on past research supporting their effect on organizational perception and reporting behaviors (Anderson et al., 2018; Chassin & Loeb,

2013; Toruner & Uysal, 2012). The supporting literature supporting their inclusion in the statistical models is provided in Chapter Two.

Data Management Plan

Participants were asked to complete the electronic survey using Qualtrics®. The collected survey responses were automatically de-identified through Qualtrics® to maintain confidentiality. Collected data was then downloaded as an “sav.” file and analyzed using the Statistical Package for the Social Sciences (SPSS®).

IRB Approval

Protection of Human Subjects

Prior to initiating the survey, eligible participants were asked to review and submit an electronic informed consent form. Careful and diligent effort was taken to protect the confidentiality of nurse participants in this study. These steps were taken to reduce the study risks for participation as much as possible. The risk for participation was considered to be minimal. The contact information for the principal investigator, dissertation chairperson, and the Boston College IRB was provided in the consent form. All participants were informed that there was likely no direct benefit from participating in the study and that they could stop at any point in time during the data collection process. Participants were notified that survey results would likely be used for the publication and dissemination of study findings, but potentially identifying details will not be disclosed.

Given the busy nature of the acute care setting, the principal investigator took the necessary steps to reduce the time burden for participants. The survey was anticipated to take less than 15 minutes and was pilot-tested with 15 graduate nursing students at the Connell School of Nursing at Boston College in November and December of 2019. Following the pilot

testing, only minor revisions were made to the wording of the survey. Participants were also able to save their responses and return to the survey at a later time point if necessary. Ultimately, the average response time to complete the 42-item survey for the final sample was 11 minutes.

At the end of the survey, participants were asked if they were interested in submitting their name and email address into a raffle for a chance to win a \$50 Amazon gift card. In total, there were five randomly-selected winners. The collected names of participants were not linked to their survey data. Raffle participants were assigned a random number through a random number generator website. A second random generator website was then used to randomly select the five participants who won a prize. Winners were contacted via email by the principal investigator.

Summary

Chapter Three has provided a detailed overview of the methodology used for this study. Information regarding the design, sample, instruments, data management plan, ethical considerations and analytical approach used to answer the research questions in Chapter One was described. The results of the data analyses are presented in Chapter Four.

CHAPTER 4

Results

This chapter presents the results detailed in Chapter Three. The chapter begins with a description of the sample, including the overall response rate, missing data and participant characteristics. Next, the descriptive statistics for the variables are presented followed by analyses for each of the research questions.

Sample Size, Response Rate and Missing Data

The survey data was downloaded from Qualtrics® and entered into SPSS® (V.27). It was estimated that 1,200 of the 3,500 SPN members who received the survey invitation would be eligible to participate. An invitation to the survey was also emailed to 1,500 nurses at Cook Children's Hospital in Texas and approximately 2,200 nurses at Seattle Children's Hospital in Washington. It is important to note that many individuals on the email distribution lists were likely ineligible for the study based on the outlined criteria; and as a result, snowball sampling was indicated. As such, an accurate response rate cannot be reported for this study. Of the nurses who received the survey, 284 met the screening eligibility criteria.

A missing value analysis was conducted for the 284 participants. In total, 3.3% of all data were missing across all cases and variables (96.7% completion per case). For 24 cases, 5% or more of the participant's survey data was missing. In compliance with the research proposal, these 24 cases were excluded from review using listwise deletion. The remaining 260 cases were carefully analyzed and particular attention was paid to the predictor and outcome variables being used in the statistical models. Of the 260 cases, 16 had missing data for one of the predictor or outcome variables and were subsequently deemed ineligible for further analytic inclusion. Following this step, the remaining 244 cases were evaluated and of those 15 had missing data.

However, for each of these cases only one variable was missing and none were being directly used in any of the planned linear regression models. Of the 15 cases, 9 had not provided a response to the number of patients he/she is typically assigned per shift. Ultimately, it was decided that it was in the study's best interest to keep these 9 cases in the final analysis as this item was likely left unanswered because it was not applicable to the participant's current role. The remaining 6 cases with missing data were also closely reviewed and deemed appropriate for analytic inclusion as each only had left one survey item unanswered and no clear pattern could be determined why. Ultimately, the final sample consisted of 244 participants.

Sample Characteristics

The 244 nurse participants came from 28 states. A large number of participants reported living in Texas ($n=96$, 39.3%), Washington ($n=61$, 25%), Massachusetts ($n=24$, 9.8%) and California ($n=12$, 4.9%). In total, the data collected from these four states made up 79% of the cumulative response set. Nurses ranged in age from 22 years old to 75 years old. The mean age of the participant was 37.78 years old. The majority of nurses (96.7%) identified as non-Hispanic and non-Latino. The majority of nurse participants (90.6%) self-identified as White. The remaining participants identified as Asian (2.5%), Black or African American (0.4%), Two or more races (4.9%), Other (0.8%) or preferred not to answer (0.8%).

Of the 244 nurses, 233 (95.5%) identified as female, 10 (4.1%) identified as male and 1 (0.4%) identified as gender non-conforming/gender queer. The average number of years working as an RN was 12.56 (SD=11.11 years). Years of nursing experience ranged from 1 to 53 years. This finding was found to have a non-normal distribution pattern with scores slightly skewed to the right. The median was 8.5 years of professional nursing experience. Years of pediatric nursing experience ranged from 1-51 years with a mean of 11.36 (SD=10.430) and median of 8

years. The results revealed that participants were well-educated: 5 (2.0%) had a diploma in nursing, 11 (4.5%) had an associate degree in nursing, 158 (64.8%) had a bachelor's degree in nursing, 57 (23.4%) had a master's degree in nursing, 5 (2.0%) had a PhD in nursing, 6 (2.5%) had a doctorate of nursing practice (DNP), and 2 (0.8%) reported a degree not provided on the list of options. Of those with graduate degrees ($n=70$), 30 (42.85%) reported being an advanced practice nurse (APRN). Of the 30 APRNs, 23 (76.66%) were certified nurse practitioners, 2 (6.66%) were certified registered nurse anesthetists and 5 (16.66%) were clinical nurse specialists.

The number of years that participants had been working in their current hospital ranged from 1-42 with a mean of 9.2 ($SD=8.905$) and median of 5.50 years. Fifty percent of the 244 participants had been working in their current hospital for five years or less. Participants were asked about how long they had worked on their current nursing unit and responses ranged from 1-37 years with an average of 6.73 ($SD=7.250$) and a median of 4 years. Table 3 provides the descriptive statistics in relation to years of nursing experience.

When asked about the average number of hours spent each week performing direct patient care, responses ranged from 2-40, with an average of 31 hours. Participants were also asked about the average number of patients assigned to them each shift and responses ranged from 1-25 with a mean of 4.4 ($SD=4.12$). Participants were asked about whether or not they had provided direct-care to patients with suspected or confirmed COVID-19 and 131 (53.7%) responded yes, 94 (38.5%) responded no, 18 (7.4%) were not sure and 1 (0.4%) preferred not to answer.

Table 3*Experience Descriptive Statistics*

	Years of Nursing Experience	Years as Pediatric RN	Years at Current Hospital	Years on Current Unit
Mean	12.5615	11.36	9.20	6.73
Median	8.5000	8.00	5.50	4.00
Std. Deviation	11.11409	10.430	8.905	7.250
Range	52.00	50	42	36
Minimum	1.00	1	1	1
Maximum	53.00	51	43	37

Organization and Unit Details

Of the 244 participants, 197 (80.7%) worked in free-standing pediatric hospitals and clinics, 32 (13.1%) worked on a pediatric unit within an adult hospital or clinic, 10 (4.1%) worked in a setting that combined pediatric and adult care and 5 (2.0%) selected “other” as their response choice. Participants were asked about their unit type and to choose from the following seven response options: (1) Medical/Surgical; (2) Intensive Care; (3) Operating Room; (4) Emergency Department; (5) Specialty; (6) Other; and (7) Psychiatry/Behavioral Health. Seventy-one participants (29.1%) reported working on a Medical/Surgical Unit, 46 (18.9%) in Intensive Care, 4 (1.6%) in the Operating Room, 18 (7.4%) in the Emergency Department, 31 (12.7%) in a Specialty Unit, 68 (27.4) selected Other, and 6 (2.5%) in a Psychiatry/Behavioral Health Setting.

The responses for the 68 participants who selected “Other” were reviewed. One participant selected “Other” but did not provide further detail in the optional free-text field. In order to ensure all unit categories contained a sufficient number of values to produce meaningful

results, the “Other” category and “Specialty Unit” were merged together. The existing data from these two categories were collapsed into the recoded unit category, “Specialty Unit and Other”.

Additionally, during the review of narrative responses, the name for one of the response options changed from “Operating Room” to “Operating/Procedural Setting—including pre-op, PACU and recovery units”. The retitling of this variable was to ensure that the label captured the full breadth of responses. For the remaining 67 participants, responses were recoded based on the six response options and in review of any details provided in the free-text field. The final breakdown is provided in Table 4.

Table 4

Unit Type

	Frequency	Percent	Cumulative Percent
Medical / Surgical	72	29.5%	29.5%
Intensive Care	51	20.9%	50.4%
Operating / Procedural Setting - including pre-op, PACU and recovery units	17	7.0%	57.4%
Emergency Department	18	7.4%	64.8%
Specialty Unit and Other	80	32.8%	97.5%
Psychiatry / Behavioral Health	6	2.5%	100.0%
Total	244	100.0%	

Union, Magnet[®] and High Reliability Organization (HRO) Status

Participants were asked about whether or not professional nurses were unionized within their organization and 73 (29.9%) reported yes, 150 (61.5%) reported no, 20 (8.2%) were not sure, and 1 (0.4%) did not provide a response. Both Magnet[®] designation and HRO status were tested as predictors in the final models. Of the 244 participants, 216 (88.5%) reported as working in an organization with Magnet[®] designation, 13 (5.3%) worked in a non-Magnet[®] setting, 10 (4.1%) in an organization working towards Magnet[®] designation and 5 (2.0%) were unsure. Participants were asked about whether or not their organization was considered an HRO, 110 (45.1%) responded yes, 2 (0.8%) responded no, 2 (0.8%) responded that they were working towards it, and 130 (53.3%) were unsure.

During the preliminary review of the data, it was revealed that for some predictor groups, there were less than 20 cases. According to Polit (2010), “the stability of the estimates declines when the sample size is inadequate in relation to the number of predictors” (p. 324). To ensure that each group had a sufficient number of cases to achieve stability, the four response groups for the HRO status variable were collapsed into two. Participants who answered that they worked in an organization that declared itself as an HRO or was working to become an HRO were regrouped together. Participants who answered that their organization was not an HRO or they were unsure about the status formed group two. The frequency and percent for both groups are displayed in Table 5.

Table 5

Organization HRO Status

	Frequency	Percent	Valid Percent	Cumulative Percent
Yes or Working Towards It	112	45.9%	45.9%	45.9%
No or Unsure	132	54.1%	54.1%	100.0%
Total	244	100.0%	100.0%	

Survey Descriptive Statistics

The data from the three survey instruments used in this study were analyzed using descriptive statistics. An overview of the findings for each survey's evaluation is described in the narrative below.

Safety Organizing Scale

The responses for all nine items in the Safety Organizing Scale were totaled and then averaged to provide the final composite score for each participant. Scores ranged from 2.67 to 7.0, with a mean of 5.48 (SD=.90). Internal consistency was measured using Cronbach's alpha and was .853. The scale results were checked for outliers and normality through the creation of a histogram, a boxplot and a kurtosis calculation. All items were above 0.3 for the corrected item-total correlation supporting internal reliability for the scale. Four cases that were deemed outliers due to lower Safety Organizing Scale scores but all were retained as during a review of these four survey responses, no concerning or inconsistent trends were identified. Details regarding the item means and standard deviations are presented in Table 6.

Table 6

Items on Safety Organizing Scale

Item	N	Mean	Std. Deviation
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When giving report to another employee, we usually discuss what to look out for:	244	6.02	1.020
We spend time identifying activities we do not want to go wrong:	244	5.38	1.384
We discuss alternatives as to how to go about our normal work activities:	244	4.89	1.570
We have a good understanding of each other's talents and skills:	244	5.75	1.103
We discuss our unique skills with each other so we know who on the unit has relevant specialized skills and knowledge:	244	4.92	1.579
We talk about mistakes and ways to learn from them:	244	5.22	1.370
When errors happen, we discuss how we could have prevented them:	244	5.53	1.398
When attempting to resolve a problem, we take advantage of the unique skills of our colleagues:	244	5.51	1.316
When a patient crisis occurs, we rapidly pool our collective expertise to attempt to resolve it:	244	6.11	1.102
Valid N (listwise)	244		

Team Psychological Safety Scale

The responses for the items on the Team Psychological Safety Scale were summed after reverse coding for the “negatively phrased” items. Once all items were directionally consistent and totaled, each score was divided by 7 (the number of scale items) to provide the participant’s final composite score. Item scores ranged from 2-5, with a mean composite score of 3.78 (SD=0.50).

Internal consistency was measured using Cronbach’s alpha and was .622. While the Cronbach’s alpha’s result was less than ideal, all original scale items were retained as the tool has been widely tested and used across a number of settings and populations. The scale results were checked for outliers and normality through the creation of a histogram, a boxplot and a kurtosis calculation. All confirmed that the scale followed a normal distribution. The boxplot did

reveal one outlier—but after reviewing the full response—the data were retained as the participant provided consistent responses throughout.

Intention to Report Safety Events Scale (ITR)

The responses for the three items in this scale were recoded to reflect that higher scores represented higher reporting intentions. Following this computation, each participant's score was summed and then averaged. Scores ranged from 1 to 7, with a mean of 5.94 (SD=1.24) and a median of 6. Internal consistency was measured using Cronbach's alpha and was .852. The scale results were checked for outliers and normality through the creation of a histogram, a boxplot and a kurtosis calculation. The findings suggested that the distribution of scores was highly skewed to the left. The results also confirmed that kurtosis was present with a calculation of 2.5. Ten cases were identified as being outliers but in close review of each participant's data set, these responses were retained. In further review of the dataset, 79 (32.4%) of the 244 participants had a score of 7, which was the highest achievable score. Descriptive statistics for the three items are displayed in Table 7.

Table 7

Descriptive Statistics for The Intention to Report Safety Events Scale (ITR)

		Item 1	Item 2	Item 3
N	Valid	244	244	244
	Missing	0	0	0
Mean		5.6721	5.8361	6.3197
Median		6.0000	6.0000	7.0000
Std. Deviation		1.56054	1.42500	1.24898
Range		6.00	6.00	6.00
Minimum		1.00	1.00	1.00
Maximum		7.00	7.00	7.00

The Intention to Report Safety Events Scale (ITR) demonstrated acceptable item-total correlations. The exploratory psychometric analysis also supports that all three items contributed to the overall reliability of the scale (Table 8). The Kaiser-Meyer-Olkin Measure of Sampling Adequacy (MSA) and Bartlett's test of sphericity were performed to assess appropriateness for a future exploratory factor analysis. The MSA was .711 and the Bartlett's test of sphericity was less than 0.05.

Table 8

Item Analysis for Intention to Report Safety Events Scale (ITR)

	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
If I make a mistake, that is caught and corrected before affecting the patient, I will report it	.706	.517	.819
If I make a mistake, but it poses no potential harm to the patient, I will report it	.789	.623	.729
If I make a mistake, that could have harmed a patient, but ultimately does not, I will report it	.694	.508	.826

Major Study Findings

The statistical results for the two research questions and their corresponding hypotheses are described below.

Research Question One

The aim of the first research question was to explore whether a pediatric nurses' intent to report a safety event is influenced by either their level of psychological safety, perception of working in an HRO or a combination of both. The question consisted of three hypotheses that were each tested using a two-part model. As aforementioned in Chapter 3, the results from the

(Intercept)	-1.101	.2141	-1.521	-.682	26.450	1	.000
Years of RN experience	.028	.0121	.004	.052	5.327	1	.021

Dependent Variable: Intention to Report

Model: (Intercept), Years of RN experience

Hypothesis 1A

A second dataset ($n=165$) was created after the removal of the 79 cases with Intention to Report scores of 7. A linear regression model using the original predictor variables and four covariates was performed on the data from the 165 participants who scored below 7 on the Intention to Report Safety Events Scale. Hypothesis 1A stated that pediatric nurses who had high levels of psychological safety, would have higher Intention to Report scores than nurses who had lower levels of psychological safety. The null hypothesis for 1A was rejected ($p<0.01$). The results are shown in Table 10. Collinearity statistics presented no concerns as the variance inflation factor (VIF) was less than 2 for each variable. The findings revealed a positive statistically significant relationship between psychological safety scores and Intention to Report scores ($p<0.01$; $\beta=0.274$). For every one-point increase in psychological safety scores, the Intention to Report score increased by .703 points.

In order to explore potential differences in reporting intentions across specialty units, dummy variables were created (with medical surgical unit serving as the constant/reference variable). The final model was statistically significant and showed that nurses working in a specialty unit had lower Intention to Report scores when compared to nurses working on a medical surgical unit ($p<0.05$; $\beta=-0.199$). As a robustness check, the models described above

were run with the full dataset (N=244) and all of the same statistically significant results were found ($p < 0.05$). These results are shown in Table 11.

Table 10

Coefficients- Dependent Variable (ITR Mean Score) for 165 Participants

Coefficients - Dependent Variable: ITR Mean Score

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	3.011	0.829		3.63	0
Magnet Status	-0.296	0.369	-0.063	-0.801	0.425
ICU Unit	-0.041	0.264	-0.014	-0.157	0.876
OR Unit	0.066	0.411	0.013	0.16	0.873
ED Unit	0.022	0.422	0.004	0.051	0.959
Specialty Unit	-0.513	0.242	-0.199	-2.119	0.036
Psych Unit	0.049	0.564	0.007	0.087	0.931
SOS Score	0.055	0.136	0.037	0.401	0.689
HRO Status	0.032	0.191	0.013	0.169	0.866
Years RN Experience	-0.006	0.009	-0.053	-0.653	0.515
PS Score	0.703	0.233	0.274	3.016	0.003

Table 11

Coefficients- Dependent Variable (ITR Mean Score) for 244 Participants

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	3.752	0.679		5.524	0.000
Magnet Status	-0.150	0.304	-0.032	-0.494	0.621
HRO Status	0.111	0.159	0.044	0.698	0.486
ICU Unit	-0.253	0.226	-0.083	-1.122	0.263
OR Unit	-0.086	0.332	-0.018	-0.258	0.797
ER Unit	0.057	0.322	0.012	0.178	0.859
Specialty Unit	-0.496	0.198	-0.187	-2.503	0.013
Psych Unit	-0.317	0.517	-0.039	-0.612	0.541
SOS Score	0.176	0.101	0.128	1.743	0.083
Years RN Experience	0.002	0.007	0.020	0.304	0.761
PS Mean Score	0.399	0.181	0.161	2.209	0.028

Hypothesis 1B

Hypothesis 1B stated that pediatric nurses who perceive themselves as working in an HRO, will have higher Intention to Report scores than nurses who do not perceive themselves to work in an HRO. The null hypothesis for 1B was rejected ($p=0.034$; $\beta=0.196$) and found that the SOS score was only statistically significant when the PS scores were not included in the model. A tolerance test was performed and showed no evidence of multicollinearity ($VIF=1.024$). When the Team PS scale was removed from the model, the only statistically significant predictor variable was one's SOS scores—suggesting that the two instruments were potentially sharing a degree of information. To confirm the validity of these results, the model was rerun with the data

collected from the original 244 participants and revealed a statistically significant relationship between SOS scores and Intention to Report Scores ($p < 0.01$). These findings are shown in Table 12.

Table 12

Linear Regression Model for HRO Perception and ITR Among 165 Participants

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intercept	3.903	1.294	3.016	.003	1.347	6.460
HRO Status	-.112	.194	-.575	.566	-.495	.272
Magnet Status	.129	.374	.345	.731	-.611	.869
ICU Unit	.061	.271	.225	.823	-.474	.595
OR Unit	.093	.418	.222	.825	-.733	.918
ED Unit	-.078	.432	-.181	.857	-.932	.776
Specialty Unit	.466	.248	1.881	.062	-.023	.955
Psych Unit	-.045	.579	-.078	.938	-1.188	1.098
SOS Mean score	.259	.121	2.137	.034	.020	.498
Years RN Experience	-.011	.009	-1.179	.240	-.029	.007

Hypothesis 1C

Hypothesis 1C stated that the combined effects of psychological safety and perception of working in an HRO would result in higher Intention to Report scores among pediatric nurses. The null hypothesis could not be rejected for Hypothesis 1C. The results from Hypothesis 1C were mixed. As the summary of findings for Hypothesis 1B shows, the SOS tool was only statistically significant when other variables weren't accounted for. Once the Team Psychological Safety Scale was added to the model, the Safety Organizing Scale was no longer statistically significant ($p=0.08$)—suggesting that the two scales likely share some degree of information with each other.

Research Question Two

The aim of the second research question was to evaluate if the psychological safety level of pediatric nurses was related to their perception of whether or not they worked in an organization that encompassed or aspired to implement HRO principles. The corresponding hypothesis for this research question is restated below and was tested using a linear regression model.

Hypothesis 2A

Hypothesis 2a stated that pediatric nurses who perceive themselves as working in an HRO setting will have higher psychological safety scores than those who do not perceive themselves as working in an HRO. The second research question consisting of one hypothesis was tested using the Pearson product-moment correlation coefficient. The bivariate correlation statistic revealed a positive and moderately strong relationship that was statistically significant ($p<0.001$; $r=0.470$). To confirm results, the full model ($N=244$) was retested and revealed statistically similar findings ($p<0.001$; $r=0.465$).

Additional Study Findings

During data analysis, an additional statistical test was performed to explore whether or not an organization's HRO status influenced one's HRO perception. These two variables were tested using a linear regression model in SPSS. The model demonstrated that the HRO's declared status did not have a statistically significant relationship with one's HRO perception (Table 13).

Table 13

Parameter Estimates for 165 Participants in HRO and SOS Scores

Parameter Estimates (N=165) Working in HRO Declared Organization and Safety Organizing Scale Scores

Parameter	B	Std. Error	95% Wald Confidence Interval		Hypothesis Test		
			Lower	Upper	Wald Chi-Square	df	Sig.
(Intercept)	5.436	.0781	5.283	5.589	4841.422	1	.000
Yes for HRO Status	.097	.1153	-.129	.323	.703	1	.402
(Scale)	.806 ^b	.0729	.675	.962			

Dependent Variable: SOS Mean Score

Model: (Intercept), HRO Groups

b. Maximum likelihood estimate.

Chapter Four Summary

Chapter four presented the descriptive and inferential statistical findings for this study. The null hypothesis was rejected for three of the four hypotheses. The statistical models revealed that both psychological safety and HRO perception influences the pediatric nurse's likelihood to report a safety event. The analyses also suggest that years of nursing experience and unit type may also play a role in one's reporting intentions. Lastly, the study revealed a positive and statistically significant relationship between one's measured psychological safety and their

perception of whether or not their workplace operates as an HRO. The following chapter will provide a detailed interpretation of these findings.

CHAPTER 5

Discussion

This study was one of the first to measure the constructs of psychological safety and high reliability (HRO) perception using both the Team Psychological Safety Scale and Safety Organizing Scale. Moreover, it is the first study to this investigator's knowledge to explore how these constructs relate to safety reporting intentions among pediatric nurses. This chapter presents a detailed discussion of the study findings, implications, limitations and future directions for research, education, practice and policy.

Interpretation of Descriptive Statistics

Sample Characteristics

Several individual-level nurse characteristics that provide context for interpreting the results are discussed here. The demographic data collected from the sample were compared to the national health workforce analysis data conducted by the Health Resources and Services Administration (HRSA) in 2018 and the National Council of State Boards of Nursing (NCSBN) in 2017 (National Center for Health Workforce Analysis, 2019; Smiley et al., 2018). According to these two analyses, there are 3,272,872 registered nurses who are actively working in the United States. The average age of the nurse stated in these two reports was between 47.9-51 years old respectively (National Center for Health Workforce Analysis, 2019; Smiley et al., 2018). The average age of the nurse in this study was 37.78 years old, being a decade younger than the benchmark reports.

According to the HRSA and NCSBN analyses, the following estimates represented the racial and ethnic makeup of the nursing workforce: 1.) 81% of nurses identify as White/Caucasian; 2.) 5%-10.2% identify as Hispanic or Latino; 3.) 5.2%-7.5% identify as Asian;

4.) 6.2%-7.8% identify as Black/African American; 5.) 2.9% identity as other; and 6.) 1.7% identify with two or more races. Males accounted for approximately 9.1%- 9.6% of today's nursing workforce (National Center for Health Workforce Analysis, 2019; Smiley, 2018). In comparison to the larger nursing workforce, the demographic findings from this study suggested that those who identify as male, Black/African American or Asian have been underrepresented in the sample.

According to the 2018 HRSA report, in terms of highest educational nursing degree reported by registered nurses was: 1.) 6.8% have a diploma; 2.) 29.6% have an associate's degree; 3.) 44.6% have a bachelor's degree; and 4.) 19.3% have a graduate degree. In comparison, participants from this study were more highly educated and more likely to hold a bachelor's degree (64.8%) and graduate degree (28.7%). The national average for years of nursing experience was 18.9 (National Center for Health Workforce Analysis, 2019). Participants from this study were generally less experienced and on average had worked for 12.56 years. It is important to note that while these analyses provided an overview on the full nursing workforce, they did not provide specialty-specific details. Thus, for all of the findings mentioned above, it remains unclear how participants in this study compared to the U.S. pediatric nursing population.

Organization and Unit Details

There is a dearth of descriptive and demographic data for pediatric nurses working in the acute inpatient setting. Thus, it is unknown if certain organization or unit types were over- or underrepresented in this study. Interestingly, when asked to identify their unit type, a large number of participants (27.4%) selected "Other" and then typed their own description using free-text rather than quickly choosing a unit description from the available and likely appropriate

dropdown options. This finding perhaps highlights that nurses wanted to honor the uniqueness of their unit and may have been uncomfortable assigning it to a broader specialty group that would not fully capture its rich cultural properties. In order to strengthen our appreciation on how unit affiliation may influence individual and collective attitudes and reporting behaviors, future research across a variety of pediatric organizations would be useful in helping understand the influence that unit affiliation and culture may have on individual and group responses.

Magnet[®] and High Reliability Organization (HRO) Status

There are currently 220 pediatric health care organizations in the United States and 96 of these (43%) have achieved ANCC Magnet[®] designation (Children's Hospital Association, 2022). A large majority of participants in this study reported working in a pediatric Magnet[®] organization (88.5%). This finding suggested that nurses working in Magnet[®] organizations were overrepresented in this study when compared to all nurses working in pediatric facilities. Numerous studies have shown the positive impact that Magnet[®] designation status has on patient outcomes, workplace perception, and staff retention (Anderson, et al., 2018; McHugh et al., 2013; Petit & Regnaud, 2015). Given the Magnet[®] model's emphasis on patient safety and nursing excellence, study participants may have demonstrated higher scores than what would be found among the complete nurse population.

While the Joint Commission and Agency for Healthcare Research and Quality (AHRQ) have long promulgated the implementation of the HRO framework, it is unknown how many organizations have embraced the model. In this study, 45.9% of participants reflected that their organization was an HRO or was planning to become an HRO in the near future. A large number of participants were unsure of whether or not they worked in an HRO ($n=130$, 53.3%). It is unknown how these results might compare to the larger pediatric nursing workforce. These

findings suggested that many pediatric nurses may not know what an HRO is. It also suggests that nurses may not be as involved in organizational decision-making and program implementation as what would be expected. Unlike hospitals that seek Magnet[®] designation, there are no credentialing requirements for organizations to declare themselves an HRO. Moreover, since there is no standardized training and implementation pathway, organizations are free to choose from a myriad of programs (Veazie et al., 2019) Tremendous variability likely exists in regards to the quality and depth of education that each program offers. The lack of a clear and standardized implementation pathway likely means that many organizations declaring themselves as an “HRO” may not actually operate as one in practice.

Research Question 1: What are the combined and unique relationships of perceived psychological safety and perception of working in an HRO on pediatric nurses’ intent to report safety events?

The aim of Research Question 1 was to determine whether a pediatric nurses’ intent to report a safety event was influenced by either their level of psychological safety, perception of working in an HRO or a combination of both. There were three corresponding hypotheses.

H1a: Pediatric nurses who have high levels of psychological safety, will have higher intent to report safety events scores than nurses who have lower levels of psychological safety.

H1b: Pediatric nurses who perceive themselves as working in an HRO, will have higher intent to report safety event scores than nurses who do not perceive themselves to work in an HRO.

H1c: The combined effects of psychological safety and perception of working in an HRO will result in higher intent to report safety event scores among pediatric nurses.

The findings from this study provided support for hypothesis 1a and 1b. Specifically, nurses with higher levels of psychological safety or who perceive themselves to be working in a highly-reliable organization, have higher safety reporting intentions. The results were consistent with past research demonstrating a positive and significant relationship between psychological safety and safety reporting intentions in the adult setting (Applebaum et al., 2016; Lee & Dahinten, 2021). These results are also consistent with previous research findings linking perceived safety culture to safety reporting behaviors (Lake et al., 2018; Vogus & Iacobucci, 2016). To date however, similar work exploring safety reporting intentions in the HRO setting has not been conducted. The null hypothesis failed to be rejected for hypothesis 1c. Although when tested separately, psychological safety ($p < 0.01$) and HRO perception ($p < 0.05$) were statistically significant predictors of safety reporting intentions, in the combined model only psychological safety exhibited statistical significance. These relationships are more fully explicated below.

Psychological Safety

Psychological safety was measured using the Team Psychological Safety Survey. The mean score for nurses in the full dataset ($N=244$) was 3.78 ($SD=0.50$). Previous studies have reported similar mean scores ranging from 3.52 to 3.89 (Alingh, et al., 2018; Applebaum et al., 2016). The results indicate that participants perceived their workplaces as providing a mild-to-moderate degree of psychological safety.

The internal reliability of the scale was measured using Cronbach's alpha ($\alpha=.622$). Previous studies have reported higher Cronbach's alphas ranging from 0.77 to 0.82 (Alingh et al., 2018; Applebaum et al., 2016; Edmondson, 1999; Leroy et al., 2012). The Cronbach's alpha was lower than what is desired for a self-report instrument and also considerably below results reported in previous studies (Alingh et al., 2018; Applebaum et al., 2016; Edmondson, 1999; Leroy et al., 2012). The reasons for this are unclear. An item-total correlation was calculated for the Team Psychological Safety Survey and the results suggested that the removal of item six would improve the internal reliability of the scale from 0.622 to 0.742. Item six states, "No one on this team would deliberately act in a way that undermines my efforts". It is possible that the negative wording of this survey item caused confusion for participants and reduced the internal reliability of the scale (Barnett, 2000). An alternative explanation is that nurses may find the very idea of team members purposefully jeopardizing the safety of patient care to be an anathema to their steadfast commitment to the nursing role and mission.

Of the 244 participants, 20% felt that mistakes were held against them "Sometimes", "Most of the Time" or "Always". When asked about their ability to bring up problems and tough issues, 1 out of 4 participants (25.4%) reflected that they could "Never" "Rarely" or only "Sometimes" do this in the workplace. When asked about how difficult it was to ask for help, 13.9% reflected that this could be done "Sometimes", 1.2% reflected "Most of the Time" and 1.6% reflected "Always". Interestingly, a large number of participants ($n=206$, 84.4%) reported that they felt that their unique skills and talents were valued by team members, "Most of the time" or "Always". The synthesis of these results suggested that while many pediatric nurses felt valued, they also were hesitant to discuss clinical concerns and issues. These results demonstrated that many pediatric nurses (20%) had a fear of reprisal and were concerned that

reported safety events would be held against them. The results from this study were slightly lower than a 2016 study reporting that 28% of pediatric nurses do not feel safe questioning authority over unsafe practices and 46% of pediatric nurses feeling that reported mistakes were held against them (Lake et al., 2018). One potential explanation for this was that more than half of participants in this study were under the age of 34 ($n=125$). Generational studies have shown that millennials, those individuals between 25-40 years of age, are increasingly risk averse with a preference for teamwork and frequent leadership feedback (Erlam et al., 2018; Keith et al., 2021). It is possible that a younger and more-highly educated sample may have different sensibilities around patient safety and cultural norms in the workplace.

The results from this dissertation study demonstrated that with each one-unit increase in psychological safety scores, intention to report scores increased by 0.27 units. This finding aligned with Applebaum's (2016) and Lee's (2021) research findings demonstrating a positive and statistically significant relationship between psychological safety and reporting intentions. The results also supported the recent nursing studies in Korea and Iran demonstrating a positive and statistically significant relationship between perceived safety culture and reporting intentions among nurses (Chegini et al., 2020; Kim, 2010; Ko & Yu, 2017), although these results cannot be readily generalized to western societies due to cultural differences.

HRO Perception

This study supported the continued use of the Safety Organizing Scale to measure HRO perception among pediatric nurses. The internal reliability of the scale was measured using Cronbach's alpha ($\alpha=0.853$) which was consistent with the reported results from previous research (Alsalem et al., 2018; Ausserhoffer et al., 2013; Manojlovich et al., 2011; Vogus & Sutcliffe, 2007a; Vogus & Iacobucci, 2016). Participants in this study had an SOS mean score of

5.48 (Range 2.67-7.0, $SD=0.90074$) which was slightly higher than the SOS mean score of 5.10 among nurses working in the adult inpatient setting (Vogus & Sutcliffe, 2007a). Participants who were unsure or reported that their organization was not an HRO had a SOS mean score of 5.43. While slightly lower than the overall mean SOS score of 5.48—this was not a statistically significant finding.

Overall, the results suggested that many inpatient pediatric nurses were working on units that have yet to achieve high reliability. As the Joint Commission points out, hospitals continue to function using a reactive mode, investigating incidents only after a safety event has taken place instead of proactively screening for potential areas of weakness (Chassin & Loeb, 2013). In this study, only 46% of participants ($n=112$) reflected that they discussed mistakes and ways to learn from safety events with colleagues (selecting “6” or “7” on Item Six). Interestingly, 77% of participants ($n=189$) reflected that during patient reports, employees usually discussed what to look out for (selecting “6” or “7” on Item One) but only 52% of participants ($n=127$) spent time identifying activities that they did not want to go wrong (selecting “6” or “7” on Item Two) and 59% ($n=144$) reflected that following an error, their team discussed ways to prevent safety events from occurring again in the future (selecting “6” or “7” on Item Seven). These results suggested that while nurses may be comfortable discussing safety concerns regarding individual patients, they were less likely to screen for potential failures at the unit or organizational level. In order for an HRO to be effective, nurses must be able to critically appraise the system as a whole.

Similar to the results from the Team Psychological Safety Survey, 65% nurses ($n=159$) reflected that they had a strong appreciation for the talents and skills of their colleagues and 58% ($n=142$) indicated that when trying to resolve a problem, they took advantage of the unique skills of their colleagues. One of the most encouraging findings was that 79.9% of participants

($n=195$) responded that during a patient crisis, the team rapidly pooled their collective expertise to manage the problem to “a great extent” (selecting “6” or “7” on Item Nine). Interestingly however, only 41% ($n=102$) reported that colleagues discussed the unique skills of team members among them. This finding suggested that open communication exchanges regarding the strengths, expertise and limitations of team members may not be occurring to the depth and frequency as what one may expect.

A commitment to resilience is one of the five HRO principles and describes the team’s ability to respond to system failures. Item three in the SOS aims to measure this principle and states, “We discuss alternatives as to how to go about our normal work activities.” Only 40% ($n=98$) of participants provided a positive response to this statement (selecting “6” or “7”). While the item-total analysis for the scale did not recommend the removal or revision of any items, there remained a chance that participants misinterpreted this scale item by assuming it was asking about “cutting corners” and participating in “workarounds.” In health care, nurses often develop workarounds after encountering a block in their practice or workflow (Mansour & Tremblay, 2019). While there is a paucity of literature regarding the number and type of workarounds in clinical practice, studies have demonstrated that they may occur when a nurse intentionally circumvents a formal policy or procedure to expedite care and balance other demands (Nixon et al., 2015; Tucker et al., 2018). Former research (Nixon et al., 2015) has also shown an inverse and statistically significant relationship between psychological safety and engaging in workarounds ($p<0.05$). Unlike the highly standardized and formalized approach promulgated within the high reliability framework, a workaround is a deliberate deviation from organizational protocol or policy (Seaman & Erlen, 2015).

Intention to Report Safety Events

This study was one of the first to explore safety reporting intentions among pediatric nurses using a modified version of a subscale in the Surveys on Patient Safety Culture (SOPS®) survey. The preliminary psychometric testing of the three-item scale suggested that the measure was both a reliable and valid tool, but may only be able to capture a restricted range of scores. The ITR scale had a mean of 5.94 (SD=1.24) and a median of 6. Scores were negatively skewed to the left, indicating that most participants had strong safety reporting intentions; which aligned with the increasing focus on patient safety emphasized by professional nursing organizations and accrediting bodies. Given the critical role that nurses play in assuring patient safety and preventing error, this finding was both welcomed and anticipated. Similar to Applebaum's 2016 research, this study explored safety reporting intentions instead of past reporting behaviors. However, unlike Applebaum's research which used a 5-point Likert Scale to measure reporting intentions (1= highly unlikely, 5=highly likely), this study used a 7-point bipolar scale. Interestingly, the five-point Likert scale (1= highly unlikely, 5=highly likely) demonstrated weaker, but still acceptable internal reliability ($\alpha=0.72$) in comparison to the internal reliability findings for the scale used in this study ($\alpha=0.852$). These findings supported the continued use of 7-point bipolar scales to measure reporting intentions as recommended by the Theory of Planned Behavior (Ajzen, 1991).

The findings from this study revealed that when all other variables were excluded from the statistical model, a positive and statistically significant relationship between HRO perception and safety event reporting intentions ($p=0.034$) existed. These results supported the 2016 study conducted by Vogus and Iacobucci—demonstrating positive and statistically significant relationships between SOS scores and fewer medication errors ($p<0.05$) and patient falls ($p<0.01$).

Control Variables

In addition to measuring psychological safety and HRO perception, four demographic variables were tested in the linear regression model: (a) Years of nursing experience; (b) Unit type; (c) Magnet® designation; and (d) HRO Status. Of the four control variables, unit type was found to have a statistically significant relationship with safety event reporting intentions.

Years of Experience. The findings from the logistic regression model demonstrated a positive and statistically significant relationship between years of nursing experience and likelihood of achieving the maximum reporting intention score (7). The logistic regression model revealed that the odds of a pediatric nurse achieving the highest safety reporting intention score of 7 increased by a factor of 0.3 with each additional year of practice. However, this finding was only applicable when the variable was tested among the participants with the highest reporting intention scores ($n=79$). One potential explanation for this finding is that the fear of reprisal may decrease with professional experience. Another potential explanation is that with time and experience, nurses developed a stronger and often unrecognized appreciation for how individual events impact the system as a whole. This accrued knowledge likely strengthened the individual's confidence and appreciation for safety reporting systems. This result supported the findings from the 2018 Dutch study demonstrating a statistically significant relationship between tenure status and psychological safety with willingness to speak up (Alingh, et al., 2018). The results also support Lyman, Gunn and Mendon's (2020) qualitative study highlighting the importance of time in the development of psychological safety among new graduate nurses (2020).

Years of nursing experience was no longer a statistically significant variable when tested in the linear regression model. This somewhat unexpected finding suggested that a nurse's

reporting intentions increase with time and experience in the field, but at a certain point a ceiling effect occurs. The nurse ultimately reaches a point where their reporting intentions have reached their maximum potential and the scale is no longer able to detect additional growth. The divergent results between the two statistical models highlighted the need for continued investigation into the influence that years of experience may have on the reporting of safety events.

Unit Type. The findings from this study demonstrated a statistically significant relationship between working in a general or specialty unit and safety event reporting intentions ($p < 0.05$; $\beta = -0.2$). The negative relationship indicated that those working in a specialty unit on average scored 0.5 points lower on the ITR scale than those working on a medical/surgical unit. Because a number of participants were assigned a unit type based on their free-text response, results should be interpreted with caution. The statistically significant findings differed from Vogus and Sutcliffe's (2007) study which revealed no statistically significant relationships between unit type, RN tenure and reported medication errors. However, it was important to note that the 2007 study organized participants using four broad categories and that this approach may have overlooked the cultural complexities and nuances that often exist across various nursing specialties and units. Moreover, Vogus and Sutcliffe's (2007) study analyzed RN experience on their unit rather than overall years of nursing experience and explored reported events rather than behavioral intentions.

Magnet® Designation and HRO Status. This study found that Magnet® designation and HRO status were not statistically significant variables for safety reporting intentions among pediatric nurse participants. Although the overarching goal of the Magnet® program is to align nursing's strategic initiatives with improved patient outcomes, the majority of studies have

focused on the practice environment, leadership, and the influence that evidence-informed practice has on patient safety rather than focusing on specific nursing behaviors (Goode et al., 2011; Kelly et al., 2012; Ma et al., 2018; Saber, 2014). Regardless, one would expect that nurses working in a Magnet® setting would feel both encouraged and motivated to report potential concerns and safety events. This surprising finding warrants exploration in future research studies. Likewise, HRO status was not a statistically significant predictor of safety event reporting intentions. As previously discussed, how organizations define and implement the HRO framework in practice was highly variable. Furthermore, many participants were unsure about their organization's HRO status. These two issues may have led to measurement error.

Research Question 2: What is the relationship between a pediatric nurse's perception of working in an HRO and their perceived psychological safety?

The aim of Research Question 2 was to determine if the psychological safety level of pediatric nurses was related to their perception of whether or not they worked in an organization that encompassed or aspired to implement the HRO principles. HRO perception was measured using the Safety Organizing Scale and psychological safety was measured using the Team Psychological Safety Scale.

H2a: Pediatric nurses who perceive themselves as working in an HRO setting will have higher psychological safety scores.

The findings from this study provided support for hypothesis 2a. HRO perception demonstrated a positive and statistically significant relationship with psychological safety ($p < 0.001$). While the variance inflation factor (VIF) did not indicate multicollinearity, the findings for this study suggested that the two instruments may share some degree of information

with each other. The potential conceptual overlap between psychological safety and HRO perception is ripe for future analyses and discussed in the latter half of this chapter.

Limitations

There were several study limitations warranting consideration. The original recruitment strategy was to invite nurses to participate solely through the Society of Pediatric Nurses (SPN). However, in order to ensure that a larger and more representative sample was included, network (snowball sampling) was ultimately required. Details about the study were distributed by several nurse scientists working in inpatient pediatric settings. Thus, recruited participants working within these settings may have had an advanced appreciation for nursing research and their responses may not be representative of the larger workforce. However, this risk was mitigated as participants were recruited from several diverse organizations across the country.

As this survey was conducted online and distributed through several different organizations, a response rate could not be calculated. It is also unknown how many respondents were members of SPN or were recruited through a member of NPNSC. Data were also collected through participant self-reporting and given the sensitive nature of some of the scale items there was a potential for social response bias. This risk was mitigated as anonymity was maintained and participants were geographically dispersed across the country. As aforementioned, potential measurement issues were identified and addressed during data analysis. While the Team Psychological Safety Scale demonstrated sub-optimal internal reliability results ($\alpha=0.622$), potential concerns regarding the interpretability of results were assuaged given the instrument's extensive psychometric testing across a variety of settings and populations (Applebaum et al., 2016; Applebaum et al., 2020; Edmondson, 1999; Koopmann et al., 2016).

Data collection occurred at the peak of the COVID-19 pandemic. Given the widespread immeasurable impact that 2020 had on staff nurses, it was possible participant responses were influenced by this historical event. During the time that data were being collected, news reporters around the globe were publicly praising the role of the nurse and advocating for their protection. This increased public attention and professional pride may have also empowered participants to submit candid and uninhibited responses.

Implications for Future Research

The findings from this study advanced the state of nursing science by highlighting the influence that elements of an organizational culture can have on reporting intentions. While this study was conducted with rigor, the generalizability of results was limited as this research area is still in its infancy and rapidly evolving. The literature review conducted on patient safety and reporting revealed that health care providers and researchers were using a variety of inconsistent terms and definitions to describe safety events. Without clear conceptual and operational definitions, our ability to measure safety reporting was threatened.

The findings supported the continued revision and testing of the revised 3-item Intent to Report Safety Event (ITR) Scale. Grounded in the Theory of Planned Behavior, the psychometric testing of the ITR scale demonstrated promising results to measure behavioral intentions among nurses. Results from the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (MSA) and Bartlett's test of sphericity supported the continued refinement and testing of the revised ITR scale. To ensure that the full breadth of the construct was captured, qualitative research should also be considered. Researchers may consider conducting cognitive interviews with nurses to identify potential opportunities to improve the clarity and presentation of scale items. By conducting mixed-methods research, investigators may develop a more detailed

appreciation for safety reporting intentions while also subjecting the ITR Scale to rigorous testing to ensure measurement precision.

The findings from this study highlighted a potential conceptual overlap between a nurse's perception of high reliability and level of psychological safety. As both the Safety Organizing Scale (SOS) and Team Psychological Safety Scale attempted to measure workplace perception using similar questions, it was possible that both were measuring the same underlying construct. In order to further explore this possibility, the items from both instruments should be pooled and tested among nurses. Future research using item response theory (Rasch analysis) and factor analysis could then be performed to better understand the dimensionality of scale items (Polit, 2010). One possible way to accomplish this is to perform the receiver operative characteristic (ROC) technique to identify the optimal cut score for the scale to be dichotomized (Steiner & Cairney, 2007). Precise distinctions such as these will assist researchers, policy makers and organizational leaders to carefully track changes and improve the accuracy of measurement over time.

In review of the survey items and results, there was a chance that item six on the Team Psychological Safety Scale (no one on this team would deliberately act in a way that undermines my efforts) and item three on the Safety Organizing Scale (we discuss alternatives as to how to go about our normal work activities) may be misinterpreted by participants. In order to strengthen the validity of the instruments, cognitive interviews with nurses should be conducted to garner a better sense on how participants read and interpret the questions being asked.

Future studies should explore the influence that years of nursing experience, HRO status, Magnet[®] status and unit type have on workplace perception and safety reporting. Following the implementation of the HRO framework, staff members should be encouraged to provide

suggestions for ways to improve future trainings and staff engagement in the change process. Given the myriad of HRO training and implementation pathways available, organizational leaders and researchers should evaluate the efficacy, costs and long-term outcomes of programs. As discovered in the literature review, organizations continue to use a variety of terms, definitions and tools to define and measure high reliability within organizations. Such inconsistencies interfere with the ability to aggregate data and promote reliable benchmarking across organizations. A well-conducted systematic review evaluating how organizations define, implement and measure high-reliability is needed. Moreover, the potential interrelationship between HRO status and Magnet status warrants future investigation.

Implications for Education

The findings from this study demonstrated that a nurse's perception of whether they work in a high reliability setting and how psychologically safe they feel profoundly effects their attitude towards safety event reporting. Organizational leaders must take the time to educate team members about why working towards a highly reliable organization is important. Leaders must also collaborate with staff to identify ways to foster psychological safety and improve safety reporting. According to the American Association of Colleges of Nursing (AACN, 2021), it is expected that graduates of baccalaureate nursing programs receive education on reliability science and strategies to improve the quality and safety of patient care in complex organizational systems. As health care becomes increasingly specialized and focused on quality improvement, nurses need to feel adequately prepared to practice on an interdisciplinary team that focuses on quality improvement measures and collaboration. Nurse leaders should routinely meet with academic faculty members to review organizational updates and initiatives and to further discuss how potential change may impact clinical practice and nursing school curriculum. By

maintaining a collaborative partnership, organizational leaders and academic faculty members can brainstorm ways to address critical research gaps and prepare nurses entering the workforce.

Barriers or deterrents to safety event reporting among nurses continue to exist. The literature review revealed that there is a myriad of terms and definitions used to define safety events in health care. The lack of standardized definitions across organizations often leads to confusion for nurses regarding what constitutes a safety event and when to report it. Organizations would benefit from periodically revisiting their definitions of patient safety as new information emerges. By emphasizing the importance of continuous learning, both new and experienced staff members can remain apprised of relevant research findings and organizational initiatives.

Academic Nursing Programs need to ensure that their curriculum has integrated safety concepts throughout which align the AACN Essentials (2021). This is particularly important as new standards emerge. Faculty members should consistently evaluate their curriculum to ensure that students are educated about patient safety, safety events and the issues surrounding the reporting process and some of the tools used to collect information. Explaining historical issues on how power imbalances and the “blame culture” have contributed to continued concerns regarding speaking up may help newer nurses develop a deeper appreciation for the issues and challenges in this field.

Psychological safety is dependent upon effective communication strategies among all team members. Using the principles of constructive conversations, nurses should continue to learn and practice effective communication skills. By strengthening this competency, nurses can brainstorm effective strategies to navigate uncomfortable conversations and identify opportunities to enhance collaboration (Clark, 2015). While in schools of nursing and in

professional practice, nurses should be provided opportunities to strengthen their communication competency by practicing conflict-negotiation skills, script development and role-play (Clark, 2015). TeamSTEPPS is one potential model that organizations may consider to strengthen communication techniques and identifying team objectives and performance goals (AHRQ, 2020a). With advanced education, nurses are more apt to reflect upon their own behaviors, appreciate the importance of interdisciplinary of inter professional collaboration and feel better-equipped to participate in uncomfortable conversations even when power differentials exist (Browning, et al., 2007; Clark, 2015).

Implications for Practice

By recognizing their unique stance within the larger organizational context, pediatric nurses should be encouraged to participate on interprofessional teams to engage in scholarly inquiry. By establishing a community of scholars across disciplines, roles and units, there will be greater opportunities for knowledge-sharing and diverse perspectives to be heard. Organizations must also recognize that their pursuit for high-reliability will be everlasting—as safety hazards will always exist (Reason, 2011). In the absence of safety events, leaders, clinicians and support staff may become less vigilant in proactively screening for risks and potential system failures in practice. Leaders need to proactively collaborate with staff members to assess their unit safety and identify risks to the system on an ongoing basis.

The HRO framework emphasizes the need for staff members to be both detail-oriented and able to critically appraise the system as a whole. Interdisciplinary education on what it means to be an HRO in health care and how all personnel can incorporate the framework into professional practice is greatly needed. While current training programs may do a fantastic job at promoting nurses to use the framework while providing direct patient care, nurses may not feel

equally as encouraged to think about the model using a systems-based approach. Organizational leaders need to ensure that HRO training programs highlight the importance of staff feedback not just at the clinical level, but across units and the organization as a whole.

As more organizations adopt the high reliability model, it will become increasingly important to gather data regarding the types of implementation programs being selected and their efficacy. Hospital leaders should continue to tailor implementation strategies, employee education programs and performance management measurement strategies based on their organization's unique needs, while also sharing plans and encouraging feedback from staff members. Being transparent regarding successes and failures enables health care organizations to learn from each other, brainstorm solutions and identify future collaborative opportunities. Implementation and evaluation programs should be analyzed in terms of their costs, applicability and impact on the number and types of safety events reported. Internally, organizational leaders should track and share information regarding safety events to promote benchmarking, deeper analyses on safety event trends and opportunities for improvement.

The results from this study highlighted the importance of team conversations. Without open communication, the team's ability to collaborate and enhance their knowledge base is greatly diminished and the ability to deliver safe and high-quality patient care is threatened. Nurses working in both formal and informal leadership roles should first reflect upon their own experiences and remain open to feedback regarding their leadership approach. By modeling and promoting inclusive leadership, nurses will be more inclined to speak up regarding their questions, feedback and concerns (Lee & Dahinten, 2021).

On an organizational level, leaders should establish formal policies and procedures on how safety events are reviewed (AHRQ, 2018b). By establishing a core team of reviewers,

organizations can conduct a deep and thorough understanding of the factors leading up to the safety event. Moreover, the establishment of workplace policies may provide assurance to nurses that they will not be inappropriately blamed or punished for reporting an event while also providing clear and consistent protocols for how and when to submit (Joint Commission, 2021; Wolf & Hughes, 2008). The review team should ask to meet with the staff member who submitted the report to ask about routine workflows, working conditions, equipment, communication exchanges, patient assignments and any other factors that may have contributed to the occurrence of the event. During these one-to-one interviews, staff members should be assured that they will not be punished or blamed and that by sharing details, they can potentially prevent a similar event from occurring again. Interviews with staff members should be guided by formal guidelines so that the investigation is consistent regardless of who conducts follow-up discussions and the type of event being reported. Following all investigations, the larger review team should jointly discuss the findings and share pertinent recommendations in a timely fashion with nursing leaders and staff members.

Formal review policies need to be established to ensure that information regarding the frequency and types of safety events being reported is tracked over time. Organizational leaders should work with data analysts and financial experts to identify trends across units, specialties, diagnoses and treatments. Organizations can closely measure and track the occurrence of safety events using several available quality improvement software products (AHRQ, 2020b). These detailed analyses should evaluate the financial impact of the reported safety events that reach patients and the cost savings that result from the detection and reporting of near-misses (Van Den Bos et al., 2011).

Implications for Policy

Under the Patient Safety and Quality Improvement Act of 2005 (The Patient Safety Act), the AHRQ received direction to oversee the certification and membership list of all Patient Safety Organizations (PSOs). Through this Act, health care organizations can share quality and patient safety information confidentially and under federal protection (AHRQ, 2018c). The aggregation and analysis of such data allows providers to develop a deeper appreciation for certain trends while also brainstorming strategies to prevent future safety events from occurring (AHRQ, 2018c). Many pediatric staff nurses may not realize that by submitting a safety event, they have the opportunity to improve patient care not just within their facility but to over 60 other pediatric organizations participating in the Child Health PSO.

This research study highlighted the need for nurses, organizational leaders and policy-makers to remain current with the reporting requirements set by the Joint Commission and Centers for Medicare & Medicaid Services (CMS). The Joint Commission (2021) frequently offers updates and recommendations on potential tools that can be tried by organizations to conduct proactive risk assessments and aggregate data to develop quality improvement initiatives. The Joint Commission continues to promulgate the importance of the high reliability framework and leaders should explore how to best implement the model in practice based upon their organization's unique needs and in review of the Joint Commission recommendations.

Summary

As pediatric patient care becomes increasingly complex, it is paramount that the nursing voice is encouraged and respected. Collaboration is only achievable when knowledge-sharing across disciplinary lines becomes the norm and all team members feel valued. The information gleaned from this study addressed a critical knowledge gap which will hopefully serve as a catalyst for future research and quality improvement initiatives. The findings highlighted the

enormous influence that organizational culture has on individual perceptions, values, intentions and behaviors. Such sharing allows data to be aggregated and supports knowledge development within a safe and diverse disciplinary community.

References

Agency for Healthcare Research and Quality. (n.d.). *Approach to improving safety*.

<https://psnet.ahrq.gov/topics>

Agency for Healthcare Research and Quality. (2017). *Surveys on patient safety culture*.

<http://www.ahrq.gov/professionals/quality-patient-safety/patientsafetyculture/index.html>

Agency for Healthcare Research and Quality. (2018a). *Adverse events, near misses and errors*.

<https://psnet.ahrq.gov/primers/primer/34/adverse-events-near-misses-and-errors>

Agency for Healthcare Research and Quality. (2018b). *Reporting patient safety events*.

<https://psnet.ahrq.gov/primers/primer/13/Reporting-Patient-Safety-Events>

Agency for Healthcare Research and Quality. (2018c). *Patient safety organizations program*.

<https://www.ahrq.gov/cpi/about/otherwebsites/pso.ahrq.gov/index.html>

Agency for Healthcare Research and Quality. (2019a). *High reliability*.

<https://psnet.ahrq.gov/primers/primer/31/High-Reliability>

Agency for Healthcare Research and Quality. (2019b). *Adverse events, errors and near misses*.

<https://psnet.ahrq.gov/primer/adverse-events-near-misses-and-errors>

Agency for Healthcare Research and Quality. (2019c). *Culture of safety*.

<https://psnet.ahrq.gov/primer/culture-safety>

Agency for Healthcare Research and Quality. (2020a). *Pocket Guide: TeamSTEPPS*.

<https://www.ahrq.gov/teamstepps/instructor/essentials/pocketguide.html>

Agency for Healthcare Research and Quality. (2020b). *AHRQ Quality indicator tools for data*

analytics. <https://www.ahrq.gov/data/qualityindicators/index.html>

- Aiken, L.H., Sloane, D.M., Barnes, H., Cimiotti, J.P., Jarrin, O.F., & McHugh, M.D. (2018). Nurses' and patients' appraisals show patient safety in hospitals remains a concern. *Health Affairs, 37*. doi: 10.1377/hlthaff.2018.0711
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*, 179-211.
- Alghamdi, A.A., Keers, R.N., Sutherland, A., & Ashcroft, D.M. (2019). Prevalence and nature of medication errors and preventable adverse drug events in paediatric and neonatal intensive care settings: A systematic review. *Drug Safety, 42*(12), 1423-1436. doi: 10.1007/s40264-019-00856-9
- Alingh, C., van Wijngaarden, J.D.H., van de Voorde, K., Paauwe, J., & Huijsman, R. (2018). Speaking up about patient safety concerns: The influence of safety management approaches and climate on nurses' willingness to speak up. *British Medical Journal (BMJ), 28*, 39-48. doi: 10.1136/bmjqs-2017-007163
- Alomari, A., Wilson, V., Solman, A., Bajorek, B., & Tinsley, P. (2018). Pediatric nurses' perceptions of medication safety and medication error: A mixed methods study. *Comprehensive Child and Adolescent Nursing, 41*(2), 94-110. doi: 10.1080/24694193.2017.1323977
- Alsalem, G., Bowie, P., & Morrison, J. (2018). Assessing safety climate in acute hospital settings: a systematic review of the adequacy of the psychometric properties of survey measurement tools. *BMC Health Services Research, 18*, 1-14, doi: 10.1186/s12913-018-3167-x
- American Association of Colleges of Nursing. (2021). *The essentials of baccalaureate education for professional nursing practice*. <https://www.aacnnursing.org/AACN-Essentials>

American Nurses Association. (2015). *Code of ethics for nurses: With interpretive statements*.

American Nurses Association.

American Nurses Credentialing Center. (n.d.). *ANCC magnet credentialing center*.

<https://www.nursingworld.org/organizational-programs/magnet/>

American Nurses Credentialing Center. (2019). *Growth*.

<https://www.nursingworld.org/organizational-programs/magnet/history/growth/>

Anderson, V.L., Johnston, A.N.B., Massey, D., & Bamford-Wade, A. (2018). Impact of magnet hospital designation on nursing culture: An integrative review. *Contemporary Nurse, 54*

(4-5). doi: 10.1080/10376178.2018.1507677

Antonow, J.A., Smith, A.B., & Silver, M.P. (2000). Medication error reporting: A survey of nursing staff. *Journal of Nursing Care Quality, 15*(1), 42-48. doi: 10.1097/00001786-

200010000-00006

Appelbaum, N. P., Dow, A., Mazmanian, P. E., Jundt, D. K., & Appelbaum, E. N. (2016). The effects of power, leadership and psychological safety on resident event

reporting. *Medical Education, 50*, 343-350. doi: 10.1111/medu.12947

Applebaum, N.P., Lockeman, K.S., Orr, S., Huff, T.A., Hogan, C.J., Queen, B.A., & Dow, A.W. (2020). Perceived influenced of power distance, psychological safety, and team cohesion

on team effectiveness. *Journal of Interprofessional Care, 34*(1), 20-26. doi:

10.1080/13561820.2019.1633290

Arnetz, J.E., Sudan, S., Fitzpatrick, L., Cotten, S.R., Jodoin, C., Chang, C.H., & Arnetz, B.B.

(2019). Organizational determinants of bullying and work disengagement among hospital nurses. *Journal of Advanced Nursing, 75*, 1229-1238. doi: 10.1111/jan.13915

- Ausserhofer, D., Schubert, M., Blegen, M., De Geest, S., & Schwendimann, R. (2013). Validity and reliability on three european language versions of the safety organizing scale. *International Journal for Quality in Health Care*, 25(2), 157-166. doi: 10.1093/intqhc/mzt001
- Barach, P., & Small, S.D. (2000). Reporting and preventing medical mishaps: lessons from non-medical near miss reporting systems. *British Medical Journal*, 320, 759-763. doi: 10.1136/bmj.320.7237.759
- Barnett, J.J. (2000). Effects of stem and likert response option reversals on survey internal consistency: If you feel the need, there is a better alternative to using those negatively worded stems. *Educational and Psychological Measurement*, 60(3), 361-370. doi: 10.1177/00131640021970592
- Bates, D.W., & Singh, H. (2018). Two decades since to err is human: An assessment of progress and emerging priorities in patient safety. *Health Affairs*, 37. doi: 10.1377/hlthaff.2018.0738
- Boston College. (2018). *Qualtrics*.
<https://www.bc.edu/offices/researchservices/CenterforStatisticsandAdvancedAnalysis/surveys/Qualtrics.html>
- Brady, P.W., & Goldenhar, L.M. (2012). A qualitative study examining the influences on situation awareness and the identification, mitigation and escalation of recognized patient risk. *BMJ Quality and Safety*, 23. doi: 10.1136/bmjqs-2012-001747.
- Browning, D.M., Meyer, E.C., Truog, R.D., & Solomon, M.Z. (2007). Difficult conversations in health care: Cultivating relational learning to address the hidden curriculum. *Academic Medicine*, 82 (9), 905-913. doi: 10.1097/ACM.0b013e31812f77b9

- Bureau of Labor Statistics. (2019). *CPI inflation calculator*. <https://data.bls.gov/cgi-bin/cpicalc.pl>
- Carmeli, A., & Gittell, J.H. (2009). High-quality relationships, psychological safety, and learning from failures in work organizations. *Journal of Organizational Behavior*, 30, 709-729. doi: 10.1002/job.565
- Chassin, M. R., & Loeb, J. M. (2013). High-reliability health care: getting there from here. *The Milbank Quarterly*, 91(3), 459-490. doi: 10.1111/1468-0009.12023
- Chassin, M.R. (2019, November 9). *One-size-fits-all approach to patient safety improvement won't get us to the ultimate goal—zero harm*. <https://www.modernhealthcare.com/opinion-editorial/one-size-fits-all-approach-patient-safety-improvement-wont-get-us-ultimate-goal>
- Chegini, Z., Kakemam, E., Asghari Jafarabadi, M., & Janati, A. (2020). The impact of patient safety culture and the leader coaching behaviour of nurses on the intention to report errors: A cross-sectional survey. *BMC Nursing*, 19 (89). doi: 10.1186/s12912-020-00472-4
- Child Health Patient Safety Organization. (2018). *A preoccupation with detection: Identifying the source of serious pediatric patient harm*. <https://www.childrenshospitals.org/Quality-and-Performance/Patient-Safety/Resources/Identifying-the-Source-of-Serious-Pediatric-Patient-Harm>
- Children's Hospital Association. (2021). *Child health patient safety organization membership roster*. <https://www.childrenshospitals.org/-/media/Files/Groups/Child-Health-PSO/Child-Health-PSO-Membership-Roster-010121.pdf?la=en&hash=F9AD085E7BF0B379D5A461DCC9931944159AF449>

- Children's Hospital Association. (2022). *Children's hospital directory*. Retrieved February 2nd, 2022 from <https://www.childrenshospitals.org/Directories/Hospital-Directory?magnetdesignation=True>
- Christianson, M.K., Sutcliffe, K.M., Miller, M.A., & Iwashyna, T.J. (2011). Becoming a high reliability organization. *Critical Care, 15*(6). doi: 10.1186/cc10360
- Chua, S.S., Chua, H.M., & Omar, A. (2010). Drug administration errors in paediatric wards: A direct observation approach. *European Journal of Pediatrics, 169*, 603-611. doi: 10.1007/s00431-009-1084-z
- Clark, C.M. (2015). Conversations to inspire and promote a more civil workplace. *American Nurse Today, 10* (11), 18-23.
- Clark, R.R.S., & Lake, E.T. (2020). Association of clinical nursing work environment with quality and safety in maternity care in the united states. *The American Journal of Maternal/Child Nursing, 45*(5), 265-270. doi: 10.1097/NMC.0000000000000653
- Cohen, E., & Patel, H. (2014). Responding to the rising number of children living with complex chronic conditions. *Canadian Medical Association Journal, 186*, 1199-1200. doi: 10.1503/cmaj.141036
- Cole, D.A., Bersick, E., Skarbek, A., Cummins, K., Dugan, K., & Grantoza, R. (2019a). The courage to speak out: A study describing nurses' attitudes to report unsafe practices in patient care. *Journal of Nursing Management, 27*, 1176-1181. doi: 10.1111/jonm.12789
- Cole, E., & Zelonka, C. (2019b). Our own worst enemies, the nurse bullying epidemic. *Nursing Administration Quarterly, 43*(3), 274-279. doi: 10.1097/NAQ.0000000000000353

- Cook, C., Heath, F., & Thompson, R. L. (2000). A meta-analysis of response rates in web-or Internet-based surveys. *Educational and Psychological Measurement, 60*, 821-836. doi: 10.1177/00131640021970934.
- Daniel, M., & Makary, M. A. (2016). Medical error—the third leading cause of death in the US. *British Medical Journal, 353*. doi: 10.1136/bmj.i2139
- DeAngelis, A., Pancani, L., Steca, P., Colaceci, S., Giusti, A., Tibaldi, L., Alvaro, R., Ausili, D., & Vellone, E. (2017). Testing an explanatory model of nurses' intention to report adverse drug reactions in hospital settings. *Journal of Nursing Management, 25*, 307-317. doi: 10.1111/jonm.12467
- Department of Health and Human Services. (2012). *Hospital incident reporting systems do not capture most patient harm*. (Publication No. OEI-06-09-00091). Washington, DC: Government Printing Office.
- Derickson, R., Fishman, J., Osatuke, K., Teclaw, R., & Ramsel, D. (2015). Psychological safety and error reporting within veterans health administration hospitals. *Journal of Patient Safety, 11*, 60-66. doi: 10.1097/PTS.0000000000000082
- Dillman, D.A., Smyth, J.D., & Christian, L.M. (2009). *Internet, mail, and mixed-mode surveys. The tailored design method*. John Wiley & Sons, Inc.
- Duffey, P., Oliver, J.S., & Newcomb, P. (2019). Evaluating the use of high-reliability principles to increase error event reporting. *The Journal of Nursing Administration, 49*, 310-314. doi: 10.1097/NNA.0000000000000758
- Dutton, R.P. (2014). Improving safety through incident reporting. *Current Anesthesiology Reports, 4*, 84-89. doi: 10.1007/s40140-014-0048-7

- Eccles, M.P., Hrisos, S., Francis, J., Kaner, E.F., Dickinson, H.O., Beyer, F., & Johnston, M. (2006). Do self-reported intentions predict clinicians' behavior: A systematic review. *Implementation Science, 1*, 1-10. doi: 10.1186/1748-5908-1-28
- Edmondson, A. C. (1996). Learning from mistakes is easier said than done: Group and organizational influences on the detection and correction of human error. *The Journal of Applied Behavioral Science, 32*, 5-28. doi: 10.1177/0021886396321001
- Edmondson, A. (1999). Psychological safety and learning behavior in work teams. *Administrative Science Quarterly, 44*, 350-383. doi: 10.2307/2666999
- Edmondson, A. C. (2003). Speaking up in the operating room: How team leaders promote learning in interdisciplinary action teams. *Journal of Management Studies, 40*, 1419-1452. doi: 10.1111/1467-6486.00386
- Edmondson, A.C., & Roloff, K.S. (2008). Overcoming barriers to collaboration: Psychological safety and learning in diverse teams. In E. Salas, G.F. Goodwin, C.S. Burke (Eds.). *Team effectiveness in complex organizations* (pp. 183-208). Routledge.
- Edmondson, A.C., Higgins, M., Singer, S., & Weiner, J. (2016). Understanding psychological safety in health care and education organizations: A comparative perspective. *Research in Human Development, 13*(1), 65-83. doi: 10.1080/15427609.2016.1141280
- Epstein, S. (1983). Aggregation and beyond: Some basic issues on the prediction of behavior. *Journal of Personality, 51*, 360-392.
- Erlam, G., Smythe, L., & Wright-st Clair, V. (2018). Action research and millennials: Improving pedagogical approaches to encourage critical thinking. *Nurse Education Today, 61*, 140-145. doi: 10.1016/j.nedt.2017.11.023

- Evans, S.M., Berry, J.G., Smith, B.J., Esterman, A., Selim, P., O'Shaughnessy, J., & DeWit, M. (2006). Attitudes and barriers to incident reporting: A collaborative hospital study. *BMJ Quality & Safety, 15*(1), 39-43. doi: 10.1136/qshc.2004.012559
- Fincham, J. E. (2008). Response Rates and Responsiveness for Surveys, Standards, and the Journal. *American Journal of Pharmaceutical Education, 72*(2), 43. doi: 10.5688/aj720243
- Fishbein, M., & Ajzen, I. (2010). *Predicting and changing behavior: The reasoned action approach*. Psychology Press (Taylor & Francis).
- Forbes, T.H., Scott, E.S., & Swanson, M. (2020). New graduate nurses' perceptions of patient safety: Describing and comparing responses with experienced nurses. *The Journal of Continuing Education in Nursing, 51*. doi: 10.3928/00220124-20200611-06
- Friese, C.R., Xia, R., Ghaferi, A.A., Birkmeyer, J.D., & Banerjee, M. (2015). Hospitals in magnet program show better patient outcomes on mortality measures compared to non-magnet hospitals. *Health Affairs, 34*(6), 986-992. doi: 10.1377/hlthaff.2014.0793
- Gates, P.J., Meyerson, S.A., Baysari, M.T., Lehmann, C.U., & Westbrook, J.I. (2018). Preventable adverse drug events among inpatients: A systematic review. *Pediatrics, 142*. doi: 10.1542/peds.2018-0805
- Glanzmann, C., Frey, B., Meier, C.R., & Vonbach, P. (2015). Analysis of medication prescribing errors in critically ill children. *European Journal of Pediatrics, 174* (10), 1347-1355. doi: 10.1007/s00431-015-2542-4
- Gong, Y., Song, H.Y., Wu, X., & Hua, L. (2015). Identifying barriers and benefits of patient safety event reporting toward user-centered design. *Safety in Health, 1*, 1-9. doi: 10.1186/2056-5917-1-7.

- Goode, C. J., Blegen, M. A., Park, S. H., Vaughn, T., & Spetz, J. (2011). Comparison of patient outcomes in Magnet® and non-Magnet hospitals. *The Journal of Nursing Administration, 41*(12), 517-523. doi: 10.1097/NNA.0b013e3182378b7c
- Goodman, J., Villarreal, P., & Jones, B. (2011). The social cost of adverse medical events, and what we can do about it. *Health Affairs (Project Hope), 30*, 590-595.
doi:10.1377/hlthaff.2010.1256
- Graham, J.W. (2009). Missing data analysis: Making it work in the real world. *Annual Review of Psychology, 60*, 549-576. doi: 10.1146/annurev.psych.58.110405.085530
- Hackman, J.R. (1990). *Groups that work and those that don't*. San Francisco, CA: Jossey-Bass.
- Harris, C. B., Krauss, M. J., Coopersmith, C. M., Avidan, M., Nast, P. A., Kollef, M. H., Dunagan, W.C., & Fraser, V. J. (2007). Patient safety event reporting in critical care: a study of three intensive care units. *Critical Care Medicine, 35*(4), 1068-1076. doi: 10.1097/01.CCM.0000259384.76515.83
- Haw, C., Stubbs, J., & Dickens, G.L. (2014). Barriers to the reporting of medication administration errors and near misses: an interview study of nurses at a psychiatric hospital. *Journal of Psychiatric Mental Health Nursing, 21*(9) 797-805. doi: 10.1111/jpm.12143
- Hershey, K. (2015). Culture of safety. *Nursing Clinics of North America, 50*, 139-152. doi: 10.1016/j.cnur.2014.10.011
- Hession-Laband, E., & Mantell, P. (2011). Lessons learned: use of event reporting by nurses to improve patient safety and quality. *Journal of Pediatric Nursing, 26*(2), 149-155. doi: 10.1016/j.pedn.2010.12.005

- Hoffman, T., Bennett, S., & Del Mar, C. (2013). *Evidence-based practice across the health professions*. Elsevier.
- Hughes, R. G., & Ortiz, E. (2005). Medication errors: why they happen, and how they can be prevented. *Journal of Infusion Nursing*, 28, 14-24. doi: 10.1097/00000446-200503001-00005
- Hung, C.C., Chu, T.P., Lee, B.O., & Hsiao, C.C. (2015). Nurses' attitudes and intention of medication administration error reporting. *Journal of Clinical Nursing*, 25, 445-453. doi: 10.1111/jocn.13071
- Hung, C.C., Lee, B.O., Liang, H.F., & Chu, T.P. (2016). Factors influencing nurses' attitudes and intentions toward medication administration error reporting. *Japan Journal of Nursing Science*, 13, 345-354. doi: 10.1111/jjns.12113
- Ismail, A. (2016). The challenges of providing effective pain management for children in the pediatric intensive care unit. *Pain Management Nursing*, 17, 372-383. doi: 10.1016/j.pmn.2016.08.005
- Jackson, J.P., Clements, P.T., Averill, J.B., & Zimbro, K. (2009). Patterns of knowing: Proposing a theory for nursing leadership. *Nursing Economics*, 27(3), 149-159.
- James, J.T. (2013). A new, evidenced-based estimate of patient harms associated with hospital care. *Journal of Patient Safety*, 9, 122-128. doi: 10.1097/PTS.0b013e3182948a69
- Jenicek, M. (2010). *Medical error and harm: Understanding, prevention, and control*. Boca Raton, FL: CRC Press.
- Joint Commission. (2008). *Sentinel events (SE): Alert 39: Preventing pediatric medication errors*. Retrieved from https://www.jointcommission.org/assets/1/18/SEA_39.PDF

- Joint Commission. (2017). *Sentinel events (SE)*. Retrieved from https://www.jointcommission.org/assets/1/6/CAMH_SE_0717.pdf
- Joint Commission. (2021). *Patient safety systems (PS)*. Retrieved from https://www.jointcommission.org/-/media/tjc/documents/standards/ps-chapters/camac_04a_ps_all_current.pdf
- Kaushal, R., Bates, D.W., Landrigan, C., McKenna, K.J., Clapp, M.D., Federico, F., & Goldmann, D.A. (2001). Medication errors and adverse drug events in pediatric patients. *Journal of the American Medical Association*, 285, 2114-2120. doi: 10.1001/jama.285.16.2114
- Kavanagh, K.T., Saman, D.M., Bartel, R., & Westerman, K. (2017). Estimating hospital related deaths due to medical error: A perspective from patient advocates. *Journal of Patient Safety*, 13, 1-5. doi: 10.1097/PTS.0000000000000364
- Keith, A., Warshawsky, N., & Talbert, S. (2021). Factors that influence millennial generation nurses' intention to stay: An integrated literature review. *The Journal of Nursing Administration*, 51(4), 220-226. doi: 10.1097/NNA.0000000000001001
- Kelly, L. A., McHugh, M. D., & Aiken, L. H. (2012). Nurse outcomes in Magnet® and non-Magnet hospitals. *The Journal of Nursing Administration*, 42(10), 428-433. doi: 10.1097/NNA.0b013e31822eddbc
- Khatri, N., Brown, G.D., & Hicks, L.L. (2009). From a blame culture to a just culture in health care. *Health Care Management Review*, 34(4), 312-322. doi: 10.1097/HMR.0b013e3181a3b709

- Kiesewetter, I., Konings, K.D., Kager, M., & Kiesewetter, J. (2018). Undergraduate medical students' behavioural intentions towards medical errors and how to handle them: a qualitative vignette study. *BMJ Open*, *8*(3). doi: 10.1136/bmjopen-2017-019500
- Kim, J., An, K., Kim, M.K., & Yoon, S.H. (2007). Nurses' perception of error reporting and patient safety culture in Korea. *Western Journal of Nursing Research*, *29*, 827-844. doi: 10.1177/0193945906297370
- Kim, M. (2010). The effectiveness of error reporting promoting strategy on nurse's attitude, patient safety culture, intention to report and reporting rate. *Journal of Korean Academy of Nursing*, *40*(2), 172-181. doi: 10.4040/jkan.2010.40.2.172
- Ko, Y., & Yu, S. (2017). The relationships among perceived patients' safety culture, intention to report errors, and leader coaching behavior of nurses in Korea: A pilot study. *Journal of Patient Safety*, *13* (3), 175-183. doi: 10.1097/PTS.0000000000000224
- Kohn, L.T., Corrigan, J.M., & Donaldson, M.S. (2000). *To err is human: Building a safer health system*. Washington, D.C: National Academy Press.
- Koller, D., Rummens, A., Pouesard, M.L., Espin, S., Friedman, J., Coffey, M., & Kenneally, N. (2016). Patient disclosure of medical errors in pediatrics: A systematic literature review. *Paediatrics & Child Health*, *21*(4), e32-e38. doi: 10.1093/pch/21.4.e32
- Koopmann, J., Lanaj, K., Wang, M., Zhou, L., & Shi, J. (2016). Nonlinear effects of team tenure on team psychological safety climate and climate strength: Implications for average team member performance. *Journal of Applied Psychology*, *101* (10), 940-957. doi: 10.1037/ap0000097
- Lake, E.T., Roberts, K.E., Agosto, P.D., Ely, E., Bettencourt, A.P., Schierholz, E.S., Frankenberger, W.D., Catania, G., & Aiken, L.H. (2018). The association of the nurse

- work environment and patient safety in pediatric acute care. *Journal of Patient Safety*, doi: 10.1097/PTS.0000000000000559
- Lambert Passos, S., Barbosa, N.O., Mayon Neves, LAA, Motta, P.A., dos Santos, J.L.B, de Sousa, F.M, & Cavalini, L.T. (2020). Computerized prescription order entry and adverse drug events in pediatrics: A systematic review. *European Journal of Public Health*, doi: 10.1093/eurpub/ckaa165.222
- Lapkin, S., Levett-Jones, T., & Gilligan, C. (2015). Using the theory of planned behavior to examine health professional students' behavioural intentions in relation to medication safety and collaborative practice. *Nurse Education Today*, 35, 935-940. doi: 10.1016/j.nedt.2015.03.018
- La Porte, T.R. (1996). High reliability organizations: Unlikely, demanding and at risk. *Journal of Contingencies and Crisis Management*, 4(2), 60-71.
- Lederman, R., Dreyfus, S., Matchan, J., Knott, J.C., & Milton, S.K. (2013). Electronic error-reporting systems: A case study into the impact on nurse reporting of medical errors. *Nursing Outlook*, 61, 417-426.e5. doi: 10.1016/j.outlook.2013.04.008
- Lee, S.E., & Dahinten, V.S. (2021). Psychological safety as a mediator of the relationship between inclusive leadership and nurse voice behaviors and error reporting. *Journal of Nursing Scholarship*, 0(0), 1-9. doi: 10.1111/jnu.12689
- Lee, Y.H., Yang, C.C., & Chen, T.T. (2016). Barriers to incident-reporting behavior among nursing staff: A study based on the theory of planned behavior. *Journal of Management & Organization*, 22, 1-18. doi: 10.1017/jmo.2015.8
- Leroy, H., Dierynck, B., Anseel, F., Simons, T., Halbesleben, J. R., McCaughey, D., Savage, G.T., & Sels, L. (2012). Behavioral integrity for safety, priority of safety, psychological

- safety, and patient safety: A team-level study. *Journal of Applied Psychology*, 97, 1273-1281. doi: 10.1037/a0030076
- Lyman, B., Gunn, M.M., & Mendon, C.R. (2020). New graduate registered nurses' experiences with psychological safety. *Journal of Nursing Management*, 28 (4). doi: 10.1111/jonm.13006
- Lyren, A., Brill, R., Bird, M., Lashutka, N., & Muething, S. (2016). Ohio children's hospitals' solutions for patient safety: A framework for pediatric patient safety improvement. *Journal for Healthcare Quality*, 38 (4), 213-222. doi: 10.1111/jhq.12058
- Ma, C., Park, S. H., & Shang, J. (2018). Inter-and intra-disciplinary collaboration and patient safety outcomes in US acute care hospital units: A cross-sectional study. *International Journal of Nursing Studies*, 85, 1-6. doi: 10.1016/j.ijnurstu.2018.05.001
- Mackesy, C. (2019). *The boy, the mole, the fox and the horse*. Harper One.
- Manojlovich, M., Saint, S., Forman, J., Fletcher, C.E., Keith, R., & Krein, S. (2011). Developing and testing a tool to measure nurse/physician communication in the intensive care unit. *Journal of Patient Safety*, 7(2), 80-85. doi: 10.1097/PTS.0b013e3182192463
- Mansour, S., & Tremblay, D-G. (2019). How can we decrease burnout and safety workaround behaviors in health care organizations? The role of psychosocial safety climate. *Personnel Review*, 48(2). doi: 10.1108/PR-07-2017-0224
- Mayo, A.M., & Duncan, D. (2004). Nurse perceptions of medication errors: What we need to know for patient safety. *Journal of Nursing Care Quality*, 19 (3), 209-217. doi: 10.1097/00001786-200407000-00007

- McFarland, D.M., & Doucette, J.N. (2019). Impact of high-reliability education on adverse event reporting by registered nurses. *Journal of Nursing Care Quality, 33*(3),285-290. doi: 10.1097/NCQ.0000000000000291
- McHugh, M.D., Kelly, L.A., Smith, H.L., Wu, E.S., Vanak, J.M., & Aiken, L.H. (2013). Lower mortality in magnet hospitals. *Journal of Nursing Administration, 43*(10), S4-10. doi: 10.1097/MLR.0b013e3182726cc5.
- Mueller, B.U., Neuspiel, D.R., & Stucky-Fisher, E.R. (2019). Principles of pediatric patient safety: Reducing harm due to medical care. *Pediatrics, 143*. doi: 10.1542/peds.2018-3649
- Muething, S.E., Goudie, A., Schoettker, P.J., Donnelly, L.F., Goodfriend, M.A., Bracke, T.M., Brady, P.W., Wheeler, D.S., Anderson, J.M., & Kotagal, U.R. (2012). Quality improvement initiative to reduce serious safety events and improve patient safety culture. *Pediatrics, 130*(2), e423-e431. doi: 10.1542/peds.2011-3566
- Muller, D., & Ornstein, K. (2007). Perceptions of and attitudes towards medical errors among medical trainees. *Medical Education, 41*(7), 645-652. doi: 10.1111/j.1365-2923.2007.02784.x
- National Center for Health Workforce Analysis. (2019). *2018 National sample survey of registered nurses: Brief summary of results*.
<https://bhw.hrsa.gov/sites/default/files/bhw/health-workforce-analysis/nssrn-summary-report.pdf>
- Nixon, A.E., Lanz, J.J., Manapragada, A., Bruk-Lee, V., Schantz, A., & Rodriguez, J.F. (2015). Nurse safety: How is safety climate related to affect and attitude? *Work & Stress, 29* (4), 401-419. doi: 10.1080./02678373.2015.1076536.

- Nolan, T., Resar, R., Haraden, C., & Griffin, F.A. (2004). *Improving the reliability of health care*. [IHI Innovation Series white paper]. Boston, MA: Institute for Healthcare Improvement.
- O'Donovan, R., & McAuliffe, E. (2020). A systematic review of factors that enable psychological safety in healthcare teams. *International Journal for Quality in Health Care*, 32(4). doi: 10.1093/intqhc/mzaa025
- Osborne, J., Blais, K., & Hayes, J.S. (1999). Nurses' perceptions: When is it a medication error? *Journal of Nursing Administration*, 29 (4), 33-38. doi: 10.1097/00005110-199904000-00011
- Oster, C., & Braaten, J. (2016). *High reliability organizations: a healthcare handbook for patient safety & quality*. Indianapolis, IN: Sigma Theta Tau.
- Ozkan, S., Kocaman, G., Ozturk, C., & Seren, S. (2011). Frequency of pediatric medication administration errors and contributing factors. *Journal of Nursing Care Quality*, 26(2), 136-143. doi: 10.1097/NCQ.0b013e3182031006
- Petit, O. D. D., & Regnaud, J. P. (2015). Do Magnet®-accredited hospitals show improvements in nurse and patient outcomes compared to non-Magnet hospitals: a systematic review. *JBIC Database of Systematic Reviews and Implementation Reports*, 13(6), 168-219. doi: 10.11124/jbisrir-2013-1155
- Pfeifer, L.E., & Vessey, J.A. (2017). An integrative review of bullying and lateral violence among nurses in magnet® organizations. *Policy, Politics and Nursing Practice*, 18, 113-124. doi: 10.1177/1527154418755802
- Pfeifer, L.E., & Vessey, J.A. (2019). Psychological safety on the healthcare team. *Nursing Management*, 50(8), 32-38. doi: 10.1097/01.NUMA.0000558490.12760.08

- Phipps, A. R., Paradis, M., Peterson, K. A., Jensen, J., Nielsen, K., Hall, M., Simonsen, K., & Norton, B. M. (2018). Reducing serious safety events and priority hospital-acquired conditions in a pediatric hospital with the implementation of a patient safety program. *The Joint Commission Journal on Quality and Patient Safety*, *44*(6), 334-340. doi: 10.1016/j.jcjq.2017.12.006
- Polit, D.F. (2010). *Statistics and data analysis for nursing research* (2nd ed.). Pearson Education.
- Qualtrics. (2019). *About Qualtrics*. <https://www.qualtrics.com/about/>
- Reason, J. (2011). *Managing the risks of organizational accidents*. Burlington, VT: Ashgate Publishing Company.
- Rinke, M.L., Bundy, D.G., Velasquez, C.A., Rao, S., Zerhouni, Y., Lobner, K., Blanck, J.F., & Miller, M.R. (2014). Interventions to reduce pediatric medication errors: A systematic review. *Pediatrics*, *134*, doi: 10.1542/peds.2013-3531
- Rishoej, R. M., Hallas, J., Kjeldsen, J.L., Christesen, T.H., & Almarsdóttir, A. B. (2018). Likelihood of reporting medication errors in hospitalized children: a survey of nurses and physicians. *Therapeutic Advances in Drug Safety*, *9*(3), 179-192. doi: 10.1177/2042098617746053
- Roberts, S.J. (2015). Lateral violence in nursing: A review of the past three decades. *Nursing Science Quarterly*, *28*(1), 36-41. doi: 10.1177/0894318414558614
- Rochlin, G.I. (1996). Reliable organizations: Present research and future directions. *Journal of Contingencies and Crisis Management*, *4*(2), 55-59.
- Ross, R.M., Wallace, J., & Paton, J.Y. (2000). Medication errors in a pediatric teaching hospital in the UK: Five years operational experience. *Archives of Disease in Childhood*, *83*(6), 492-497. doi: 10.1136/adc.83.6.492

- Rutledge, D.N., Retrosi, T., & Ostrowski, G. (2018). Barriers to medication error reporting among hospital nurses. *Journal of Clinical Nursing, 27*(9-10), 1941-1949. doi: 10.1111/jocn.14335
- Saber, D. A. (2014). Frontline registered nurse job satisfaction and predictors over three decades: A meta-analysis from 1980 to 2009. *Nursing Outlook, 62*(6), 402-414. doi: 10.1016/j.outlook.2014.05.004
- Sarin, S., & McDermott, (2003). The effect of team leader characteristics on learning, Knowledge application, and performance of cross-functional new product development teams. *Decision Sciences, 34*(4), 707-739. doi: 10.1111/j.1540-5414.2003.02350.x
- Schein, E. H., & Bennis, W. G. (1965). *Personal and organizational change through group methods: The laboratory approach*. New York, NY: Wiley.
- Seaman, J.B., & Erlen, J.A. (2015). Workarounds in the workplace-A second look. *Orthopaedic Nursing, 34*(4), 235-242. doi: 10.1097/NOR.0000000000000161
- Sears, K., O'Brien-Pallas, L., Stevens, B., & Tomblin Murphy, G. (2016). The relationship between nursing experience and education and the occurrence of reported pediatric medication administration. *Journal of Pediatric Nursing, 31*, e283-e290. doi: 10.1016/j.pedn.2016.01.003
- Sheikhtaheri, A. (2014). Near misses and their importance for improving patient safety. *Iranian Journal of Public Health, 43*(6), 853-854.
- Singer, S.J., Gaba, D.M., Geppert, J.J., Sinaiko, A.D., Howard, S.K., & Park, K.C. (2003). The culture of safety: Results of an organization-wide survey in 15 California hospitals. *BMJ Quality & Safety, 12*(2), 112-118. doi: 10.1136/qhc.12.2.112

- Singer, S.J., & Vogus, (2013). Reducing hospital errors: interventions that build safety culture. *Annual Review of Public Health, 34*, 373-396. doi: 10.1146/annurev-publhealth-031912-114439
- Smiley, R.A., Lauer, P., Bienemy, C., Berg, J.G., Shireman, E., Reneau, K., & Alexander, M. (2018). The 2017 national nursing workforce survey. *The Journal of Nursing Regulation, 9*(3). doi: 10.1016/S2155-8256(18)30131-5
- Society of Pediatric Nurses. (n.d.). *About the society of pediatric nurses*.
<http://www.pedsnurses.org/page/about-spn>
- Sorra, J.S., & Dyer, N. (2010). Multilevel psychometric properties of the AHRQ hospital survey on patient safety. *BMC Health Services Research, 10*(199), 1-13. doi: 10.1186/1472-6963-10-199
- Sorra, J., Gray, L., Streagle, S., Famolaro, T., Yount, N., & Behm, J. (2018). *AHRQ hospital survey on patient safety culture: User's guide*. (AHRQ Publication No. 18-0036-EF). Rockville, MD: Agency for Healthcare Research and Quality.
<http://www.ahrq.gov/professionals/quality-patientsafety/patientsafetyculture/hospital/index.html>
- Streiner, D.L., & Cairney, J. (2007). What's under the ROC? An introduction to receiver operating characteristics curves. *The Canadian Journal of Psychiatry, 52*(2), 121-128.
- Stockwell, D. C., Bisarya, H., Classen, D. C., Kirkendall, E. S., Landrigan, C. P., Lemon, V., Tham, E., Hyman, D., Searles, E., Hall, M., Muething, S.E., Schuster, M., & Sharek, P.J. (2015). A trigger tool to detect harm in pediatric inpatient settings. *Pediatrics, 135*(6), 1036-1042. doi: 10.1542/peds.2014-2152

- Stockwell, D.C., Landrigan, C.P., Toomey, S.L., Loren, S.S., Jang, J., Quinn, J.A., Ashrafzadeh, S., Wang, M.J., Wu, M., Sharek, P.J., Classen, D.C., Srivastava, R., Parry, G., & Schuster, M.A. (2018). Adverse events in hospitalized pediatric patients. *Pediatrics*, *142*, doi: 10.1542/peds.2017-3360
- Stratton, K.M., Blegen, M.A., Pepper, G., & Vaughn, T. (2004). Reporting of medication errors by pediatric nurses. *Journal of Pediatric Nursing*, *19*, 385-391. doi: 10.1016/j.pedn.2004.11.007
- Taylor, J. A., Brownstein, D., Klein, E. J., & Strandjord, T. P. (2007). Evaluation of an anonymous system to report medical errors in pediatric inpatients. *Journal of Hospital Medicine: An Official Publication of the Society of Hospital Medicine*, *2*(4), 226-233. doi: 10.1002/jhm.208
- Teng, C.I., Ho, L.H., & Chen, W.C. (2009). Improving health professional services: Applying the theory of reasoned action to examine determinants of intention to report patient safety events. *Management Review*, *28*, 137-140.
- The Health Foundation. (2011). *Evidence scan: High reliability organisations*. Retrieved from <https://www.health.org.uk/sites/default/files/HighReliabilityOrganisations.pdf>
- The Joint Commission. (2017). *Sentinel event alert*. https://www.jointcommission.org/assets/1/18/SEA_57_Safety_Culture_Leadership_0317.pdf
- The Office of the National Coordinator for Health Information Technology. (2018). *What is computerized provider order entry?* <https://www.healthit.gov/faq/what-computerized-provider-order-entry>

- Throckmorton, T., & Etchegaray, J. (2007). Factors affecting incident reporting by registered nurses: the relationship of perceptions of the environment for reporting errors, knowledge of the nursing practice act, and demographics on intent to report errors. *Journal of PeriAnesthesia Nursing*, 22, 400-412. doi: 10.1016/j.jopan.2007.09.006
- Toruner, E.K., & Uysal, G. (2012). Causes, reporting, and prevention of medication errors from a pediatric nurse perspective. *Australian Journal of Advanced Nursing*, 29(4), 28-35.
- Tucker, A.L., Nembhard, I.M., & Edmondson, A.C. (2007). Implementing new practices: An empirical study of organizational learning in hospital intensive care units. *Management Science*, 53(6), 894-907. doi: 10.1287/mnsc.1060.0692
- Tucker, A.L., Zheng, S., Gardner, J.W., & Bohn, R.E. (2018). When do workarounds help or hurt patient outcomes? The moderating role of operational failures. *Journal of Operations Management*, 66, 67-90. doi: 10.1002/joom.1015
- Van Den Bos, J., Rustagi, K., Gray, T., Halford, M., Ziemkiewicz, E., & Shreve, J. (2011). The \$17.1 billion problem: The annual cost of measurable medical errors. *Health Affairs*, 30(4), 596-604. doi: 10.1377/hlthaff.2011.0084
- Weick, K.E., & Sutcliffe, K.M. (2007). *Managing the unexpected: Resilient performance in the age of uncertainty*. New York, NY: John Wiley & Sons.
- Vaughan, D. (2006). Changing NASA: The challenges of organizational system failures. In S.J. Dick & R.D. Launius (Eds.). *Critical Issues in the History of Spaceflight*. (pp. 345-375). Washington D.C.: National Aeronautics and Space Administration.
- Vaughn, D. (2016). *The challenger launch decision, risky technology, culture, and deviance at NASA*. Chicago, IL: The University of Chicago Press

- Veazie, S., Peterson, K., & Bourne, D. (2019). *Evidence brief: Implementation of high reliability organization principles*. Washington, DC: Evidence Synthesis Program, Health Services Research and Development Service, Office of Research and Development, Department of Veterans Affairs. VA ESP Project # 09-199.
- Vessey, J. A., DeMarco, R., & DiFazio, R. (2010). Bullying, harassment, and horizontal violence in the nursing workforce the state of the Science. *Annual Review of Nursing Research*, 28(1), 133-157. doi: 10.1891/0739-6686.28.133
- Vogus, T.J., & Sutcliffe, K.M. (2007a). The safety organizing scale: Development and validation of a behavioral measure of safety culture in hospital nursing units. *Medical Care*, 45(1),46-54.
- Vogus, T.J., & Sutcliffe, K.M. (2007b). The impact of safety organizing, trusted leadership, and care pathways on reported medication errors in hospital nursing units. *Medical Care*, 45(10), 997-1001. doi: 10.1097/MLR.0b013e318053674f
- Vogus, T.J., & Sutcliffe, K.M. (2012). Organizational mindfulness and mindful organizing: A reconciliation and path forward. *Academy of Management Learning and Education*, 11(4), 722-735. doi: 10.5465/amle.2011.0002C
- Vogus, T.J., & Iacobucci, D. (2016). Creating highly reliable health care: How reliability-enhancing work practices affect patient safety in hospitals. *Industrial and Labor Relations Review*, 69(4), 911-938. doi: 10.1177/0019793916642759
- Vrbnjak, D., Denieffe, S., O’Gorman, C., & Pajnkihar. (2016). Barriers to reporting medication errors and near misses among nurses: A systematic review. *International Journal of Nursing Studies*, 63, 162-178. doi: 10.1016/j.ijnurstu.2016.08.019

- Wakefield, B.J., Blegen, M.A., Uden-Holman, T., Vaughn, T., Chrischelles, E., & Wakefield, D.S. (2001). Organizational culture, continuous quality improvement, and medication administration error reporting. *American Journal of Medical Quality*, *16*(4), 128-134. doi: 10.1177/106286060101600404
- Wakefield, D.S., Wakefield, B.J., Uden-Holman, T., & Blegen, M.A. (1996). Perceived barriers in reporting medication administration errors. *Best Practices: Benchmarking Healthcare*, *1*(4), 191-197.
- Wolf, Z.R., & Hughes, R.G. (2008). Chapter 35: Error reporting and disclosure. In *Patient Safety and Quality: An Evidence-Based Handbook for Nurses* (pp. 1-47). Agency for Healthcare Research and Quality.
- Yoo, M.S., & Kim, K.J. (2017). Exploring the influence of nurse work environment and patient safety on attitudes toward incident reporting. *The Journal of Nursing Administration*, *47*, 434-440. doi: 10.1097/NNA.0000000000000510
- Yung, H.P., Yu, S., Chu, C., Hou, I.C., Tang, F.I. (2016). Nurses' attitudes and perceived barriers to the reporting of medication administration errors. *Journal of Nursing Management*, *24*, 580-588. doi: 10.1111/jonm.12360

APPENDIX A

Demographic Form

1. Are you currently licensed and employed as a staff nurse providing direct patient care to pediatric patients in the acute care setting?

Yes

No (thank you for your time, currently ineligible to participate in this survey).

2. Where do you reside? (drop down: state/province)

3. What year were you born? (drop down: year)

4. Are you Hispanic or Latino/a?

Yes

No

5. Which of the following best describes your racial background?

American Indian or Alaska Native

Asian

Black or African American

Native Hawaiian or Other Pacific Islander

White

6. What sex were you assigned at birth?

Female

Male

Prefer not to answer

7. What is your current gender identity?

Female

Male

Transgender Male/ Trans Man/ FTM

Transgender Female/ Trans Woman/ MTF

Gender Non-Conforming/ Gender Queer

Prefer not to answer

8. Which of the following best describes your sexual orientation?

Lesbian, Gay, or Homosexual

Straight or Heterosexual

Bisexual

Something else

I am not sure

Prefer not to answer

9. What is the highest nursing degree you have completed?

- Diploma in nursing
- Associate degree in nursing
- Bachelor's degree in nursing
- Master's degree in nursing
- PhD in nursing
- DNP
- Other (Please specify)
- Prefer not to answer

10. If responds yes to anything above a Bachelor's in nursing:

Are you an Advanced Practice Registered Nurse (APRN)?

- Yes, Certified Nurse Midwife (CNM)
- Yes, Clinical Nurse Specialist (CNS)
- Yes, Certified Registered Nurse Anesthetists (CRNA)
- Yes, Nurse Practitioner (NP)
- Yes, Other (please specify)
- No
- Prefer not to answer

11. Do you have any professional certifications?

- Yes
- No
- Prefer not to answer

12. Which professional certifications do you have? (Select all that apply)

- CHPPN (Certified Hospice and Palliative Pediatric Nurse)
- CPEN (Certified Pediatric Emergency Nurse)
- CPHON (Certified Pediatric Hematology Oncology Nurse)
- CPN (Certified Pediatric Nurse)
- CPON (Certified Pediatric Oncology Nurse)
- PCNS-BS (Pediatric Clinical Nurse Specialist)
- PMHCNS-BC (Psychiatric and Mental Health Clinical Nurse Specialist)
- PPCNP-BC (Pediatric Primary Care Nurse Practitioner)
- Other (Please specify)

13. How many years have you been working as an RN? (text entry)

14. How many years have you been working as a pediatric RN? (text entry)

15. How many years have you been working at your current hospital? (text entry)

16. How many years have you been working on your current nursing unit? (text entry)

17. On average, how many hours per week do provide direct patient care? (drop down)

<8

- 8-11.9
- 12-15.9
- 16-19.9
- 20-23.9
- 24-27.9
- 28-31.9
- 32-35.9
- 36-39.9
- 40+
- Per-diem

18. On average, how many patients are you assigned every shift? (drop down)

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

19. What best describes where you work?

- A free-standing pediatric hospital or clinic
- A pediatric hospital or unit within an adult hospital or clinic
- A hospital or clinic combining care for adult and pediatric patients
- Other (please specify)

20. What type of unit do you work on?

- Medical/Surgical
- Intensive Care
- Operating Room
- Emergency Department
- Specialty
- Other (please specify)

21. Does your facility have Magnet designation?

- Yes
- No
- No, but the organization is working towards it
- Unsure

22. Is your facility considered a “high reliability organization” (HRO)?

- Yes
- No

No, but the organization is working towards it
Unsure

23. Is your facility unionized?

Yes

No

No, but the organization is working towards it

Unsure

APPENDIX B

Safety Organizing Scale

Please respond to the following items. Answer each question for the extent to which it characterizes the behavior of people with which you currently and regularly work (e.g., people in your department, clinic, etc.).

Give a numerical response from 1 to 7 for each question. 1 meaning “not at all” and 7 meaning “to a very great extent.”

1. When giving report to another employee, we usually discuss what to look out for: _____
2. We spend time identifying activities we do not want to go wrong: _____
3. We discuss alternatives as to how to go about our normal work activities: _____
4. We have a good understanding of each other’s talents and skills: _____
5. We discuss our unique skills with each other so we know who on the unit has relevant specialized skills and knowledge: _____
6. We talk about mistakes and ways to learn from them: _____
7. When errors happen, we discuss how we could have prevented them: _____
8. When attempting to resolve a problem, we take advantage of the unique skills of our colleagues: _____
9. When a patient crisis occurs, we rapidly pool our collective expertise to attempt to resolve it: _____

Final Score: _____

APPENDIX C

Team Psychological Safety Survey

On your work unit/team....

1. If you make a mistake on this team, it is often held against you (R).

Never Rarely Sometimes Most of the Time Always

2. Members of this team are able to bring up problems and tough issues.

Never Rarely Sometimes Most of the Time Always

3. People on this team sometimes reject others for being different (R).

Never Rarely Sometimes Most of the Time Always

4. It is safe to take a risk on this team.

Never Rarely Sometimes Most of the Time Always

5. It is difficult to ask other members of this team for help. (R).

Never Rarely Sometimes Most of the Time Always

6. No one on this team would deliberately act in a way that undermines my efforts.

Never Rarely Sometimes Most of the Time Always

7. Working with members of this team, my unique skills and talents are valued and utilized.

Never Rarely Sometimes Most of the Time Always

APPENDIX D

Intention to Report Safety Events Scale

While at work, if the following events happened, how would you most likely respond?

1. If I make a mistake, that is caught and corrected before affecting the patient, I will report it.

Definitely will: 1 2 3 4 5 6 7: Definitely won't

2. If I make a mistake, but it poses no potential harm to the patient, I will report it.

Definitely will: 1 2 3 4 5 6 7: Definitely won't

3. If I make a mistake, that could have harmed the patient, but ultimately does not, I will report it.

Definitely will: 1 2 3 4 5 6 7: Definitely won't