AN ANALYSIS OF THE INNATE FACTORS IMPACTING PATIENT SAFETY IN OUR HOSPITALS

A THESIS

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By

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On my honor I have neither given nor received unauthorized aid on this thesis.

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Abstract

This study addresses the structural and organizational factors that are associated with varying levels of patient safety in hospitals across the U.S. With a sample of 1,171 nurses across 27 hospitals, I use t-tests and logistic regression analysis to examine the factors that have an association with nurse perceptions of patient safety. The subjective nature of this study focuses on nurse perceptions of quality care. Frequent pressure, dysfunction, and a lack of collaboration between nurses and physicians as felt by nurses prove to be associated with poor patient safety in hospitals. The aim of this study is twofold: 1) to bring attention to the prevalence of medical errors due to a lack of patient safety in our hospitals; and 2) to highlight the factors that are creating unsafe environments for patients in hopes of guiding future policymakers, labor-rights activists, and healthcare organizations to put patients first.

Introduction

Medical errors are the third leading cause of death in the United States and account for more than 250,000 deaths a year worldwide (Michael 2019). It is the equivalent to a jumbo jet crashing every day. Although the definition of medical errors may vary, the Institute of Medicine defines them as, "the failure to complete a planned action as intended or the use of a wrong plan to achieve an aim" (Kohn et al. 1999:1). Medical errors and a lack of patient safety are often the results of organizational dysfunction, labor force dynamics and the pressure that is put on nurses in our hospitals.

Recent health reforms, including the Affordable Care Act, have attended to the issue of medical errors and insufficient quality of care. The awareness of substandard care in our hospitals needs to be widespread in working toward reducing the present issue. The Affordable Care Act has established three initiates for the Centers for Medicare and Medicaid to reward or penalize hospitals based on their performance and safety. They have created a program called the Hospital-Acquired Condition Reduction Program which penalizes hospitals with high rates of patient injury and a lack of patient safety. 1,865 out of the country's 5,267 hospitals have been penalized since the introduction of the program in 2015. The punishment consists of a 1% cut in payment for every fiscal year by Medicare. The Value-Based Purchasing Program is a performance-based reward program for hospitals. It evaluates them on varying measures of care and either rewards or penalizes them based on those measures. The Readmissions Reduction Program reports all-cause readmissions within 30 days of a patient's release. It was estimated that in 2017, 2,596 hospitals in the U.S. were expected to be fined $528 million due to readmissions. In implementing these initiatives, Medicare and Medicaid Services are hoping to encourage better care within our hospitals without completely dropping their programs (Rau 2020). These programs are part of the national strategy to address and fix the present issue seen in hospitals (Eloquest 2017).

Calls within medical professions have also brought awareness to the prevalence of medical errors and attention to the patient safety issue. Health care providers are themselves beginning to respond more publicly about how workplace conditions and constraints are compromising their ability to provide safe, effective care. Comments have been made on the "moral injury" that nurses experience due to the struggles they face at work. Moral injury is defined as, "the emotional, physical, and spiritual harm people feel after perpetrating, failing to prevent, or bearing witness to acts that transgress deeply held moral beliefs and expectations"

(Bailey 2020:1). This term which originally stems from the sentiment of soldiers post-war, has now been applied to health care and has been used by nurses to describe the anguish they feel. Bailey states, "4 in 10 physicians report feelings of burnout, according to the 2019 Medscape report. And the physician suicide rate is more than double that of the general population" (Bailey 2020:3). Wan (2019) told a similar story from a report done by the National Academy of Medicine. He describes America's healthcare system as a broken one in which nurses are forced to work like error-prone "zombies" (Wan 2019). Evidently, there is a flaw in the present system. High rates of patient injury, the moral distress nurses experience, and the larger systematic pressure and dysfunction in hospitals run parallel to the trends we see in hospitals lacking patient safety.

This study addresses the many structural and organizational factors within our hospital systems that contribute to poor quality of care. I use t-tests and regression models to examine these factors. I use nurses' perceptions of care as they are a strong indicator of the actual care within hospitals. Drawing on relevant literature, I assess whether and to what degree nurses' perceptions of institutional dysfunction, work pressures, and physician-nurse relations are associated with their perceptions of patient safety.

Literature Review

Throughout the past half-century, awareness around healthcare quality and safety has risen due to the prevalence of medical errors and the lack of adequate patient safety seen in our hospitals. The discussion around patient safety has gone through several shifts of topical interest but has ultimately tried to grasp what factors are impacting patient safety in our hospitals and what changes need to be made to better their systems and provide the utmost safety to patients (Waring et al. 2016). Patient safety revolves greatly around the factors that affect nurses, as nurses are at the forefront of care for patients. Rather than placing individual blame on nurses or physicians for error, attention to the wider system of care such as communication patterns, culture, and management has begun to be addressed. In the report, *To Err is Human*, the authors wrote, "building safety into processes of care is a more effective way to reduce errors than blaming individuals…The focus must shift from blaming individuals for past errors to a focus on preventing future errors by designing safety into the system" (Kohn et al. 1999:5).

With the inevitability of error, inconsistencies in medical knowledge, an increasing demand for and shortage of supply in nurses, environmental pressures, and the institutional structures that are present in hospitals, patient safety is at a pinnacle point of concern for hospitals (Carayan and Gurses 2008). Some frequently observed factors that impact patient safety are heavy workload and stress among nurses, inadequate sleep, a lack of communication and teamwork between nurses and physicians, and advances in technology. In order to understand why patient safety is being affected by these factors, it is useful to pull from the theory and developments made in research, policy, and practice.

Complex Systems/Structure of Risk

In *Normal Accidents,* Perrow draws insights from organizational theory to shed light on the idea that no matter how hard we try, accidents are intrinsically going to occur in complex systems. In analyzing risk, his main points of concern are complex interactions and tight coupling. Tight coupling refers to when two elements are dependent on one another. When these

interactions and elements are intertwined, the possibility for risk is increased (Perrow 1999). In *The Limits of Safety,* Sagan who is also interested in this topic focuses his attention on the social and psychological aspects of accidents (Sagan 1993). Sagan elaborates on the high-reliability theory which believes that hospitals can provide consistent excellence in their quality and safety of patient care (Jenson 2007). Perrow was skeptical of Sagan's analysis. Hughes on the other hand, supports Sagan's emphasis on the importance of high reliability. He believes in the idea that organizations can have systems and routines that make errors more visible to nurses and doctors for them to react quickly and fix the problem before the error causes harm to the patient (Hughes 2008). When applying this theory in hospitals, patient safety and quality have improved due to safety interventions, validity in medical knowledge, and double-checking measures (Hughes 2008).

Systems theory is used frequently when understanding the complicated world of healthcare. Kohn discusses the complex systems that are exemplified in many hospital units. He emphasizes the complexity of these systems within intensive and emergency care units. He then goes on to classify health care services as "an industry prone to accidents" (Kohn et al. 1999:60). Errors happen due to human cognitive functions and when there is a mixture of complex interactions occurring, the likelihood of human cognitive functions leading to error, or potential error is increased (Hughes 2008).

Fox offers another interesting perspective to the sociology of healthcare safety and quality (Waring et al. 2016). She is skeptical of the scientific conviction of medical knowledge. Fox believes that there are "gaps" and inconsistencies in medical knowledge that have shaped our modern medicine and have brought about unsafe environments. Among these gaps are the difficulties of maintaining the knowledge and services of modern medicine and the doubts that are created by a variation in scientific findings (Waring et al. 2016). She argues that professional socialization enables the monitoring of these gaps through the control of uncertainty. Fox asserts that this "uncertainty" is often shrouded in silence and that to bridge these "gaps", the uncertainties that are present need to be discussed and made more widely known so that environments can be made safer (Waring et al. 2016).

On a different but important note, it has been difficult for healthcare providers to keep up with the advancements of technology and science in hospital systems. The Institute of Medicine discusses the quality chasm that is seen in healthcare. Medical science and technology have advanced at an extremely rapid rate in the past half-century which has brought growing complexity to systems within healthcare. Americans are also now living longer partly due to these advancements. With that comes an increase in chronic conditions and an increase in the chance for error. With such rapid technological evolvement, the healthcare system has struggled "to translate knowledge into practice and to apply new technology safely and appropriately" (Richardson et al. 2000:1). Sociologists believe that safety issues in the care of patients are unlikely to be alleviated through technological improvements. Many also believe that it will be unlikely for us to see a huge change in the culture and work environment of hospitals because of the economical, institutional, and political environments that are embedded in the industry (Jenson 2008).

Health care systems are complex and have become even more complex as medical knowledge and systems have failed to keep pace with technological advancements. Gaps and inconsistencies in translation and procedures coupled with the ever-evolving science of healthcare have contributed to these challenges. Additionally, complications are only made more likely in this industry so prone to error. The inevitability of error and imperfection of healthcare

needs to be addressed to better grasp the forthcomings of patient safety and to improve safety efforts in hospitals.

Workforce Dynamics

Although there is a structure of risk within hospitals, we also have to think about the workforce dynamics at play when trying to understand some of the factors that lead to unsafe environments. One factor at play that shouldn't be overlooked is the labor force shortage – both as a result of a lack of supply of professionals, but also due to corporate employment practices. Several factors have led to this increasing demand for nurses. The United States population was expected to grow by 18% from 2000 to 2020. The 65-year-old and over population which typically has greater health care needs was estimated to grow by 54%. This increasing population calls for a greater demand in nurses and hospitals to try to maintain the nurse-to-patient ratio (Carayon and Gurses 2008). These factors raise concern because there is already an inadequate number of nurses working in the system today. Additionally, as seen with increasing health care costs, hospitals have reduced their nursing staff and have implemented required overtime to meet high demands. Another result of increased health care costs is that organizations have decreased the length of a patient's stay. Meaning, not only do nurses have an increased workload due to longer hours and fewer medical professionals to split up tasks, they are also working under a more intensive time restraints to get patients healthier quicker (Carayon and Gurses 2008).

Discussion around workload in hospitals has often been associated with patient safety. Heavy workload in the workplace has shown to induce stress, fatigue, and burnout among all industries but is especially apparent in the field of nursing (Carayon and Gurses 2008, Waring et al. 2016, Rogers 2008, Hare et al. 1988, Colligan et al. 2008, McGrath et al. 2003, and Jennings 2008). Increased workload, extended work hours, and lack of sleep in hospitals are factors proven to be conducive of error (Rogers 2008). With an increase in the number of instances to perform under pressure, comes an increase in the chance for something to go wrong. Ultimately all these factors affect a nurse's stress and a patient's safety and satisfaction. When a nurse experiences heavy workload and the stress that comes along with that, they often also have feelings of job dissatisfaction. This can lead to low self-esteem, poor decision making, and an increase in turnover, all, again affecting patient safety (Aitkin et al. 2013). Colligan et al (2008) found that workplace stress was often associated with burnout, illness, and emotional distress. With higher nurse burnout, the cycle of a shortage in nurses continues and the workload continues to increase. Situational level workload can also be affected by a nurse's work unit, the number of patients they are assigned to, family needs, and communication among team leaders (Carayon and Gurses 2008).

Stress, as mentioned is another huge outcome of heavy workload experienced by nurses. McGrathe, Reid, and Boore (2003) found that the most commonly marked stressor among nurses was experiencing too little time to perform the duties that were needed to get done to satisfy their patients. Half of the respondents in their study reported that stress stemmed from imposed deadlines (McGrathe et al, 2003). Cognitive resources are often reduced when feelings of stress and anxiety are present. When cognitive resources are reduced and workload is increased, there is also often a reduction in attention to tasks, leading to unsafe environments (Carayon and Gurses 2008).

Decision making becomes impaired when nurses experience stress, inadequate sleep, an increase in patients, and extended work hours in the workplace. Carayon and Gurses (2008:206)

found that each additional patient that was assigned to a nurse, "was associated with a 7 percent increase in the likelihood of mortality within 30 days of admission and in the likelihood of failure to rescue". Heavy workload among nurses leads to fatigue, chaos, and confusion on unit floors that often take a toll on the patient. Most hospital staff nurses now work 12-hour shifts and some reported working as much as 20 consecutive hours in one shift (Rogers 2008). Insufficient sleep is associated with a nurse's work performance in regard to safety risks, their mood, cognitive function, and overall satisfaction (Rogers 2008). This imbalance of work distribution is engrained in our hospital systems.

Nurses spend a significant amount of their time working to administer medications. Errors due to mistakes in medication administration have had the greatest impact on causing patients harm (Kelly 2003, Bates 1995, Hicks 2004, Beyea 2003). These errors occur due to a lack of concentration and communication, an increase in workload, and distractions (Hughes 2008). Physicians are responsible for prescribing and transcribing medications while nurses are responsible for administering them to patients (Hughes 2008). When a physician makes an error in medication administration, it can be intercepted by pharmacists or nurses but when a nurse makes an error in medication administration, it is up to their peers, patients, or patients' families to notice that something may be wrong. The American Academy of Pediatrics and hundreds of other organizations are making efforts to increase patient and family-centered care as the family plays a vital role in noticing and pointing out these slips (O'Malley et al. 2019). A focus on pulling the family into the care of the patient is an extremely important factor in working towards the fullest quality and safety of care within hospitals (O'Malley et al. 2019). Error due to medication administration can occur due to many factors many of which have already been mentioned including; heavy workload, stress, fatigue, and a lack of communication and collaboration between nurses, physicians, and patient families due to institutional structures within the hospital.

Mason (2008) found that participants in her study identified barriers to safer medication administration and patient safety related to their work environment. Some of these barriers were, a culture lacking safety, communication, teamwork, and voices of lead nurses in important decision-making (Mason 2008). Hospitals with lower-rated work environments have increased odds of mortality (Olds et al. 2017). Nurses and physicians are essential actors in hospitals. Their relationship with one another and the patient is one that can have a profound effect on patient safety. Establishing collaboration between the two has been a long struggle.

A hospital's work environment has a huge impact on creating possibilities for collaboration and fostering a culture of patient safety (Olds et al. 2017, Jennings et al. 2008, Hughes 2008). West (2000) offers insight into the social structures within hospitals that may contribute to a lack of communication. She discusses the homophily principle which she argues has created boundaries and social limitations within hospital work environments (West 2000). The homophily principle is the idea that individuals tend to migrate towards others that are similar to them and stay within those boundaries rather than mingling with people who are different from themselves. This causes barriers to communication within hospitals as it often creates cliques and a lower likelihood of open and often collaboration among all staff members (West 2000).

A lack of communication and collaboration can also be the result of many other environmental factors. In the classroom at nursing/medical school, nursing students and medical students have little to no interaction. This leads to a culture of separation which is then carried on in hospitals. This lack of communication and teamwork often leads to breakdown and frustration

which can then result in error (Benike and Clark 2013). Benike and Clark (2013) discuss how The General Pediatric Unit at the Mayo Clinic in Rochester, Minnesota formed a committee to discuss communication, teamwork, and patient care within their unit. One of the factors they saw that created a lack of communication was the fact that nurses and physicians didn't fully have a grasp about each other's work. The nurses' and physicians' perceptions of each other's work was very different from what each actually does in their day to day. This was another cause of breakdown (Benike and Clark 2013). The structures that brought about disinvolvement in schooling between the physicians and nurses had a clear impact on the way they later interacted in their work environments.

In a 1986 report of the *Annals of Internal Medicine,* researchers found that "nurse-physician relations were the single most important predictor of mortality rates in 13 intensive care units in academic medical centers" (Mason 2008). Many of the nurses who participated in the survey reported not communicating with the doctors they were working with regarding patient care because they were intimidated as they had experienced verbal abuse in the past when doing so (Mason 2008). There is a clear moral imperative present in the organizational hierarchy that is engrained in our hospital systems. Substandard care has become normalized within the culture of hospitals (Waring et al. 2016). Why is acting in the best interest of the patient jeopardized by a shortage of nurses, the work environment and this rigid hierarchy? These long-standing issues are at a time of desperation and as nurses play such an important role in patient safety, there is a need for them to call for change and demand for a system that puts patients first (Mason 2008).

Reporting on the quality of safety and care can be a difficult thing to measure in hospitals. Since nurses are the primary providers of care to patients, they are some of the best reporters on this topic. McHugh and Stimpfel (2012) assessed the validity of nurse reported hospital quality and care and actual hospital performance to tell how useful indicators nurses can be of the quality and care of hospitals. They found that a "10% increment in the proportion of nurses reporting excellent quality of care was associated with lower odds of mortality and failure to rescue, greater patient satisfaction, and higher composite process of care scores" for a range of patients (McHugh and Stimpfel 2012:2). This study gives validity to the data gathered from nursing surveys on hospital patient safety and care.

To go further in understanding the theory, policy, and research done on patient safety in hospitals, it is useful to look at the data that has been gathered on the topic. By pulling data from a large enough sample size, it is possible to analyze and compare some of these important concepts and factors that are so often mentioned in the literature. Insight from nurses is one of the best ways to assess the patient safety of a hospital. When compiling and utilizing nurse reported data, variables can be manipulated to try to pin down which and how much certain factors are impacting different levels of perceived patient safety within hospitals. In this research project, I will examine nurses' perceptions of patient safety within their hospitals. I will look at questions that ask them about complex systems, collaboration, satisfaction, and institutional pressures. In doing so, I hope to home in on some of the factors that may be negatively affecting patient safety.

Methods & Data

To conduct this research project, I used data from the 2016 Newly Licensed Registered Nurse New Cohort 3 Survey. This third wave panel survey was conducted in the United States and was funded by the Robert Wood Johnson Foundation as part of the RN work project which is a national study of new nurses. The surveys were distributed to 27 sites and across 14 states to newly registered nurses. Ten of the states were able to provide perfect lists of nurses who had obtained their license during the time period of interest, August 1, 2014 to July 31, 2015. The total number of surveys sent out was 3,780. Of those, 1,171 were completed and eligible. The response rate was 36% as estimated by the PSRAI (Kovner 2016).

The survey was a means of receiving feedback from nurses on questions regarding turnover, nursing education, job satisfaction, and attitudes toward their work environments. The study aims to understand the needs and challenges nurses face, their reasoning for staying within a job or leaving, and to compare different job settings. The data was also used to help point out the similarities and differences between nurses graduating in different years. Since nurses are the primary caregivers to patients, the researchers decided to use their feedback as a way of figuring out what sorts of changes need to be made to the systems in place to ensure the utmost quality of care (Kovner 2016).

The concepts I focus on in this study and draw from in the data set are the pressures that are placed on nurses, the dysfunction that is often present due to complex systems, and the level of collaboration between nurses and physicians. Ultimately, I observe several variables that together measure each one of these concepts. In doing so, I can begin to see whether the concepts have an association with patient safety and whether they coincide with the literature. To see if any of them have an association, I test each of these concepts with my primary variable of focus, nurse perceptions of patient safety within their hospital setting. The nurse reported overall patient safety grade is treated as the dependent variable in my testing. It was an ordinal variable and was originally broken down into five different categories: “failing”, “poor”, “acceptable”, “very good”, and “excellent” (Kovner 2016). I decided to collapse this variable and make it dichotomous where a higher value represents a deficient patient safety grade. I collapsed the “failing”, “poor”, and “acceptable” categories under deficient status and collapsed the “very good” and “excellent” categories under the not deficient status. My dichotomous dependent variable indicates a deficient status or not. Ultimately, I define my “deficient” grade as anything less than very good. I made my dependent variable dichotomous in order to keep the results clean and simple. Had I stuck with running an ordered logistic regression, the results would have shown a similar pattern as the logistic regression results presented in this study.

I generated a dichotomous variable to capture whether a nurse gave their unit a deficient grade or not. My dependent variable is thus based on nurses’ perceptions of patient safety. I will be looking at how their perceptions of patient safety are associated with their ratings of workplace conditions. I am confident in my decision to use this subjective nurse data as a measure of patient safety because McHugh and Stimpfel (2012) confirm its validity in their research as mentioned previously. Additional data editing included renaming and recoding all the relevant variables. I recoded certain variables because I wanted them to coincide with the levels of my dependent variable, nurse perceptions of patient safety grade (deficient grade with the higher value (1) and not deficient grade with the lower value (0)).

To generate the most valid and reliable measures of my complex, multi-dimensional concepts, I generated three composite variables. I wanted to use composites that spoke to some

of the concepts in my literature review (complexity/risk of systems, collaboration or lack thereof, and work pressure/shortage of nurses). Before operationalizing the variables, I tested for factor loading and unique variances to see if they were worth collapsing. I used a benchmark horst of 0.4. With a strong correlation between my variables and the factor, values >.65, I generated the composites. I also tested the strength of the composites by simply using the alpha command. Each Chronbach alpha score was above .8 indicating strong coherence in responses to the variables.

There were a series of questions in the survey that asked nurses about their perceptions of collaboration between them and the physicians they work with. More specifically they asked whether nurses agreed or disagreed with statements around there being strong nurse/physician relationships, and teamwork and collaboration between the two. I wanted to create this composite to have a variable that measures an overall perception of the extent of collaboration between the nurses and physicians. In doing so, I would be able to gain an understanding of the organizational hierarchy that is often seen in hospitals. Another series of questions asked nurses about their perceptions of function and dysfunction within their work environment. Factors that measure this included lack of information, incorrect instruction, interruption by others, lack of equipment, and organizational rules and procedures. Nurses selected answers that indicated the frequency of times that those factors occurred for them in a given week and/or month. This composite measures the complexity of systems and the organizational dysfunction that occurs in hospitals. My last composite included a series of questions that asked nurses about factors that put environmental pressures on them when performing their job. This composite contained only two variables, inadequate help, and conflicting job demands. This composite measures the pressure that is put on nurses and points to how the shortage of nurses has affected that pressure. Details of the variables used are described in a descriptive statistics table as seen in Table 2 (Kovner 2016).

Table 1 lays out the correlation coefficients for each independent variable which is useful to note when understanding the correlation of means and how they cohere. The strongest correlation is between dysfunction and pressure. Since the correlation between the two is positive, it indicates that as one increases so does the other. The collaboration variable is less correlated with dysfunction and pressure, but we can see that since the correlation is negative, it decreases as the others increase and vice versa.

Table 1. Correlation Coefficients for Independent Variables

	Dysfunction	Pressure	Collaboration
Dysfunction	1.00		
Pressure	0.70	1.00	
Collaboration	-0.26	-0.20	1.00

I used Stata Statistical Software to conduct my analyses. I ran bivariate tests to examine each of my composite variables independently with my dependent variable. T-test analyses adjusted for unequal variances. After running the t-tests, complimentary graphs (box plots) and margins graphs were produced. Following the bivariate analyses, I conducted multivariate logistic regression analyses. I began to conduct my multivariate analysis using multivariate logistic regression predicting the log odds of the outcome for a one-unit increase in the composite variables. A check for multicollinearity revealed no issues in the model. My regression results were additionally plotted using the coefplot command. The

margins/marginsplot commands were used to calculate and graph predicted probabilities of a deficient grade at different levels of my independent variables. Further analysis on the bivariate and multivariate testing will be made in the following section.

Table 2. Descriptive Statistics of Regression Variables (n=1,099)

	% (n)			
Dependent Variable				
Overall Patient Safety Grade(Deficient)				
Not Deficient	717 (61.23)			
Deficient	382 (32.62)			
Independent Variables				
	Mean	**SD**	**Min**	**Max**
Pressure Composite	2.56	1.17	1	6
Inadequate Help				
Conflicting Job Demands				
Dysfunction Composites	2.49	.95	1	6
Incorrect Instruction				
Lack of Information				
Organizational Rules				
Lack of Equip/Supply				
Interruption by others				
Phys/Nurse Collaboration Composite	3.03	.58	1	4
Teamwork				
Collaboration				
Good Working Relationship				

Findings

Table 2 provides descriptive statistics of the dependent and independent variables used in my models. Under each composited independent variable are the measures that were used to generate that composite. Details of the variables used to generate the composites are included in the appendices section of the paper under Appendix A. An observation to note within Table 2 is that 33% of nurses rated their hospital unit as having a deficient safety rating. It is important to remember this detail when observing test results from the model below.

I began my testing by developing two-sample t-tests for each independent variable with the dependent variable. There were unequal variances in each composite tested with the dependent variable which was fixed simply by adding unequal to the end of my t-test command. My dysfunction composite received a Cohen's d of -.86 indicating a large effect size, my pressure composite received a Cohen's d of -.93 indicating a large effect size, and my collaboration composite received a Cohen's d of .53 indicating a moderate effect size. For each t-test, the corresponding two tailed p-values were less than 0.05: dysfunction p-value=0.000, pressure p-value=0.000, and collaboration p-value=0.000. The difference in means for each composite variable between both categories within my dependent variable (deficient status) were

different from 0 which allowed for differences in variances across groups. Pressure on nurses as compared to deficiency received a t-statistic of -14.69, dysfunction of a hospital as compared to deficiency received a t-statistic of -13.63, and collaboration levels as compared to deficiency received a t-statistic of 8.15, indicating that there is strong evidence of departure from the null hypothesis for each independent variable. Table 3 represents the results of all three t-tests with their descriptive statistics.

Table 3 *Results of t-tests and Descriptive Statistics Pressure, Dysfunction, and Collaboration by Deficiency*

Outcome	Deficiency						95% CI for Mean Difference	t	p
	No			Yes					
	M	SD	n	M	SD	n			
Pressure	2.20	1.07	713	3.30	1.35	381	-1.02	-14.69	0.000
Dysfunction	2.23	.81	713	3.00	1.02	381	-77	-13.63	0.000
Collaboration	3.14	.55	677	2.84	.60	369	.30	8.15	0.000

p-values based on two tailed tests of significance

In Figure 1, the margins-based box plot displays the confidence intervals and means for the pressure, dysfunction, and collaboration variables. It is evident that the higher mean values for pressure and dysfunction (indicating more pressure and dysfunction) get produced under the deficient patient safety grade and the lower mean values for pressure and dysfunction (indicating less pressure and dysfunction) get produced under the not deficient patient safety grade. The box plot also shows that the higher mean values for collaboration (indicating more collaboration) get produced under the not deficient patient safety grade and the lower mean values for collaboration (indicating less collaboration) get produced under the deficient patient safety grade.

Figure 1. Distribution of Nurses Responses by Deficient Grade Status

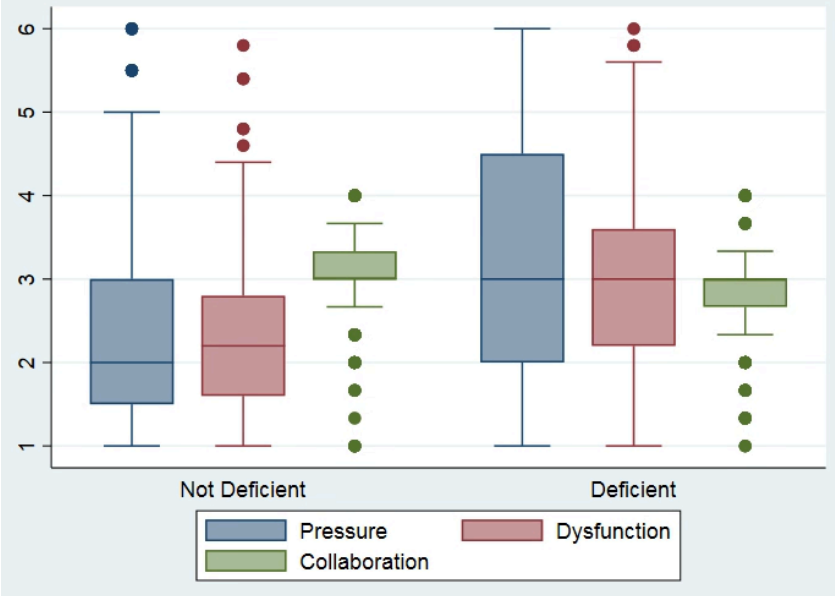


Figure 2 conveys the results from the multivariate logistic regression test. It presents the coefficients with their standard errors, the z-statistic, p-values, and their 95% confidence

intervals. The regression coefficients give us the change in log odds of the outcome for a one unit increase in the independent variables. Nurses perceived dysfunction, pressure, and collaboration have a significant association on their perception of the overall patient safety rating of their hospital.

In figure 2 we can see that for a one unit increase in dysfunction, the odds of having a deficient patient safety grade increases by a factor of 1.57. For a one unit increase in pressure, the odds of having a deficient patient safety grade increases by a factor of 1.61. Lastly, for a one unit increase in collaboration, the odds of having a deficient patient safety grade decreases by .5. Hospitals in which nurses reported higher levels of dysfunction and pressure had worse patient safety ratings while hospitals in which nurses reported higher levels of collaboration had better patient safety ratings. The confidence intervals for collaboration tells us that we can be fairly certain of the odds that are displayed. The wider CIs seen for pressure and dysfunction, as also seen in Figure 1 tell us that there is a greater range in possible results for these variables, but that doesn't change the odds likelihood. The CI ranges for dysfunction, pressure, and collaboration are shown in Figure 2 in parenthesis. The regression tells us that 1,042 observations were used in this model, indicating that the missing values for different variables were dropped, leaving only the common observations among each in the model.

Figure 2. Integrated Regression Results

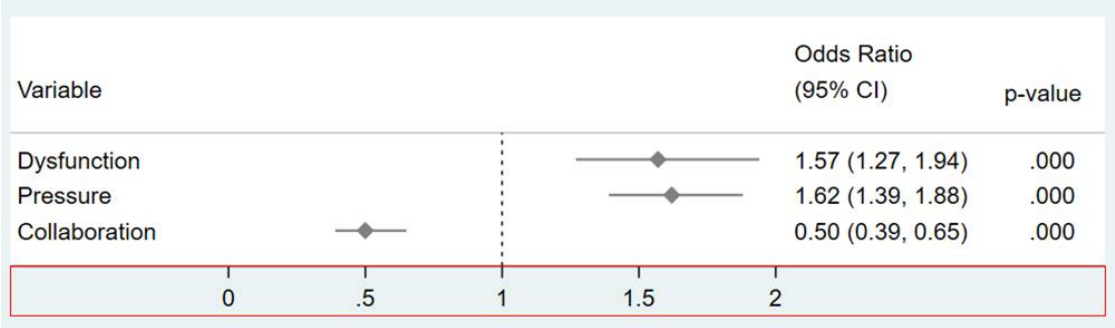
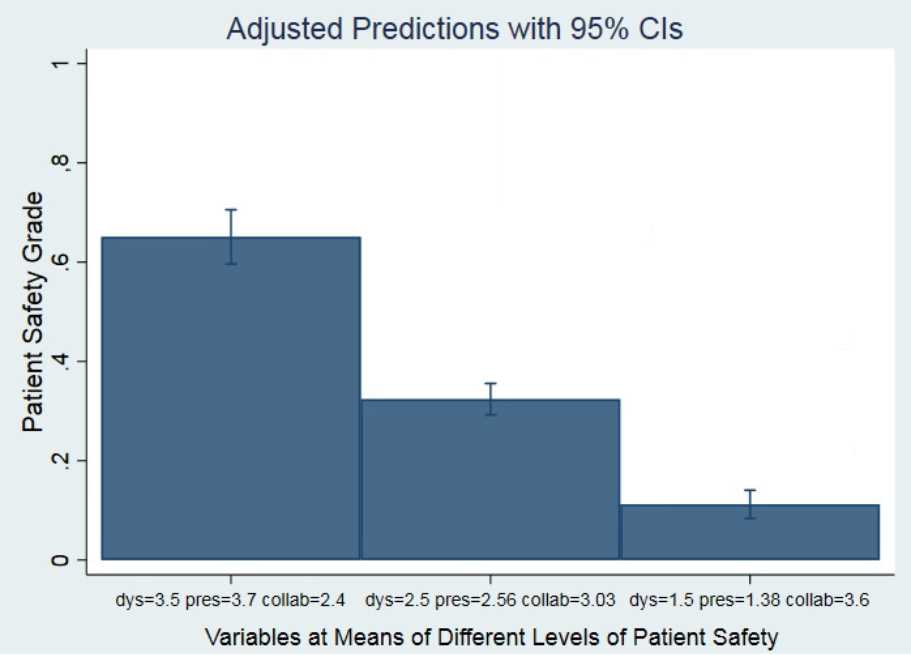


Figure 3 presents the predicted probabilities, calculated from the logistic regression model for each independent variable held at specified means and versions of those means. The mean values used for each independent variable included the actual mean of each variable as well as values one standard deviation above and one standard deviation below. When using these different versions of mean values, it is possible to see the predicted results of patient safety grade if those means were to go up or down. When entering designated means into the command, it was important to keep in mind that the collaboration variable runs in the opposite direction of the other two in terms of better/worse. Because of this, in the test series with included means, I purposefully put the one standard deviation above mean of collaboration with the one standard deviation below means of pressure and dysfunction. This way, when viewing results, I would hope to find a correlation that made sense with all three of the composites.

Figure 3 is similar in ways to the t-test margins-based graph as it shows the predicted probability of means at varying levels of overall patient safety grade. The difference though is that in the multivariate logistic regression test, we can see how those means acting together are distributed across varying patient safety grades. Figure 3 shows the predicted probability of a deficient grade when favorable conditions are low (1 standard deviation below), at their means, or high (1 standard deviation above). As shown, for a one standard deviation increase in the

mean of pressure (3.7) and dysfunction (3.5) and a one standard deviation decrease in the mean of collaboration (2.4), the predicted probability is much closer to the deficient rating of patient safety. The predicted probability of patient safety grade with these mean values is 0.66. When the actual reported mean values of each variable are combined, pressure (2.56), dysfunction (2.5), and collaboration (3.03), the predicted probability of patient safety grade is 0.32 which is much closer to the not deficient score than with the previous mean values. This makes sense because 61.23% of the nurse reported patient safety grades were in the not deficient category. Lastly, when there is a one standard deviation decrease in the mean of pressure (1.38) and dysfunction (1.5) and a one standard deviation increase in the mean of collaboration (3.6), the predicted probability of patient safety grade is .1 indicating a close prediction to the not deficient patient safety grade. With a 95% confidence interval, we can be fairly certain of the results displayed.

Figure 3. Variables at Means of Difference Levels of Patient Safety



Discussion and Conclusion

Overall, all three of the factors addressed in this study prove to be associated with varying levels of patient safety. The pressure nurses feel and the dysfunction they report show to be more closely associated with deficient patient safety than that of a lack of collaboration between nurses and physicians. An increased number of times a nurse feels pressure or reports dysfunction in their work setting is associated with a nurse reporting a deficient patient safety grade. The more a nurse disagreed with their being collaboration between the nurses and physicians within their unit was associated with a nurse reporting a deficient patient safety grade. These findings correspond with the comments made in the literature. These results are not overly surprising. It is expected that if a nurse responds in a critical way to any of the factors that could negatively affect patient safety, they would also rate their hospitals' patient safety grade poorly.

The inadequate help and conflicting job demand factors that made up the pressure variable were highly associated with the deficient dependent variable. I would argue that these

factors have been further accentuated by the fact that there is a shortage of nurses in today's world. The shortage puts more pressure on nurses. The pressure nurses feel has led to high-stress environments, heavy workloads, low satisfaction, and often burnout continuing the nurse shortage/pressure cycle. As shown by the tests, as a nurse feels more pressure, they are more likely to have worse feelings about patient safety within their hospital. High-pressure work environments often force nurses to hurry to get their tasks done quickly ridding them of their focus on care and attention to detail. This often leads to careless errors and threatens a patient's safety.

Dysfunction characterized by incorrect instruction, interruption, organizational rules, and lack of information and equipment speaks to the complexity of systems and the high chance of risk within hospitals. Thinking back to Perrow's comments on normal accident theory, we are reminded that mistakes are inevitable (Perrow 1999). This is especially true in an industry so prone to error. Even a fully functioning environment is bound to face errors because of the complexity of systems. Hospitals rely on the functionality of their systems. When dysfunction occurs, it is likely that a patient's safety would become threatened. This dysfunction component also speaks to the gaps that are present in medical knowledge. There is extreme difficulty in managing the complexity of modern medicine, technology, and the vast scientific knowledge that is evolving every day. It is natural that gaps occur and go on to affect the guidance that physicians give to nurses regarding instruction, information, rules, etc.

The collaboration variable measured by nurses' perceptions of collaboration, teamwork, and working relationships between them and physicians also has an association with a nurse's overall patient safety grade. Although it is not quite as strong as the pressure and dysfunction variables, the association is still present, and it helps further inform the literature. As nurses are essential actors in patient care, it is important that their voices and concerns be heard. A lack of transparency and communication between the nurses and physicians can lead to breakdown. Nurses may not feel like they can voice their concerns, might be afraid of what will happen if they do, and information/instruction can often get lost in translation when that pathway is not completely clear. This study and the literature on the subject demonstrate how important it is for nurses and physicians to have a good working relationship when working towards providing the safest environments possible.

Together, these factors help point to the broader concepts that are associated with deficient and not deficient patient safety cultures. Identifying the factors that have such a strong association with patient safety helps take away the individual blame that is often put on nurses for making mistakes. Ultimately this study displays that hospitals with worse nurse rated patient safety grades are more likely to have environments where nurses feel frequent pressure, dysfunction, and a lack of collaboration. Continued research and efforts to improve the systems in place are much needed. The normalization of substandard care must be acknowledged by researchers, policy-makers, and health organizations when working to better the current systems in place and to ensure the best possible care and safety for patients.

This study includes some limitations. The measures used in this study are subjective nurse responses which can be a useful way to gauge patient safety levels. With more time and resources, I would have also used objective measures to help answer my research question with more validity and certainty. The sample was fairly large and diverse among 27 hospitals across the country. If I wanted to gain a better cross-cultural understanding of this topic, it would have been useful to have this survey spread across different parts of the world. It was tactful though to have a geographical focus as the results from different countries may have shown a greater

variation in responses and may have obscured the topic. Some implications for future research would be to use qualitative data to gather first-hand accounts of nurse experiences and their direct perceptions. I would also investigate other prevalent factors as mentioned in the literature such as medication administration, advancements in technology, and inconsistencies in medical knowledge.

Appendix A. Frequency distributions of variables making up the composite IVs

Independent variables embedded in composites	% (n)
Inadequate Help	
Never	29.80 (349)
Less than once a month	24.85 (291)
1-3 days per month	16.48 (193)
1-2 days per week	11.87 (139)
3-4 days per week	8.11 (95)
5 or more days per week	3.42 (40)
Conflicting Job Demands	
Never	27.24 (319)
Less than once a month	21.09 (247)
1-3 days per month	19.56 (229)
1-2 days per week	14.18 (166)
3-4 days per week	9.05 (106)
5 or more days per week	3.33 (39)
Incorrect Instruction	
Never	37.97 (410)
Less than once a month	38.79 (429)
1-3 days per month	15.73 (174)
1-2 days per week	4.88 (54)
3-4 days per week	2.26 (25)
5 or more days per week	1.27 (14)
Lack of Information	
Never	1.54 (18)
Less than once a month	5.81 (68)
1-3 days per month	9.82 (115)
1-2 days per week	22.80 (267)
3-4 days per week	32.54 (381)
5 or more days per week	21.95 (257)
Organizational Rules	
Never	1.02 (12)
Less than once a month	3.59 (42)
1-3 days per month	10.76 (126)
1-2 days per week	18.70 (219)
3-4 days per week	28.69 (336)
5 or more days per week	31.43 (368)
Lack of Equip/Supply	

Never	2.73 (32)
Less than once a month	5.29 (62)
1-3 days per month	14.18 (166)
1-2 days per week	24.00 (281)
3-4 days per week	26.64 (312)
5 or more days per week	21.52 (252)
Interruption by others	
Never	14.69 (172)
Less than once a month	21.01 (246)
1-3 days per month	18.10 (212)
1-2 days per week	19.30 (226)
3-4 days per week	14.35 (168)
5 or more days per week	6.40 (75)
Teamwork	
Strongly agree	226 (19.30)
Agree	178 (15.20)
Disagree	631 (53.89)
Strongly disagree	24 (2.05)
Collaboration	
Strongly agree	18.02 (211)
Agree	55.51 (650)
Disagree	14.52 (170)
Strongly disagree	2.22 (26)
Good Working Relationship	
Strongly agree	18.87 (221)
Agree	63.11 (739)
Disagree	7.43 (86)
Strongly disagree	1.20 (14)

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