BEST PRACTICE RECOMMENDATIONS FOR NURSE STAFFING TO
IMPROVE PATIENT SAFETY OUTCOMES IN THE HOSPITAL

By
OLGA LYNN ROMERO

A Thesis Submitted to The W.A. Franke Honors College
In Partial Fulfillment of the Bachelor’s degree
With Honors in
Nursing
THE UNIVERSITY OF ARIZONA
DECEMBER 2022

Approved by:

____________________________
Dr. Goldsmith
Department of Nursing
Abstract
Currently, there are no regulations regarding nurse staffing in most of the United States. Low staffing is associated with increased falls, medication errors, mortality, pressure injuries, and infections. Notable nursing organizations have suggested safe staffing ratios, but ratios experienced nationwide are much higher. There were three aims to this thesis. The first being to highlight the relationship that exists between low nurse staffing levels and patient safety outcomes. The second was to identify nursing-to-patient ratios that reduce the likelihood of adverse patient outcomes on three general nursing units. The last aim was to identify the financial costs associated with negative patient outcomes. Reduction of adverse patient outcomes by utilizing mandated nursing-to-patient ratios can lead to cost savings.

From this research, evidence-based practice guidelines regarding nursing-to-patient ratios were created. Ratios proven to reduce the incidence of these outcomes are 1:4 on medical-surgical units, 1:2 in the intensive care unit, and 1:3 in the emergency department with adjustments made for specific patient populations. Charge nurses, when kept out of staffing, are crucial to patient safety and act as a huge resource for nurses. To keep patients safe and improve retention of nurses, proactive and safer staffing is necessary.
CHAPTER 1

Introduction

Statement of Purpose

There are no established limits on the number of patients a nurse can take care of during their shift. This lack of nurse-to-patient ratio limits is found in all nursing specialties whether it be in the acute care setting of hospitals, or long-term care settings like nursing homes. Professional organizations may set forth standards regarding staffing, but these are merely suggestions. Despite the lack of definitive nurse-to-patient ratios, evidence suggests there are considerable adverse effects on patient well-being when nurses are assigned to care for too many patients. The aim of this thesis is to highlight the extent of the relationship between the number of patients a nurse takes care of and the adverse outcomes that result. Another aim is to identify nurse-to-patient ratios that reduce the likelihood of these outcomes. One last objective is to address the financial costs incurred by these negative outcomes. With this information, an evidence-based practice guideline for hospitals will be created to optimize patient well-being while aiding these facilities to overcome staffing shortfalls that can be costly. These guidelines may also be utilized in creation of legislation regarding staffing at the federal level, whether through congress or by the Centers for Medicare and Medicaid services.

Background and Importance

In the United States as well as many other developed countries, there is a crisis occurring in healthcare. The demand for healthcare workers is increasing, but the supply of workers is not keeping up. This deficit is likely to increase in the next few years due to the large aging population as well as the rise in obesity in society which will lead to an increase in chronic illnesses (Maclean et al., 2014). On top of this, the current COVID-19 pandemic has placed a
large burden on the system. A significant amount of healthcare workers have been diverted to COVID units, facilities, testing, and vaccination centers to combat the pandemic, decreasing the amount of staff available to address the needs of the healthcare system. Although the demand for healthcare workers has increased and is experiencing unprecedented stress from current events, this is not the only problem contributing to the deficit. There is also a large number of healthcare workers leaving their professions altogether (Brook et al., 2018). This is especially true in the nursing field. The reasons theorized for the high turnover rate in nursing include low staffing levels, low job satisfaction, forced overtime, and burnout. Burnout is an emotional state of exhaustion that results in a worker's inability to feel connected to their jobs (Mudallal et al., 2017). Burnout leads to fatigue, depression, and ambivalence. Burnout interferes with the quality-of-care patients receive. As burnout increases, care quality decreases (Mudallal et al., 2017). These factors are interrelated, and, in essence, they feed into one another creating a vicious cycle that is hard to break (Maclean et al., 2014). Furthermore, a large volume of nurses is retiring, and more are set to retire in the coming decade. The average age of nurses is now 50 years old (American Association of Colleges of Nursing, n.d.). Over 1 million nurses will leave the profession due to retirement alone by the year 2030 (American Association of Colleges of Nursing, n.d.).

Professional organizations such as the American Nursing Association (ANA) advocate for safer nursing practices through funding research as well as establishing guidelines regarding nurse-to-patient ratios (American Association of Nurses [ANA], n.d.b). They have their own political action committee (PAC) to aid in the election of nurses in public offices on both sides of the congressional divide (American Association of Nurses [ANA], n.d.b). This is meant to catalyze change in healthcare that benefits nurses and patients alike. They have been successful
in some regard. In 1990 the ANA created the Magnet Accreditation that can be received if hospitals and other healthcare facilities meet certain standards in nursing care. Magnet hospitals tend to have better staffing ratios and lower turnover in nursing due to better working environments. The ANA also helped pass the 2019 Nursing Workforce Development Program ACT which increased funding available nationwide to nursing schools so that nursing programs could be expanded (ANA, 2018). This will lead to an increase in nurses to address the current shortage in the coming years. Furthermore, in 2019, the Nurse Staffing Standards for Hospital Patient Safety and Quality Care Act was introduced to the senate which could potentially result in mandated nurse-patient ratios for the entire country (Brown, 2021). The ratios set forth in this act include a 1:4 ratio in medical-surgical units, 1:3 in the Emergency Department (ED), and 1:1 in the intensive care unit (ICU) (Brown, 2021). Seven states have already instituted safe staffing measures including Washington, Texas, and Nevada with the help of the ANA (ANA, 2018). The specific measures vary but some legislation requires staffing committees composed of nurses to create staffing plans for healthcare facilities (Bartmess et al., 2021). Connecticut, Illinois, Nevada, Ohio, Oregon, and Texas are states that have implemented this type of legislation (Bartmess et al., 2021). Other measures include having legislative guidelines for staffing in place, although these measures are more lenient than mandated ratios. In Massachusetts, the ICU has a mandated ratio of 1:2, and an acuity tool must be used to adjust this ratio (Bartmess et al., 2021). Other areas of nursing are excluded from legislation in Massachusetts. Legislation in states like Vermont, Rhode Island, and New York, only require healthcare facilities to be transparent with the public about nurse-to-patient ratios they utilize (Bartmess et al., 2021).

The California Nurses Association is a reputable organization that advocates for safe nurse staffing levels (National Nurses United, n. d.). They were integral in the implementation of
mandated ratios in California (National Nurses United, n. d.). The ratios that they suggest are 1:1 in trauma ED, a ratio of 1:2 in the intensive care unit, and a ratio of 1:5 in the medical-surgical unit (National Nurses United, n. d.). The current nursing ratios experienced across the U.S. fall short of these suggested ratios. The ratios actually experienced by nurses include up to 8 on medical surgical units in Illinois and anywhere from 5-10 in ED’s in New York (Driscoll et al., 2018; Lasater et al, 2021; New York Nurses Association, n.d.). One study showed that nurses in the ICU can be assigned up to 4 patients (Driscoll et al., 2018).

Nurse staffing levels are determined in a few ways and vary with each facility. Often hospitals use nurse-to-patient ratios, in which there are a specific number of patients assigned to each nurse (Twigg et al., 2020). The distribution of patients may also be achieved with consideration to the acuity of each patient. Acuity is a term to describe the level of care a patient needs. Higher acuity patients require a higher number of interventions and are likely sicker than a patient of lower acuity. Acuity is an important thing to take into consideration because interventions can be lengthy and can cut into the time a nurse has to spend with other patients they have been assigned. Many hospitals also use nursing hours per patient day (NHPPD) as a measure (Twigg et al., 2020). There are huge discrepancies between what is considered a safe staffing level based on any of these methods (Twigg et al., 2020). Even when companies have supposedly set standards, nurses are frequently assigned more than this in a manner termed surging (North Carolina Healthcare Foundation, 2021). Nurses are surged with patients during times of excessive sick calls, during local emergencies, on excessively busy days, or when nurses already on shift must go home (Wisconsin Healthcare Emergency Preparedness Program, 2015). Typically, there is an anticipated number of people that call out of work, and this is incorporated into the staffing plans of hospitals. When the number of actual sick calls or absences exceeds
this, the hospital does not have the staff to compensate and thus assigns more patients per nurse (North Carolina Healthcare Foundation, 2021).

In an effort to relieve these surges or staffing shortfalls, many hospitals mandate overtime or being on call. Facilities have codes for the level of saturation of patients (Wisconsin Healthcare Emergency Preparedness Program, 2015). When the census reaches a certain level, they declare an internal emergency. Unit managers, Clinical Nurse Leaders (CNLs), and floor nurses are expected to respond to the increased demand by coming outside of their normal scheduled hours to help with direct patient care (Wisconsin Healthcare Emergency Preparedness Program, 2015). Consequently, nurses that are continually taking higher patient loads or that are being forced to work excessive hours experience burnout and job dissatisfaction. This results in high turnover (Dall'Ora et al., 2020). This turnover further intensifies the low staffing levels as the nurses still employed must compensate by either working extra shifts or taking on more patients, resulting in more nursing resignations just around the time the previous staff is being replaced (Dall'Ora et al., 2020). Both low nurse staffing levels and mandated overtime result in fatigue and have been proven to have serious consequences such as increased injuries experienced by nurses as well as an increased rate of medication errors that could harm patients (Dall'Ora et al., 2020). Relatedly, low staffing levels that result from these issues have the potential to further affect patient safety in various ways.

Patient safety is an umbrella term that involves many factors. These factors depend on the healthcare setting the patient is in. For instance, patient safety in the hospital often takes into consideration falls, development of pressure injuries, catheter-associated urinary tract infections (CAUTIs), central line-associated bloodstream infections (CLABSIs), and blood clot post-surgery among other facets (Centers for Medicare & Medicaid Services[CMS], n. d.). Hospitals are
monitored on various parameters that contribute to overall patient safety. These events are considered preventable and when they occur, they not only lengthen the stay of hospitalization but can result in morbid outcomes (CMS, n.d). Many of these situations require early, and prompt treatment to maximize the outcome for the patient. All of these factors are nurse-sensitive outcomes, meaning that their rates are influenced by nurses specifically. Nurses help prevent as well as identify the onset of these issues early. They also assess patients' mobility and help patients ambulate in an effort to prevent falls and pressure injuries. As nurses are human, there is a limit that can be reached in the number of tasks they can get done during their shift and this varies with the number of patients they have as well as the acuity of these patients (American Nurses Association [ANA], n.d.). Numerous health insurance companies are now refusing to cover the costs of these events because they are preventable. Consequently, thousands of dollars incurred from treatment for these issues must be covered by the hospital instead. In the context of the ED, where there is a high turnover in patients, additional measures of safety exist. These include wait time to be seen, time to diagnosis, and bedtime for those needing to be admitted (Henneman et al., 2015). Staffing adequately could result in cost savings to the company provided that they are proactive in their staffing measures.

**Significance to Nurses**

The majority of nurses are employed by hospitals, and the majority of short staffing occurs in this type of environment. The total nursing workforce is approximately 2.8 million in the United States, of which 1.7 million are employed by hospitals (Bakhamis et a., 2019). Nurses are also faced with significant burnout from higher nurse-patient ratios. One qualitative study done by Bakhamis et al. (2019), looked at nursing perceptions of the issue. Over 70% of nurses
have indicated that they experienced burnout, and 65% of those left their job because of this (Bakhamis et al., 2019). A major contributing factor to their burnout based on perception was inadequate staffing. Low staffing and subsequent burnout also contribute to high turnover rates. Nursing turnover varies by location, specialty, and facility size. In 2021 the national average nursing turnover was 27.1% (NSI Solutions, 2022). This has increased from the national average by 6.4% due to the pandemic (NSI Nursing Solutions, 2022). The nursing workforce has also decreased by 2.47% in the same time frame (NSI Nursing Solutions, 2022).

There are significant costs incurred from inadequate staffing. One hospital found that for every percentage increase in nursing turnover in a hospital, there is a financial loss of $300,000. The high turnover also costs a significant amount of money in order to replace nurses. The costs associated with replacing one nurse is around $88,000 (NSI Nursing Solutions, 2022). The costs incurred from nursing turnover range from $5.2 to $9 million each year per hospital (NSI Solutions, 2022). The units experiencing the highest turnover are also those with the highest nurse-to-patient ratios or high acuity patients including medical surgical units, telemetry, and the emergency departments. The most prominent threat to patient safety, medication errors, costs approximately 4 million dollars per hospital each year (Flynn et al, 2012). There is also the expenditure relating to utilizing travel nursing agencies, which was occurring before COVID. For every 20 travel nurses used by a hospital, there is an increase in costs of $4.2 million (NSI Nursing Solutions, 2022). The increase in expenditure from adverse effects and having to rely on staffing agencies cause hospitals to be more conservative in staffing in the future to make up for losses.
Summary

The United States Healthcare System is flawed in that this system does not have consistent requirements for nursing-to-patient ratios. The overall population is aging, and obesity related illnesses are rising which leads to an increase in utilization of acute care services for chronic conditions. This places increasing demand on nurses present in the workforce resulting in a decreased amount of nurses available to carry out this work due to burnout and turnover. The imbalance between supply and demand of workers is going to continue to grow unless something is done to stop this. Although the cyclic nature of understaffing nurses and overworking them to the point of burnout existed long before the onset of the pandemic, COVID has placed a seemingly insurmountable burden to overcome. This is due to the siphoning of a large sum of an already dwindling resource pool that has been done to address the pandemic.

Professional organizations such as the ANA, have achieved some wins in their fight for better staffing measures by increasing the number of states with staffing laws, increasing nurses that hold legislative positions, and increasing funding for nursing programs. Although there are agencies, such as the Centers for Medicare and Medicaid Services (CMS), that have identified nursing levels as contributors to patient safety, there still remains a lack of consistency in staffing measures. Part of this is due to there being no consistent guidelines for determining safe staffing levels. Despite using any of these three methods; nursing-to-patient ratio, NHPPD, and acuity, exceptions are made to the supposedly set inter-facility standards because of the constant turnover of staff. In order to understand the benefits of being proactive in staffing in order to break this cycle, one must consider the specific negative outcomes of low staffing levels on patients, the financial costs of these events, the methods that show promise in determining safe

...
staffing numbers, and nursing ratios that have proven best on the various units that are present in most hospitals whether located in rural or big city.
Chapter Two

The focus of Chapter 2 is to present a literature review on research that has been conducted on nurse staffing levels related to patient safety outcomes as well as financial costs associated with negative patient outcomes linked to inadequate staffing. The search engines used were PubMed and CINAHL. The search terms included “nurse-to-patient ratio”, “patient safety”, “nurse burnout”, “nurse turnover”, and “nurse workload”. Some search terms related to costs included “infections”, “healthcare-associated infections”, “costs of healthcare-associated infections”, and “costs of adverse patient outcomes”. The research articles were limited to within the last 10 years. The research found was from the years 2013, 2016, 2017, and 2018. In this chapter, research that addresses the specific negative outcome that results from low staffing levels will be addressed. Throughout this research, there were numerous studies available on the effects of staffing levels on patient safety. Some of these studies only consider the NHPPD method. Others include specific nursing ratios including optimal ratios that showed the greatest decrease in adverse outcomes. From there, the common costs related to these events are presented. In the summary and discussion section, the best ratios will be presented for the three types of units common in most hospitals. The usual hospital units that occur in even rural areas include an Intensive Care Unit (ICU), Medical-Surgical (Med-Surg) Unit, and an Emergency Department (ED). Staffing measures and research was focused on these three areas.
Literature Review Results

Nurse Staffing: Impact on Patient Outcomes

The research done by Lee et al. (2017), focused on how workload to staffing ratio affected the overall survival rates of patients in Intensive Care Units (ICUs). This was a retrospective analysis and longitudinal cohort study. The sampling technique was convenience sampling as only two units participated. Net benefit regression, as well as logistic regression, were used in the analysis of the data. Researchers looked at two ICUs located at different hospitals in Hong Kong, China (Lee et al., 2017). The first unit, designated ICU1, was at a regular hospital. ICU2 was at a teaching hospital (Lee et al., 2017). Information was gathered surrounding the stay of 845 patients and this information included nurse staffing numbers. Patients were scored using the Therapeutic Intervention Scoring System (TISS-76) tool which factored in the types of machines the patient was hooked up to, the medications the patient was on, and the diagnosis of the patient. The scores for the whole unit were summed and then divided by the number of nurses on for that shift. A higher score indicated a higher workload per nurse. The workload points per nurse ranged from lower 30’s to around 52.

The results indicated that there was a difference in survival rates as well as mortality rates depending on this score. For instance, when this score exceeded 52, the mortality rate was 18.5%, whereas on days when the score was less than 40, the mortality rate was only 10.5% (Lee et al., 2017). Moreover, when this ratio was above 52 there was a 95% chance of death occurring. Lastly, they found that patients were twice as likely to survive to discharge when this number was consistently lower than 40. Although the study showed that there was a difference in patient outcomes when nursing levels were higher, one thing that must be considered is the applicability of this to the healthcare system in the United States which is likely different than
China. For instance, the nursing shifts in this study were 8 hours in comparison to the 12-hour standard for hospitals here. Another issue is that nurses likely have different workloads, even on the same shift and this was brought up in the discussion of the study, which helps boost their credibility. Another thing brought up by the authors was that the TISS-76 included tasks carried out by the nursing assistants, not the nurses and so this could have influenced the statistics. For situations that could have confounded their variables, they provided hyperlinks to other studies with similar results.

The study done by Thomas-Hawkins et al. (2020), was a cross-sectional study that utilized correlation as well as other statistical tools to evaluate the data. These researchers focused on the relationships between nurse staffing, workload, work left undone, and patient safety. The researchers wanted to know how registered nursing (RN) staff in hemodialysis units perceived the level of safety during shift change and overall, for their facility (Thomas-Hawkins et al, 2020). Work left undone and workload were factors they hypothesized to influence patient safety negatively (Thomas-Hawkins et al, 2020). A total of 104 dialysis nurses were randomly sampled from a combined list of over 1200 nephrology nurses provided by a state board of nursing as well as a nursing association. A questionnaire was sent out with various types of questions including the number of patients the nurse frequently took care of. In this questionnaire, nurses were asked to rate safety of patient transitions, overall patient safety, and workload on a Likert scale (Thomas-Hawkins et al, 2020). Care that was left undone included charting, patient monitoring, supervision of nursing assistants, as well as teaching and interacting meaningfully with patients. They rated this categorically as having nothing left done at the end of shift, 1-2 things left undone, or 3 or more left undone (Thomas-Hawkins et al, 2020).
The data displayed that the average number of patients taken care of was 11 but incredible variance existed, as it could go up to 48 patients. Additionally, the average for tasks left undone was 1-2 tasks, with the category of three or more being the next most common answer chosen. Interestingly, the nurses that indicated having more things left undone were also the ones who rated their facilities as being less safe. The correlation was .418 with a statistically significant p-value of .0001 (Thomas-Hawkins et al, 2020). Additionally, those that noted having more patients were also the ones that noted having more care left undone. The correlation for this was .410, with a statistically significant p-value of less than .001. One limitation cited by the authors was that the results may not be generalizable to other dialysis units because only two states were included in the sampling. This was stated in the limitations section of the study and so helps with credibility. Another limitation stated was that there was a low mail-in rate, and the authors proposed other types of sampling methods in future studies. Although this study looked at one aspect of the nursing field, there is not a guarantee that the results are translatable to other nursing settings which likely have different nursing cultures, patients, and overall responsibilities.

The study done by Driscoll et al. (2018), was a meta-analysis that looked at different research focused on identifying a relationship between nurse-to-patient ratios and nurse-sensitive outcomes in specialty and a higher level of care units such as the ICU, cardiac ICU, and cardiac thoracic surgery recovery units. The nurse-sensitive outcomes included patient falls, catheter-associated urinary tract infections (CAUTIs), central line-associated bloodstream infections (CLABSIs), and usage of restraints among many others. A total of nine databases were used in the search including CINAHL, Cochrane, and Medline (Driscoll et al., 2018). The articles had to have the following to be considered; patients admitted to higher specialty units,
focused on patients over the age of 18, published between 2006 and 2017, utilized quantitative methods, and include the primary nursing outcomes of interest to the researchers. A total of 35 studies fit these criteria, all of which originated from countries in the northern hemisphere, including the United States, Canada, Mexico, China, and Thailand (Driscoll et al., 2018). Some of the medical subject headings (MeSh) and search terms utilized in the search were; coronary care, high dependency, critical care, nurse staffing, nurse ratio, and nurse dose. The team included an information technologist specialist that helped direct the search for studies. The Newcastle Ottawa scale (NOS) was used to determine the quality of the studies in the meta-analysis. The studies were matched with studies most like it in the sample, and then statistical analysis was applied to them as a group (Driscoll et al., 2018). The team defined nurse-patient ratios in two ways. The first way was the number of nurses in a 24-hr period divided by the number of occupied beds at that time. The second way was the total nursing hours per patient bed.

The results showed a relationship between nurse-to-patient ratios and many nurse-sensitive patient outcomes. Mortality rates were 14% lower in units with higher nurse staffing. On units with lower nurse staffing, the odds ratio for intravenous medication errors increased. For patients that were intubated, when there was a ratio of 1:1, critical care units that had a higher number of nurses to patients had lower pressure injury incidents, physical restraint usage, and healthcare-associated infections. Relatedly, when nurse hours per patient day were lower, patients were 68% less likely to acquire a CLABSI, 79% less likely to get pneumonia, and 31% less likely to develop a pressure ulcer (Driscoll et al., 2018). One study showed that for every patient added per nurse, there was 35% more likely to have an extended hospital stay. Several of the studies showed that ratios 1:2 or lower decreased length of stay and mortality and
improved the perception of care by patients. Interestingly, there was no relationship found between cardiac arrest and nurse-patient ratios in ICUs (Driscoll et al., 2018). One limitation stated by the authors included the differences in patient populations among the studies. There were also differences in methods of calculating nurse-patient ratios. To help validate the team's findings, the researchers included information on another meta-analysis that came to similar conclusions (Driscoll et al., 2018). One limitation that was not stated by the researchers was the difference in the healthcare system and environment of the different countries. Some governments such as Canada, fund healthcare for all citizens, whereas the United States government does not. This funding may influence the nursing environment. On top of this, the scope of practice in nursing in the countries varies. Lastly, another limitation of this study is that the data extraction tool used is new and made for their research and so the validity of this tool has yet to be determined (Driscoll et al., 2018).

The study done by McHugh et al. (2016) looked at the relationship between nurse staffing levels, the nursing environment, and how this affected patient survival rates following an in-hospital cardiac arrest (IHCA). The researchers hypothesized that better staffing levels and working environments for nurses increased the likelihood of survival in patients that experienced a cardiac arrest in that facility (McHugh et al., 2016). This study utilized and assimilated information from three different databases. The first database was called the Get With The Guidelines Resuscitation (GWTG-R) run by the American Heart Association (AHA) (McHugh et al., 2016). This database provided details surrounding cardiac arrests, such as patient characteristics, outcome of resuscitation, resources available to nurses, and hospital characteristics. There were some exclusion criteria applied to the patients pulled from the database. Patients who were younger than 18 years old, had an implanted cardioverter, or were
not housed on medical surgical or intensive care floors were not considered (McHugh et al., 2016). After these exclusion criteria were applied, 11,160 patients remained in the sample. This study also utilized a multistate nursing survey database that provided information on the support that the nurses received from their management and leadership as well as information on the nurse-physician relationships (McHugh et al., 2016). The hospitals were determined to be poor, mixed, or good environments based on these criteria. The survey responses were matched to the hospitals where the 11,160 patients were housed, which included 75 hospitals located across Pennsylvania, Florida, New Jersey, and California. The researchers also utilized statistical measures to control for age of the patient, the conditions that the patient presented with, as well as critical care interventions that were already being applied to the patient before the cardiac arrest occurred because these could have confounded the results as they all are known to influence the likelihood of survival post-arrest (McHugh et al., 2016).

The results of this study showed that there was a negligible difference in survival rates between lower-staffed and better staffed intensive care units. However, there was a significant difference in survival on medical-surgical floors. Specifically, there was a decrease by 5% in the odds ratio for survival with each additional patient added to the nurse's assignment (McHugh et al., 2016). One potential explanation they provided as to why there was no difference in ICUs is because these areas already have standard nurse-patient ratios that don’t deviate considerably from the average. One of the limitations of this study identified by the researchers was that the research does not show causality between the variables of interest, but rather sheds light on a relationship existing that needs further exploration (McHugh et al., 2016). They suggest repeated measures statistics to explore and define the relationship better (McHugh et al., 2016). There is also a sort of selection bias with using the GWTG-R. The hospitals that use this quality
improvement system are usually higher-tech hospitals located in big cities with more resources at their disposal and so it cannot be generalized to rural hospitals and those that otherwise have limited resources (McHugh et al., 2016). Another limitation that was brought up was that the change in patient ratios daily is less drastic in the hospitals being studied compared to those that are smaller and rural, so the effects on staffing seen may not give an accurate picture of the extent of the effect staffing has (McHugh et al., 2016). One issue with the study not stated in the articles is that they included the state of California in which nurse-to-patient ratios are already mandated by law. The researchers missed an opportunity to use this state as a control or a comparison to the other states where no mandate existed.

**Effects of Charge Nurses on Patient Safety**

The study done by Cathro (2016), was a grounded theory study that looked at the job of the charge nurse and how they contribute to patient safety. The sampling technique was purposive. The study was carried out on a 400-bed hospital unit in a metropolitan area. The researcher conducted 11 interviews and six observations (Cathro, 2016). All charge nurses were kept out of staffing, meaning that they did not take on a patient assignment themselves (Cathro, 2016). Some of the actions that charge nurses take to increase safety include watching patients. They also assist in patient care directly such as by toileting patients and assisting with medication patients (Cathro, 2016). They conduct admission and discharges to help out. They were also integral in activating rapid responses when patient conditions change. They aided in the education of both patients and staff members. They also help with fall prevention by rounding on patients to check alarms, identify clutter that needs to be cleared and answer call lights (Cathro, 2016). Lastly, they prioritized placing confused patients closer to the nursing station to prevent falls (Cathro, 2016). One of the limitations of the study was the level of
evidence. This study was observational, and the extent of contribution charge nurses make to safety could not be determined.

**Nurse staffing: Specific Ratios that Reduce the Occurrence Of Negative Patient Outcomes**

The first study regarding levels of staff was a study by Jansson et al. (2019). The purpose of the study was to determine if there was an association between nurse staffing and workload on ventilator-associated pneumonia and mortality. It was an observational cohort study carried out in a Finland teaching hospital between 2014 and 2015. The researchers utilized nursing-to-patient ratios as their staffing measure. The researchers also used the same TISS scoring system as Lee et al. (2017) described previously. One other scoring system used was the Intensive Care Nursing Scoring System (ICNSS) (Jansson et al., 2019). Much like the TISS, the ICNSS is a measure that takes into consideration the workload or acuity of the patient based on their status, but it also includes the demand of the patient’s family (Jansson et al., 2019). The researchers looked at the rates of ventilator-associated pneumonia (VAP) in relation to nurse-to-patient ratios which are preventable events and nursing-sensitive outcomes monitored by CMS (Jansson et al., 2019). Convenience sampling was used to obtain the sample for this study as anyone that met their standards was included in the study. To be included in the study, patients had to have been intubated for at least 48 hours. The exclusion criteria were that they could not have pneumonia or a tracheostomy on admission. Participants could not be already severely immunocompromised prior to their admitting diagnosis. This means that those with human immunodeficiency virus (HIV) and those that were neutropenic were excluded.

The p-value was set to less than .05 (Jansson et al., 2019). The sample size was 85 patients. The average nursing-to-patient ratio ranged from .9 nurses per patient to 1.3 nurses per
patient. An important finding was that when this number was 1.0 or less, then the VAP numbers were also lower. When this number was higher than one, the incidents of VAP were also higher (Jansson et al., 2019). The survival rate in those patients was also lower, 31% compared to 35.7% when a staffing ratio of around 1 was observed. They also found that when the nursing workload was higher, higher infection rates were seen. This finding was statistically significant, and the p-value was 0.009 (Jansson et al, 2019). The optimal patient ratio according to this study is 1 nurse to 1 patient in this type of unit. A limitation of the study was that the compliance to VAP prevention protocols was not monitored (Jansson et al., 2019). This could have influenced the results of the study if there was less compliance in bundle usage to prevent VAP in either of the groups (Jansson et al., 2019). Another potential limitation not mentioned in the study was that the sample consisted of mostly male patients. This doesn’t give an adequate representation of all patients experienced on these units and so may not be applicable to the actual population. One strength of this study was that they brought up other research that had been done in this area and compared the findings to show the consistency of their own results with what has already been established. Another strength was the significance of their findings, as they got well below their set p-value which increases the likelihood that their findings were not related to error.

The next study was done by Kouatly et al. (2018). This was a prospective study that gathered data for 48 months on nursing-sensitive outcomes and nurse staffing levels. The hospitals all utilized the NHPPD method for staffing measurement. The aim of the study was to determine the effects of higher staffing levels on various outcomes such as pressure ulcers and falls (Kouatly et al., 2018). The study took place in Lebanon. The sampling method was convenient as the data on all patients present during the time of the study were included. Although the sample included critical care unit patients as well, the information for both units
was presented separately and only the medical-surgical unit data will be presented. The sample consisted of 68,000 patients but the actual percentage of these that were included in med-surg was not expressed, only the percentages of these outcomes and the unit-specific NHPPDs were discussed. The p value was set at less than .05 (Kouatly et al., 2018).

The average NHPPD on the medical surgical was 4.25 hours with a standard deviation of 1.22 hours (Kouatly et al., 2018). More hours signify that there are more nurses present per patient. The researchers found that the lower the NHPPD resulted in a higher occurrence in the hospital acquired pressure injuries (HAPIs). The odds ratio for this finding was 4.33 with a p value of .001 which is statistically significant (Kouatly et al., 2018). Furthermore, lower NHPPD was associated with an increased incidence of CLABSI with an odds ratio of 2.61 and p value of .006. The rate of HAPIs was also much higher with an odds ratio of 3.77 and a p value of .004 (Kouatly et al., 2018). The increase in CLABSI and HAPIs were both statistically significant too. There was no significant difference found between CAUTIS or VAP (Kouatly et al., 2018). According to this author, the higher the number of hours were per patient, the lower rate these outcomes were seen. This means that a NHPPD amount of at least 5.47 is needed to reduce their occurrence. One strength of this study was that the hospital did not use supplemental staffing agencies at all. Nurses supplied by agencies are temporary, and the turnover of these individuals is high. These nurses do not get enough time to learn all of the hospital’s policies and care bundles, and so usage may not be as consistent. Had staffing agencies been used, this could have influenced the results. One limitation is there may not be generalizability to the population in the American healthcare system. Another limitation is that they did not clearly define the sample size of patients specific to this unit which is an important factor to consider in order to really understand the percentages being presented.
The study done by Lasater et al (2021) was a cross-sectional analysis and observational study that looked at state-specific staffing ratios, high and low. The aim of the study was to determine if a relationship existed between survival rates, length of stay, and nurse staffing levels (Lasater et al, 2021). The researchers used data from the American Hospital Association along with a survey from nurses that worked in these facilities. Data was gathered from 87 acute care hospitals in Illinois. The sample size of patients was 210,493, all of whom were 65 years or older (Lasater et al, 2021). The researchers excluded data on patients that were diagnosed with psychiatric conditions including alcohol or drug-related addictions (Lasater et al, 2021). The researchers also excluded data on patients that were present in the hospital longer than 60 days. The range of patients per nurse was from 4.2-7.6, with an average of 5.4. For each additional patient assigned to a nurse, an increase in odds of staying increased by 5% (Lasater et al, 2021). The optimal ratio was identified to be 4 patients per nurse, as this had the lowest mortality and length of stay per patient.

It was also noted that had this 1:4 ratio been maintained over the 1-year period the study occurred, 1595 deaths could have been prevented with an estimated overall cost savings of 117 million (Lasater et al, 2021). Strengths cited in this study are that research utilized data directly from nurses employed on these medical-surgical units and they also refrained from defining any causal relationships in their data. This makes them more trustworthy and depicts their aim to remain unbiased (Lasater et al, 2021). Researchers also used study methods that were similar to other studies done on nurse staffing levels and patient outcomes. Limitations of this study include that the hospitals varied, and so inter-facility differences could have influenced the results. For instance, some facilities have more techs per nurses, transporters, and tubing systems that decrease workload and increase the amount of time nurses can spend with patients. Other
facilities require nurses to transport patients themselves, and manually deliver specimens to the lab. One last limitation is that they used data from a specific age group of people and so their results may not be generalizable. This is because many patients on an adult medical surgical unit fall below this age range.

Henneman et al. (2015) also looked at staffing levels in the emergency department. They performed a computer simulation of data in an academic hospital. The ratios under consideration were 1:2, 1:3, 1:4, and 1:5. The researchers looked at the acuity of patients which was based on the amount of resources used and procedures done, such as labs/ekg/x-ray, and the type of medications given (Henneman et al., 2015). The researchers also examined measures such as bed utilization and wait time to determine how each of these ratios affected them. Each simulation looked at staffing for a 72-hour time frame. The sample size for patients was 27,000 virtual patients. Another aim of this study was to determine the optimal ratio that decreased wait time, bedtime, and bed utilization (Henneman et al., 2015). The overall trend was that for each additional patient assigned to a nurse, there was an increase in bed utilization, wait time, and bedtime. The confidence interval for all of these values was 95%. More specifically, with a 1:2 ratio the wait time was 92 minutes and a 60% bed utilization. This wait time was 168 minutes and bed utilization was 90% with a 1:5 patient ratio. The optimal ratio specified in this study to reduce wait time and decrease bed utilization was 1:2, although a 1:3 ratio was effective with the presence of ED technicians to help nurses (Henneman et al., 2015). One strength of this study is that they had a high confidence interval and the national averages in wait time were similar to those created by this simulation. One limitation of this study is that each simulation changed, and there was not a control group. Furthermore, a weakness of this study was that simulated data was being used in place of actual patient data. Although this was meant to mimic a real ED, it could
have added confounding variables to the data. The difference may partially have been due to the patient mix that presented to this virtual ED. Another limitation is that there is no talk about the overall validity of using this simulation tool.

**Financial Costs of Adverse Patient Outcomes**

The study done by Zimlichman et al. (2013) was a meta-analysis. The purpose of the study was to identify the average costs associated with infections acquired in healthcare and the incidence that these occurred. The researchers also explored the approximate costs it contributed to healthcare each year based on the value of money in 2013. The researchers utilized the PubMed and Medline research databases. The inclusion criteria were that the studies had to be done in the United States, and they had to have data on the typical hospital units such as medical-surgical, ICU, and tele. The studies needed to have data on five types of infection associated with healthcare. Infection control is a nursing-dependent outcome. Nurses monitor for early signs of infections as well as implement interventions meant to prevent infections. A total of 26 studies met their criteria and were included in this meta-analysis. The costs associated with central lines were averaged at $46,000. The incidences of these infections were 1.27 per every 1000 device days. It contributes a total cost of 1.9 billion dollars to the healthcare system each year. The cost associated with VAP was $40,000, the incidence is 1.33 infections for every 1000 device days. It contributes 3 billion each year in healthcare costs in the United States. The costs associated with infections of surgical sites was $21,000. The incidence was 1.98 per 100 procedures. It contributes approximately 3.3 billion dollars to healthcare costs each year. Clostridium infections cost an average of $896, have an incidence of 3.85 per patient day, and contribute 1.5 billion dollars in healthcare costs. One limitation of the study was that they had to
utilize data from up to 25 years ago which may not depict the current state of healthcare. They also had to adjust costs from the various time points using inflation rates to estimate the costs.

Summary

In summary, low staffing levels are associated with poorer patient outcomes regardless of whether ratios, NHPPD, or acuity staffing measures are used (Driscoll et al., 2018; Lee et al., 2017; Thomas-Hawkins et al., 2020). Higher staffing levels are associated with a reduction in CLABSI, CAUTIs, HAPIs, and mortality rates (Driscoll et al., 2018; Lee et al., 2020). Lower staffing levels are associated with reduced survival rates post cardiac arrest, increased length of stay in hospital, and care left undone (Driscoll et al., 2018; McHugh et al., 2016). In medical surgical units, a ratio of 1:4 is optimal in reducing mortality rates and length of stay. Benefits were noted for a ratio of 1:5 as well. In the ICU, intubated patients have the lowest VAP rates when nursing-to-patient ratios are maintained at 1:1 in comparison to the standard 1:2. In the Emergency Department, bed utilization and RN utilization is lowest for a ratio of 1:2 but is still lowered with ratios of 1:3 in the presence of ER technicians. Patient safety is improved in the presence of a charge nurse as they help monitor for gaps in patient safety. They directly help by answering bed alarms when other nurses are busy and help toilet patients ultimately leading to fall prevention. Many of the nursing sensitive patient safety indicators cost healthcare a significant amount of money each year, and these costs must be covered by hospitals themselves. The costs range from $896 per incident for infections like Clostridium difficile (C DIFF) to up to $46,000 on average for each incident of a CLABSI. As better staffing leads to a decrease in rates of these incidents there is potential cost savings from staffing better as these costs will be reduced. Further cost savings would occur in a reduction of turnover of the nursing staff and
reduction of medication errors. One of the major concerns with this type of research is that although some studies show reductions in infection rates among other outcomes, other studies may show no difference despite using similar ratios. Perhaps the difference is that some of these facilities utilize acuity tools in addition to ratios or NHPPD to assign patients and adjust staffing levels accordingly. Further, none of the studies have addressed the need to utilize both acuity scoring systems and ratios together. When used in isolation, these systems both have weaknesses (Marquis & Huston, 2019). Nursing ratios do not account for differences in patients leading to overloading one nurse with an unfair assignment (Marquis & Huston, 2019). For acuity measures, a nurse with lower acuity patients might be overloaded with too many patients because of the lack of a cap. When utilized together, these methods may compensate for the weaknesses of the other leading to safer patient assignments (Marquis & Huston, 2019).
Chapter 3: Evidence-Based Practice Recommendation for Nurse-to-Patient Ratios

Hospitals differ greatly based on the types of care offered but in general, most hospitals, even rural ones, contain an ED, ICU, and a medical-surgical floor. The goal was to identify a specific nurse-to-patient ratio for these three basic hospital floors. These ratios are meant to be a starting point for staffing measures as they do not account for the actual acuity of patients. Acuity tools are beneficial in ensuring that a nurse's workload is fair so that one nurse is not overloaded with extremely sick patients (Marquis & Huston, 2019). Acuity tools should be used in conjunction with these ratios. Only one of the studies specifically mentioned an acuity tool used, thus specific acuity tools for each unit will not be presented here. It is recommended that the ratios set forth in this best practice recommendation be used as a maximum or cap for the number of patients a nurse should take care of. Unit specific patient acuity tools should be utilized by each unit to adjust these ratios to better fit the specific patient population on a unit given a specific time period. With heavier patient loads, nursing managers and Clinical Nurse Leads should use discretion in offering additional nurses especially when nurses express concern about the safety of their assigned workload. Further, actual acuity tools that are appropriate to each unit should be utilized when creating patient assignments, and these ratios adjusted accordingly. In Table 1, there are recommendations listed regarding specific ratios to utilize based on research, the rationale for that recommendation, and the level of evidence behind that recommendation. The recommendations predominantly focus on ratios but also include other aspects of staffing that help alleviate the burden placed on nursing staff such as the presence of a charge nurse. The studies used to make the recommendation ranged in level of evidence. The range includes level three for cohort and case-control designs to level six for expert opinion.
Table 1.

*Evidence-Based Practice Recommendations*

<table>
<thead>
<tr>
<th>Type of Unit</th>
<th>Recommendation</th>
<th>Rationale</th>
<th>References</th>
<th>Level of Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical-Surgical unit</td>
<td>A ratio of 1:4 patients is optimal.</td>
<td>When this ratio is implemented, the overall mortality rates 30 days after discharge are reduced by 16%. Hospital length of stay can also be reduced, providing cost savings to the hospital. This ratio is associated with a reduction in HAPIs, falls, and CLABSIs. When nurses have fewer patients there is less missed care, and more time with patients that allows for the identification of issues early.</td>
<td>(Lasater et al., 2021) (Kouatly et al., 2018)</td>
<td>Level IV Level IV</td>
</tr>
<tr>
<td>ICU</td>
<td>A ratio of 1:2 in non-ventilated ICU patients.</td>
<td>This ratio was associated with a decrease in mortality on the unit as well as 28 days after discharge, decreased length of stay, and improved perception of</td>
<td>(Driscoll et al., 2018)</td>
<td>Level IV</td>
</tr>
<tr>
<td>Ratio</td>
<td>Description</td>
<td>Evidence</td>
<td>Level</td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td>-----------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
<td>-------</td>
<td></td>
</tr>
<tr>
<td>1:1</td>
<td>A ratio of 1:1 for patients that are ventilated.</td>
<td>Patients that are ventilated are at an increased risk of hospital-acquired infections and are higher acuity because of the various drips that go along with keeping them ventilated. Mortality and hospital-acquired infections are decreased when nurses taking care of ventilated patients are only assigned to one. (Driscoll et al., 2018) (Jansson et al., 2019)</td>
<td>Level IV Level III</td>
<td></td>
</tr>
<tr>
<td>ED</td>
<td>A ratio of 1:1 in trauma ED.</td>
<td>This is the ratio suggested by the California Nurses Association.</td>
<td>Level VII</td>
<td></td>
</tr>
<tr>
<td>1:2</td>
<td>A ratio of 1:2 is best when the made-up of emergency critical care patients.</td>
<td>This ratio was identified to reduce wait times and emergency room crowding. This was through the increased time available for nurses to discharge or admit patients quickly. (Henneman et al., 2015)</td>
<td>Level IV</td>
<td></td>
</tr>
<tr>
<td>1:3</td>
<td>A ratio of 1:3 is appropriate in the presence of a patient care technician.</td>
<td>This ratio could provide similar results as the ratio of 1:2 with the presence of emergency technicians to help nurses with blood draws, and EKGs among other duties. When the technicians carry out these functions, they alleviate some of the task burdens on the nurse providing them with free time to take care of things like assessments, discharging, and admissions providing</td>
<td>Level VI</td>
<td></td>
</tr>
</tbody>
</table>
A ratio of 4:1 should be the maximum. This is the ratio listed by the California Nurses Association. This ratio is meant for patients that are stable and have lower acuity. (National Nurses United, n.d.) Level VII

| All units | A charge nurse should be present on the unit and remain out of staffing. | Charge nurses are an essential resource for nurses to carry out functions safely. When they are kept out of staffing, they are able to help floor nurses in numerous ways. They medicate patients, identify late medication administration, and assist with toileting patients. They are also able to respond to call lights, and bed alarms when nurses are busy. They provide guidance and prioritize patient placement to increase safety by putting confused patients closest to the nursing station. (Cathro, 2016) | Level VI |
Summary of Evidence-based Practice Recommendations

The ratios listed are very similar to those implemented in California, proposed by the California Nurses Association, and those proposed in the Nurse Staffing Standards for Hospital Patient Safety and Quality Care Act. The difference occurs mostly in medical-surgical units. The set ratio in California is 1:5, whereas the optimal ratio listed in the study done by Lasater et al. (2021) and suggested here is 1:4. A maximum ratio of 1:5 can be utilized in the medical-surgical setting as it still showed benefits in comparison to higher ratios in the study (Lasater et al., 2021). In the ICU the max ratio should be 1:2 and this ratio should be adjusted to 1:1 for intubated patients. The recommended ratios in the ED vary by patient complexity. Trauma patients should be cared for on a 1:1 basis. The ratio for nurses caring for critical care patients awaiting ICU placement should be set at 1:2. A ratio of 1:2 is ideally optimal for all patients in the ED but can be adjusted to 1:3 provided that there is a technician on the unit to help alleviate the burden of non-nursing tasks (Henneman et al., 2015). A charge nurse should also be present on the unit and kept out of staffing so that they can support nurses throughout the shift either through direct patient care or indirectly.

These ratios were identified to improve patient safety in one aspect or another. The patient safety outcome addressed was unit specific at times. Patient safety outcomes associated with certain ratios in medical-surgical units and in the ICU were mortality and length of stay. In the ED, indicators regarding bed flow or wait times were used (Henneman et al., 2015). The ratios set forth should be utilized to plan for staffing and likely will require the hiring of new nurses. Although staffing with extra nurses is going to cost money to implement at first, the cost savings potential is significant and will likely outweigh the costs incurred to do this. Research
evidence suggests that the cost savings will be seen through a reduction in the following: length of stay, nursing turnover, CLABSIs, CAUTIs, and falls (Lasater et al., 2021; NSI Solutions, 2022).
Chapter 4: Implementation and Evaluation of Effects of Nursing to Patient Ratios

The previous chapters were dedicated to the description of nurse staffing concerns present today, identifying negative effects of low staffing and pinpointing nursing ratios that reduce the likelihood of these negative effects. With this information, an evidence-based practice recommendation was created for specific nursing-to-patient ratios for three types of units. The next step and purpose of chapter 4 is to determine the efficacy of the ratios set forth. Chapter 4 outlines the dissemination of these practice guidelines. This chapter shows how these ratios will be implemented and how they will be evaluated.

The Plan-Do-Study-Act (PDSA) model is a system used to test the effects of a particular change that is implemented in the healthcare setting and is ideal for quality improvement projects (Agency for Healthcare Research and Quality, n.d.b). The PDSA method will be used to guide the proposed implementation, evaluation, and dissemination of the practice recommendations because this model allows for incremental changes to be made to the plan to optimize outcomes. This model provides needed flexibility in comparison to other models. The first step in this cycle is to plan (Agency for Healthcare Research and Quality, n.d.b). During this planning step, staffing needs are going to be identified and baseline data is going to be gathered for comparison later on. Responsibilities will also be delineated. The next step is do, in which ratios will be actually implemented (Agency for Healthcare Research and Quality, n.d.b). The study step will follow this. This step is dedicated to new data gathering, comparison of this data to baseline, and interpretation of data to determine if the effects theorized are occurring. At this point in time, if changes need to be made to improve implementation of the ratios, those can be made here. The final step is to act. In this step data collected in the study component of the model is evaluated to
determine if expected outcomes were met or not. If outcomes were not met the implementation is revised, and the cycle is repeated. If outcomes are met, the new practices are adopted. A secondary part of the final step would be to disseminate the research findings to stakeholders so that advocacy efforts can begin for mandating these ratios in other facilities.

**Plan**

A meeting will be called with the stakeholders. Stakeholders include the chief nursing office of the hypothetical facility along with the nurse managers, charge nurses, nursing educators, and the nurses involved in direct patient care on the units of interest. These individuals will be directly involved in the implementation of this process and thus will need to know the plans to carry out the implementation process. The purpose of this meeting is to inform stakeholders of concerns relating to patient safety, and the research findings that substantiate the usage of ratios to improve safety on these units. This meeting further gives staff the opportunity to ask questions or gain clarification regarding the changes to be implemented.

Approximately 6 months prior to the implementation of these ratios, the baseline data gathering phase will occur to determine baseline rates of measurements regarding staffing, patient safety, and costs related to both. This would include a survey for nursing satisfaction and burnout to be administered 6 months prior to the implementation of the ratios. The survey will be mandatory for all nurses working on that unit where implementation occurs and will be administered by the occupational health nurse. This will allow comparison for change in nursing satisfaction and burnout on the units that have implemented ratios as this same survey will be re-administered at the end of the 6-month implementation period. At this point in time, the staff on these three units will be advised of the changes to be implemented to their units so that they have ample time to prepare for changes and complete surveys needed.
The occupational health nurse will also be responsible for gathering data on the workplace injuries among nurses throughout the 6-month period before initiation on these units. The unit managers will be responsible for gathering the baseline turnover rate for registered nurses on their unit. Unit managers will also be responsible for monitoring infections rates, falls, length of stay, medication errors, and mortality for their units. The costs of turnover, infection rates, medication errors, and falls will be calculated for each unit before implementation of these ratios. In addition, the ED unit managers will be required to monitor average bedtime, wait-time, and bed-utilization through the 6 months before implementation.

The baseline data gathering phase will occur over a 6-month time period, similar to the length of time of implementation of the ratios to ensure that the data being compared have consistent timeframes. The ratios will initially be implemented on one hypothetical unit at a time starting in the medical surgical unit, then the ICU, and then the Emergency department. The reason being that hiring for specialty units requires longer to get people oriented and trained. This also distributes the anticipated increase in initial costs over a few months, making the project more feasible financially.

Based on evaluation of current resources, nursing managers would potentially have to work with human resources to hire additional staff members. Determining the number of staff needed requires an understanding of the layout of each unit and typical scheduling protocols. Nurses in the hospital typically work 12-hour shifts, and there are two shifts per day. Full-time nurses typically work three shifts per week. The hypothetical medical-surgical unit is a 32-bed unit. The minimum nursing to patient ratio of 1:4 will be implemented and maintained over a 6-month period. This means that at least eight nurses will need to be staffed each shift along with a charge nurse. This equates to a need of at least 32 full time nurses and four full-time charge
nurses to cover 6 days of the week. The remaining 16 nursing shifts and one charge nursing shift for the 7th day would need to be covered through part-time, per-diem, or float pool staff. As a last resort, nurses provided by staffing agencies will be used. The charge nurse is to be kept out of ratio, meaning they will not directly take on a patient assignment of their own. They will be tasked with auditing patient safety on the unit, and assisting nurses involved in direct patient care.

The ICU has a total of 18 beds and the capacity to ventilate six patients at one time. This means that a total of nine nurses need to be present for each shift and up to 12 nurses per shift if all ventilators are being used. At least 36 full-time nurses and four charge nurses will be needed to staff the unit 6 days of the week. On the 7th day, 18 nursing shifts and two charge nursing shifts would need to be covered. This too can be achieved through utilizing part-time, per diem, or float pool staff. Having 1-2 nurses on call per unit each shift will help ensure that nurses can be pulled in if needed when more ventilated patients are admitted. Dedicating these positions to per-diem staff positions would ensure other nurses are not being burdened with overtime. As utilizing staffing agencies can cost nearly double or triple the costs of staff nurses, paying people to be on-call at the regular rate could still be considered fiscally responsible to reduce usage of staffing agencies. Again, staffing agencies will be utilized as a last resort. The charge nurse will be kept out of ratio. Their responsibilities will be to audit patient safety on the unit, intervene when necessary, and assist nurses when requested.

The Emergency Department will have tiered ratios based on acuity. For trauma patients, the ratio will be set at 1:1. Critical care level patients will be set at 1:2, and the rest will maintain a ratio of 1:3 as a technician should be present for each shift. The ED has 30 beds. Of these, two trauma rooms and four ICU level rooms. There would need to be a total of four nurses to staff
these higher acuity rooms every shift. A total of eight nurses would need to staff the remaining rooms each shift. The combined total means that 12 nurses and one charge nurse will need to be present each shift. This means that at least 48 full time nurses and four full-time charge nurses will be needed to cover 6 days of the week. The remaining day will require 24 nursing shifts, and two charge nurse shifts to be covered. This can be achieved by using part-time, per-diem, or float pool staff. As a last resort, staffing agencies will be utilized. The ED charge nurse will also be kept out of staffing so that they can audit patient safety and assist the nurses when needed.

**Do**

This stage is the actual implementation of the nursing ratios. Over the course of six months, staffing on the three hypothetical units would follow the established ratios with no fluctuations beyond the guidelines from chapter three. Staffing on these three units will be prioritized during bed flow to ensure these ratios are maintained as fluctuations could influence the results at the end of the study. Bed flow is the meeting that occurs during every shift in hospitals (Marquis & Huston, 2019). The purpose of the meeting is to determine staffing needs for the on-coming shift based on number of scheduled staff versus current patient census. During this meeting, staff is also arranged for the next shift. The decision to float nurses to other units is carried out during this meeting (Marquis & Huston, 2019).

On the medical surgical unit, the staffing is going to be set at 1:4 but can be extended 1:5 only when staff cannot be secured for a shift and all other measures have been attempted to get staff in to maintain this ratio. In the ICU the ratio will be set at 1:2 for all patients apart from those ventilated. The ratio for nurses caring for ventilated patients will be set at 1:1. In the Emergency department, the ratios will be set at 1:1 for trauma level patients, 1:2 for critical care patients and 1:3 for all other patients provided that a technician is present to help the nurses. The
ratio will change to 1:2 if there is no technician present. At the end of the six months pilot period, another nursing satisfaction and burnout survey will be conducted. New data will also be collected regarding nursing injuries, patient infections, patient falls, and medication errors which will be evaluated in the next step.

**Study**

There will be three broad categories of indicators used to determine if the newly implemented ratios are effective. The three categories include nursing indicators, patient safety indicators, and costs. The nursing indicators that will be monitored are nursing satisfaction with their job, nursing turnover rate, nursing workplace injuries, and nursing burnout. All of these directly influence the number of staff available and are influenced by low staffing levels. With better staffing, ideally there will be a reduction in turnover, burnout, and workplace injuries in nursing along with an improvement in satisfaction. This will lead to decreased costs relative to turnover and workers compensation for injuries attained on the job. The patient safety indicators will include incidents of the following: falls, medication errors, CLABSI, CAUTIs, VAP, actual length of stay versus anticipated, and mortality. If the set ratios are effective, there should be declines noted in all of these on the unit where ratios are implemented. The change in rates of falls, medication errors, and infections will also lead to reduction in costs to the hospital directly. In the ED, some additional measurements include bed utilization, bedtime, and wait-time. This prevents crowding in the ED and improved turnover in patients. As more patients are seen, there should be an increase in revenue.

**Act**

After the PDSA cycle on each unit ends, adjustments can be made to the plan and a revised plan can be re-implemented. For instance, if there is no improvement noted on medical
surgical unit rates of infections, consideration will be given to eliminating the 1:5 ratio option. Another adjustment that could be made is to increase the number of technicians present on the unit as this is a lower cost option that could lessen the time burden on nurses, allowing them to focus more on nursing-specific tasks. Additionally, one modification could be to incorporate acuity tools specific to each unit to allow for more equal distribution of workloads. Unit staff nurses should be included in selecting appropriate acuity tools as they have a better understanding of the acuity of patients on their unit, and which tool would be most beneficial in distributing patient loads amongst their unit. Once desired changes are supported by data collected on nursing indicators, patient safety indicators, and costs, then hospital leaders may consider implementing these nurse-to-patient ratio changes permanently on these units.

Once evidenced based practice ratios have been maintained hospital wide for 1 year, the results of the PDSA cycle data would be compiled in a report and advocacy efforts will begin. Patient safety is a concern for many individuals and organizations. Getting key stakeholders involved is essential so that these staffing guidelines can expand and potentially become standards that are implemented in all hospitals. Key stakeholders who would benefit from standardized, evidence-based staffing including nursing staff affected by these ratios, the community that receives care at these facilities, and the insurance companies that control reimbursement for care received. The Centers for Medicare and Medicaid Services has been instrumental in holding healthcare facilities accountable for preventable events (Aiken & Fagin, 2022). Partnering with them to achieve these changes on a larger scale is doable and would benefit the insurance company as a large portion of patients hospitalized are those over the age of 65 and covered through Medicare (Aiken & Fagin, 2022).
Summary

Chapters 1 and 2 were dedicated to the description of staffing issues and researching beneficial methods of staffing such as set ratios. The purpose of Chapter 3 is to describe the evidenced based practice recommendations regarding specific nursing ratios that show benefit is reducing negative patient outcomes. Chapter 4 is dedicated to the planning, implementation, and evaluation of these ratios to determine if they are effective. There are three types of factors that will be considered to determine efficacy of ratios including nursing indicators, patient safety indicators, and costs. Nursing factors include nursing satisfaction, nursing turnover, and nursing workplace injuries. Patient safety measures include infection rates (ie CLABSI, CAUTI, VAP), falls, mortality rates, length of stay in comparison to standards, and medication errors. Baseline data will be gathered 6 months prior to implementation, and new data will be gathered during the 6-month implementation period. This data will be compared. The last factor would be calculating cost savings from reduction in turnover, nursing injuries, and all the patient safety variables mentioned. This reduction in costs depicts financial benefits of staffing proactively and subsequently will provide other hospitals with concrete evidence to persuade them to initiate the changes without governmental involvement until mandated ratios can be achieved. Although the plan for this study is to implement the ratios in this facility specifically, these best practice recommendations have the potential to benefit millions of healthcare workers and healthcare recipients in the United States. Thus, advocacy efforts should begin by educating the public and disseminating these findings to powerful organizations capable of initiating change.
References


Retrieved from https://www.ahrq.gov/hai/pfp/haccost2017-results.html


https://www.ahrq.gov/health-literacy/improve/precautions/tool2b.html


Centers for Medicare & Medicaid Services. (n. d.). *Hospital-acquired conditions*. Retrieved from [https://cms.gov/Medicare/Medicare-Fee-for-Service-Payment/HospitalAcqCond/Hospital-Acquired_Conditions](https://cms.gov/Medicare/Medicare-Fee-for-Service-Payment/HospitalAcqCond/Hospital-Acquired_Conditions)


http://doi.org/10.1177/1474515117721561


https://doi.org/10.1016/j.healthpol.2020.08.003


https://www.jstor.org/stable/26813342


https://doi.org/10.1016/j.jhin.2018.12.001


http://doi.org/10.1136/bmjopen-2021-052899


https://doi-org.ezproxy1.library.arizona.edu/10.1146/annurev-publhealth-032013-182508


NSI Nursing Solutions. (2022) NSI national healthcare retention & RN staffing report. NSI Nursing Solutions. Retrieved May 12, 2022, from


http://doi.org/10.4103/0972-5229.130573

Nephrology Nursing Journal, 47(2), 133-142.
https://doi.org/10.37526/1526-744X.2020.47.2.133


## Table of Findings

<table>
<thead>
<tr>
<th>Author(s) and Date</th>
<th>Research Purpose/Questions, variables</th>
<th>Study method, design, sample, setting</th>
<th>Results/Findings</th>
<th>Notes: (data collection, instrument details, study strengths, limitations, Level of evidence)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Cathro, 2016)</td>
<td>-The purpose of this study was to determine how charge nurses contribute to patient safety throughout their shift. -Charge nurses were observed throughout their shift by researchers that would document tasks they completed. -All charge nurses were kept out of staffing. Their sole focus was monitoring the flow of the unit during their shift.</td>
<td>-This was a grounded theory and observational study. -A 400 bed hospital in the metropolitan area was selected. Six medical-surgical units in this hospital were utilized to sample participants from. -Purposive sampling was used. -A total of 11 interviews and 6 observations occurred during this study. -Participants were included from all 3 shifts.</td>
<td>-One theme that arose is that charge nurses are gatekeepers for patient safety. -Three categories of themes were balancing multiple roles, maintaining a watchful eye, and working with and leading the healthcare team. -Charge nurses act as educators for patient, family, and staff. They address patient safety through identifying high fall risk patients. They advocate for safer practice environments.</td>
<td>-The interviewees' responses were transcribed. -Researchers observed until data saturation was achieved. -The data collection included open coding, axial coding, and selective coding methods via the NVIVO Qualitative Data Analysis Software. -Strengths include verifying back with participants about the themes that emerged which ensures that accurate themes were</td>
</tr>
</tbody>
</table>
Researchers controlled for biases through journals before the interviews and observations. Charge nurses plan out patient assignments utilizing acuity to prevent overloading one nurse with a patient. Charge nurses answer call lights, assist patients to the bathroom, and advocate moving high risk patients closer to nursing stations. Charge nurses audit charters to prevent infections like CLABSI, and CAUTIS. One weakness is that this study is observational and so has a lower level of evidence. The level of evidence is VI.  

| (Driscoll et al., 2018) | The purpose of this meta-analysis was to determine whether or not there was a relationship between nurse patient ratios and nursing sensitive patient outcomes. Major nurse sensitive patient outcomes looked at include unplanned extubation rates, 35 individual cross-sectional studies were included and 1-point prevalence study. All individual studies were done in acute care units such as intensive care units (ICUs), cardiac intensive care and cardiac thoracic surgery recovery units. | There was a relationship identified between nurse-to-patient ratios and patient outcomes. Mortality rates were 14% lower on units with higher nurse staffing. On units with lower nurse staffing, the odds ratio for intravenous medication errors | Information technologist specialist helped direct the search. Nurse/patient ratios were calculated in two ways; number of nurses over 24-hour period divided by number of patients. The other was the number of nursing hours per patient. Extraction tool used by |
pressure injuries, catheter associated urinary tract infections (CAUTIs), and central line associated bloodstream infections (CLABSIs). Some others include falls and length of stay.

- Search engines included Medline, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Embase, Cochrane Database of Systematic Reviews, etc.
- Search or MeSH terms used in the search were dosage of nursing, cardiac care, critical care, nurse staffing, and nurse ratio.
- Inclusion criteria:
  1. Mixed population or adult population wards in the intensive care, cardiac specialty, or critical care units.
  2. The nurse ratios calculated by the number of nurses per occupied bed, or the number of nurse hours per occupied bed.
  3. Had to be published increased.
- Critical care units that had a higher number of nurses to patients had lower pressure injuries incidents, physical restraint usage, and health care associated infections.
- There was no relationship found between cardiac arrest and nurse-patient ratios in ICUs.
- Patients with a higher nursing hour per day were 68% less likely to get a CLABSI, 79% less likely to get pneumonia while in the hospital, and 31% less likely to develop a pressure ulcer.
- One study identified that increasing the patient per nurse by one resulted in a 35% increased chance in those patients having researcher; validity of measurement tool had not been verified.
- Newcastle Ottawa scale (NOS) was used to determine the quality of the studies used.
- Odds ratios to determine effect size, as were hazard ratios and risk ratios.
- Inverse ratio; used to change patient to nurse ratios to nurse-to-patient ratios.
- Credibility: The researcher graded the evidence and reliability of the articles used. The researchers also provided information on another meta-analysis that had similar findings, and so the findings matched up with other work.
- Limitations: They stated limitations such
between the years 2006 to 2017
4. Quantitative statistical methods.
5. Include some of the outcomes of interests, such as CLABSIs, CAUTIs, falls, med errors, pneumonia, cardiac arrest, and death.
- The studies originated from the United States, Canada, Mexico, Europe, China and Thailand.

- The purpose of this study was to determine the impact of nursing to patient ratios on quality of care in the Emergency Department.
- The variables being measured were bed utilization, RN utilization, wait times, extended hospital stays.

- The study was a computer simulation that utilized real patient and hospital data to study the effects of staffing on the various variables of interest.
- A total of 200 simulations were carried out, each lasting 72 hours.

- RN utilization is the amount of time designated by a nurse to direct patient care. The optimal RN time utilization is set at 70% as this allows for nurses to chart and address things that come up.
- In the national ED, the simulation tool was created for this research study specifically and was not named.

- One of the strengths of this study is that they utilized data to create the national ED which resembles a typical ED.
The ratios being studied included 1:2, 1:3, 1:4, and 1:5. Researchers theorized that less nursing staff available resulted in increased wait times, bed utilization, RN utilization, and wait time. The sample size was 27,400 virtual patients. Data was gathered at an urban hospital and used to create the algorithms for the simulation. Researchers worked with expert nurses and doctors to delineate average time spent for certain procedures to determine RN utilization. There were two groups, the National ED and the high-acuity ED. The National ED had a patient population that resembled typical ED populations and was used as a control and comparison group for the National ED.

Average wait time was 78n minutes. Increasing the number of patients per RN leads to increase in RN utilization, bedtime, and bed utilization. The optimal ratio was identified as being 1:2. This ratio was associated with RN utilization of 60%, 92 minutes of wait time. A ratio of 1:5 was associated with 90% RN utilization and 168-minute wait time. Increased bed-time also increased bed utilization, leading to crowding. A ratio of 1:3 had similar results for bedtime and RN utilization when there was an emergency room technician on the unit to help out nurses with in the US. They compared data from the actual simulations to this data. They also utilized real patient data to create the overall study and experts set the standards of measurement they were using. One of the limitations of this study is that the results were from simulations. The validity of the tool they utilized to carry out simulations was not determined. The level of evidence is IV.
- The purpose of this research was to determine how nurse staffing levels and nursing workload affect VAP and mortality rates. The researchers theorized that low staffing was associated with increases in mortality and VAP rates. The variables of interest were nursing-to-patient ratios, acuity scores along with VAP and mortality rates.

| Jansson et al., 2019 | -This was a prospective cohort study. The study was carried out at a teaching hospital in Finland. The study was carried out from 2014-2015. The sample size was 85 patients. The sampling type was convenience. Criteria for inclusion into the study was being ventilated for at least 48-hrs. Exclusion criteria included a diagnosis of pneumonia or having a tracheostomy. They could also not be deemed immunocompromised such as having a diagnosis of HIV. | -Researchers set the p value to .05. Nursing-to-patient ratios range but averaged .9 to 1.3 nurses per patient. When the ratio was 1:1 or less, VAP rates were also lower. VAP rates increased when this ratio was above 1:1. Survival rates were 31% when the ratio was above 1:1. The survival rate was 35.7% when the ratio was 1:1. The p value for survival rates was .009, which is considered statistically significant. | -The scoring systems used to evaluate acuity of patients were the Therapeutic Intervention Scoring System and Intensive Care Nursing Scoring System. One limitation of the study is that the sample was composed of mostly male patients. This may not be representative of the actual population of patients seen each day in the ICU. One strength of the study is that researchers brought up other studies that contained similar findings as their own. The findings in this study were consistent with findings in other studies. They also had a statistically significant p value which means the findings are not likely |
| (Lasater et al, 2021) | -The purpose of this study was to determine if nurse staffing ratios affected mortality and length of stay for patients. Researchers theorized that lower ratios were associated with increased mortality, length of stay, and increased costs. The variables of interest were 30-day mortality rates, length of stay, nursing-to-patient ratios, and costs. | -This was a cross-sectional analysis and observational study. The sample size was 210,493 Medicare patients and 1391 registered nurses. The data was pulled from 87 hospitals located in Illinois along with a survey administered to nurses from those facilities that worked on medical-surgical units across the state. The data was gathered from the American Hospital Association database. Patients were excluded if they had psychiatric diagnoses like addiction or if they had lengths of stay. | -The ratios experienced on medical surgical units varied significantly from 4.2 to 7.6 patients per nurse. The optimal ratio was determined to be 1:4, although reduce in mortality and length of stay was seen for a ratio of 1:5. 30-day mortality rates increased 16% for each additional patient added to the nurse's assignment. If hospitals had maintained a ratio of 1:4 on medical surgical units over the course of the study, 1595 deaths could have been prevented. Likewise, those facilities would | -STATA statistical software was utilized to carry out data analysis. One of the strengths of the study is that they surveyed nurses that worked at these facilities so that nursing to patient ratios were accurate. One of the limitations of the study is that various hospitals were utilized in the study. Different hospitals have different policies, procedures, and cultures that could have affected the results. For instance, some places may have transporters, technicians, and other methods to assist nurses. Another limitation is |
| (Lee et al., 2017) | - To determine if there is a relationship between nursing workload and survival of patients in the intensive care units.  
- Took into consideration variables of nurses per shift, severity of patients illness as well as characteristics of their care, and lastly survival rates.  
- How does workload or staffing ratios affect survival rates to hospital discharge was the specific question being asked. The objective of  

| 56 stays that exceeded 60 days.  
| have saved a cumulative of $117 million.  
- 51.2% of nurses surveyed stated that their patient assignment last shift was more than they felt they could safely take care of.  
| that they used data from only elderly population. This may not be generalizable to medical surgical units that have younger generations of patients as well.  
- The level of evidence is IV.  

| - This was a cohort study.  
- Used retrospective analysis and net benefit regression analysis.  
- Convenience sampling  
- 2 ICUs of interest, 1 from a teaching hospital and the other from a regular hospital.  
- The setting was in two intensive care units in Hong Kong that were multidisciplinary.  
- ICU 1 was a 12-bed unit.  
- ICU 2 was a 22-bed unit.  
- 845 critically ill  
| - Having a workload to nurse ratio of 52 for 1 day or greater had an increased likelihood of death as determined through the odds ratio for survival.  
- The survival to hospital discharge is projected to be the most when workload to nurse ratio is less than 40.  
- 18.5% of patients died when the ratio was consistently greater than 52, and only 10% died when this ratio was consistently less than 40.  

| - This study was done in Hong Kong so there are likely differences between healthcare systems in different countries. However, nurse ratios are an issue being studied worldwide and so could be relevant.  
- From a peer reviewed medical journal.  
- Tool for measuring nursing workload was used, the Therapeutic Intervention Scoring System-76. The higher the score, the higher the workload and the sicker
The study was to determine if low nursing scores benefited critical patients, as well as to find out exactly what ratio was best.

- There was not a hypothesis officially stated in the paper, but the authors seemed to think that lower nursing ratios are beneficial as they brought up a lot of studies related to this in the introduction.

Patients over a 5-month period were analyzed.

- Patients who had a workload to nursing ratio of always less than 40 were 2X more likely to survive until discharge than patients with similar overall status but higher workload to nursing ratio.

- The p value was set at .05.
- NHPPD averaged 4.25 hrs. but could range 1.22 hours above or below this.
- Lower NHPPD was associated with an odds ratio of 4.33 for HAPIs. The finding was statistically significant with a p value of .001.

- Level of evidence was 4 because this was a cohort study.

- The purpose of this research was to determine the relationship that exists between nursing staffing and patient safety outcomes in lower income countries.

Researchers theorized that low staffing levels were associated with poorer patient outcomes.

- The study was conducted at a 420-bed tertiary hospital in Lebanon.
- The sample size was 68,000 patients.
- The research study was carried out over 48 months.
- The sampling

(Kouatly et al., 2018)

- The Statistical Package for the Social Sciences (SPSS) tool was utilized to analyze the data which has shown to have high validity.
- A strength of this study is that they did not use staffing agencies to supplement staffing needs. Staffing agency nurses do not have the

<table>
<thead>
<tr>
<th>Purpose of Research</th>
<th>Study Design</th>
<th>Sampling</th>
<th>Sampling Size</th>
<th>Sampling Duration</th>
<th>p Value</th>
<th>NHPPD Average</th>
<th>Odds Ratio for HAPIs</th>
<th>Level of Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determine relationship between nursing staffing and patient safety outcomes in lower income countries.</td>
<td>Prospective</td>
<td>Unknown</td>
<td>68,000 patients</td>
<td>48 months</td>
<td>.05</td>
<td>4.25 hrs.</td>
<td>4.33</td>
<td>4</td>
</tr>
</tbody>
</table>
like increases in infection rates and falls. The variables of interest were falls, HAPIs, CAUTIs, CLABSIs, and VAP. The technique was convenient. Data from all patients present during the time period of the study were included. All the patients on the unit during this time period were utilized in the study. The units included were medical surgical units and critical care units. They utilized the NHPPD method to determine staffing. Lower NHPPD was associated with increased CLABSIs. The odds ratio was 2.61 with a p value of .006. The NHPPD needed to reduce CLABSI and HAPIs were 5.47.

(McHugh et al., 2016) - To determine what - This was a - Staffing varied on - A good nursing
A relationship existed between nurse staffing or work environment and cardiac arrests that occurred in the hospital. The researchers hypothesized that high nurse to patient ratios and better nursing work environments increased the odds a patient would survive until discharge after experiencing an in-hospital cardiac arrest.

To test this hypothesis, a cross-sectional study was conducted. Data was gathered from 3 places:
1. The American Health Associations (AHAs) Get With The Guidelines In-Hospital Cardiac Arrest-Resuscitation Database (GWTG-R) which provided information surrounding the patients that underwent cardiac arrests in the hospital such as if they survived, diagnoses, etc.
2. The University of Pennsylvania Multi-State Nursing Care and Patient Safety Survey which gave access to information regarding nursing perceptions of the work environment and staffing averages in the hospitals included.
3. Medical surgical units had the most. The average was 7 and there was a standard deviation of 2.8. and less variable in ICUs at about 2.3 patients per nurse with a standard deviation of 6.

Staffing in the ICU did not show a sizable effect on survival rates.
- Adding 1 extra patient per nurse on medical-surgical units, decreased survival to discharge by 5%.
- Survival rates decreased by 16% in hospitals graded as poor working environments.

A poor working environment is defined as a place where nurses are capable of making decisions regarding patient care, they make decisions regarding resources, the nurse-physician is not strained. This was based on nursing perceptions.

- Studied included statistics related to failure to rescue (FTR).
- Limitations include the merging of data from multiple sources as the information gathered from each was not from the same point in time.
- Nurse staffing to patient ratios were also not in real time, they were averages of ratios for those hospitals.
- A confounding variable is that the GWTG-R hospitals were much less...
3. The AHAs annual surveys which added to the descriptions of the hospitals included in the study.
- The data represented 75 hospitals in 4 states; Pennsylvania, New Jersey, California, and Florida.
- The data was from various both adult medical surgical and intensive care units.
- Logistics regression was utilized.
- A total of 11,160 adult patient stays were looked at.

different than those that were not part of this quality improvement measure. These hospitals often had advanced technology and were larger.
- Exclusion criteria regarding patients; less than 18 years of age, not housed in an adult ICU or Med/Surg unit, and presence of implanted cardioverter.
- Practice Environment Scale of the Nursing Work Index (PES-NWI) to grade the hospital environment as good, mixed, or bad based on the score. This score was based on things like nurse manager ability, leadership, and support of the nurses as well as the nurse and physician relationship.
- Credibility: controlled
<p>| (Thomas-Hawkins et al, 2020) | -To determine if patient safety and nurse-staffing levels are correlated with patient safety. -There are two indicators of safety in this journal which include patient transitions in care as well as a healthcare employee's perception of patient safety. -Looked into staffing levels, workload, care left undone, and patient safety outcomes. -High turnover in this patient care setting makes the possibility for mistakes more likely. -Sought to answer these questions. | -This study used descriptive statistics. -Cross-sectional, correlational design. -On a list of over 1200 nephrology nurse names acquired from a board of nursing and nursing association; 160 were sampled but only 104 participated due to inclusion criteria of being a dialysis nurse specifically. -The sampling technique was random, and the data was gathered using an online mailed questionnaire. Dillman survey method. -Least squares regression with a | -Low staffing, high workloads, and care left undone were all significantly associated with unsafe shift change periods and lower safety ratings. -Only 27% of nurses did not agree with things falling between the cracks during patient shift change. -31.7% disagreed that important patient care information is often lost during patient shift change. -Only 33% agree that handoffs or transitions were safe. -40% of nurses reported having a workload score. | --Patient transitions were characterized as safe when there was effective communication, accurate information, minimal interactions, among other things. When these things do not happen, adverse patient events occur. -Ratings by nurses of unsafe patient shift change are associated with higher probability of adverse patient reactions. -Demographics were taken of participants as well. -Included percentages on all of the questions. | for known confounding variables in statistical analysis such as age, diagnosis, heart rhythms present at time of code. -Level of evidence: 6 |</p>
<table>
<thead>
<tr>
<th>Question</th>
<th>Methodology</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What percentage of RN staff in hemodialysis units report positive ratings of patient shift change safety and overall patient safety?</td>
<td>- Power analysis was done to determine the sample 13 or higher. - 34% of nurses reported 3 or more care activities left undone at the end of their shift. - Ratios, workload, and number of care activities left undone all correlated with negative effects on safety outcomes as perceived by nurses. The highest correlation found was between care left undone and patient safety.</td>
<td>- They asked, the data was all present in the report which made understanding the material much easier and the report very transparent. - Patient to nurse ratios varied from 48 to 1, with the average being around 11. - Scale of HSOPS used for nurses to rate safety during patient shift change which utilizes the Likert scale, higher scores indicated higher safety as perceived by the nurses. - Workload was assessed through a 5-item workload scale based on the Individual Workload Perception Scale. This was a Likert scale as well. - Level of evidence was 6 since this is a ...</td>
</tr>
<tr>
<td>2. What are the effects of RN staffing, RN workload, and care left undone on ratings over patient safety?</td>
<td>mediation model was also used.</td>
<td>- 34% of nurses reported 3 or more care activities left undone at the end of their shift. - Ratios, workload, and number of care activities left undone all correlated with negative effects on safety outcomes as perceived by nurses. The highest correlation found was between care left undone and patient safety.</td>
</tr>
<tr>
<td>3. Does care left undone connect staffing and workload to ratings of safety?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
(Zimlichman et al., 2013)

- The purpose of this research was to estimate average costs associated with hospital acquired infections like CLABSIs and CAUTIs in hospitals.
- The researchers theorized that hospitals spend a significant amount of money each year on these infections.
- The variables of interest were incidence rates of infections, attributable costs of these infections, and added length of stay during hospitalization.
- The infections under consideration were VAP, CLABSIs, CAUTIs, C DIFF, and MRSA.
- This was a systematic review that gathered data from hospitals from the years 1986-2013.
- A total of 26 studies were included.
- The inclusion criteria were that studies had to be conducted within the United States and one adult medical surgical or ICUs.
- Pediatric units of any sorts were excluded from the study as were long-term acute care facilities.
- The search engine used was PubMed.
- The MeSH terms utilized were -
- Costs per CLABSIs averaged at $46,000 per incident. These infections occurred 1.27 per every 1000 device days. The total cost of these is 1.9 billion dollars per year.
- The average cost to treat VAP was $40,000. VAP occurs in 1.33 infections for every 1000 device days. VAP costs the healthcare system 3 billion dollars each year.
- The cost to treat surgical site infections (SSIs) average $21,000. SSIs occur in 1.98 per 100 procedures. SSIs cost approximately 3.3 billion dollars each year in healthcare.
- Clostridium infections cost on average $896 to -
- The database used to extract data for infection rates was the National Healthcare Safety Network from the Centers for Disease Control and Prevention.
- One weakness of the study is that they utilized only adult infection rate data to determine the costs. As some of these infection types occur in the pediatric population as well, the actual costs could be significantly higher. Another limitation is that the data used was up to 25 years old. Healthcare costs have risen significantly in that time period.
- One strength of the study is that only
| treat per incident and occur in 3.85 per patient day. C DIFF costs the US healthcare system about 1.5 billion dollars per year. research articles conducted within the United States was used which ensures that healthcare economies did not interfere with the results. |