IMPLEMENTATION OF A STANDARIZED ELECTRONIC HANDOFF TOOL FOR ADVANCE PRACTICE PROVIDER PASS-OFF

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This DNP Project is accepted in partial fulfillment of the requirements for the degree Doctor of Nursing Practice.

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Chapter One

Introduction

Three seminal works published by the Institute of Medicine in 2000 to 2004 highlighted the state of healthcare at that time, and the need to redesign the way quality care was provided (Kohn, Corrigan & Donaldson, 2000; Institute of Medicine (IOM), 2001; Page & IOM, 2004). *To Err is Human* (IOM, 1999), informed the nation that nearly 100,000 patients die each year due to preventable medical errors and over 15 million more patients are injured annually (IOM, 1999). *Crossing the Quality Chasm* (IOM, 2001), which stated that the United States healthcare system does not provide consistent and high-quality care to its patients, presented the healthcare community with aims for improvement. By focusing on safe, effective, equitable and patient-centered-care which is delivered in an efficient and timely manner, the authors argued that health care systems would be far better at meeting the complex needs of patients (IOM, 2001). *Keeping Patients Safe: Transforming the Work Environment of Nurses* (IOM & Page, 2004), built off the previous two publications and identified guidelines for improving patient safety and providing quality care by addressing the conditions and demands that nurses work under. The constant theme throughout each of these documents is a call for change that incorporates the complex and changing needs of patients, and the ever-present need to redesign the healthcare system to ensure high quality and safe care to all patients.

It is important to understand the definition of a medical errors, which Grober and Bohnen (2005) define as "an act of omission or commission in planning or execution that contributes or could contribute to an unintended result" (Grober & Bohnen, 2005, pg 42). Updated research has yielded numbers that are much higher than reported in *To Err is Human* (1999), which estimated that 44,000 to 98,000 patients die annually due to medical errors (IOM, 1999). James (2013),

stated that single studies or small studies could not provide a defensible estimate on deaths from preventable errors for hospitals across the United States. However, he concluded that by combining several studies, using an evidence-based approach, one could estimate the number of deaths related to medical errors (James, 2013). Using data from 2007, there were 34.4 million discharges from hospitals in the United States; using an average of preventable adverse events and a ratio of death to preventable errors from several studies, an estimated number of deaths related to preventable medical errors was calculated to be 210,000 annually (James, 2013), a number much higher than reported by the IOM 13 years earlier. Furthermore, this number was reiterated in 2016, when an analysis performed by Mackary and Daniels (2016), calculated the mean rate of death from medical errors from four different studies done since the 1999 IOM report (Healthgrades, 2004; Dept. of Health and Human Services, 2010; Landrigen et al, 2010; Classen et al, 2011), showing a mean rate of 251,454 deaths annually (Makary & Daniels, 2016). If this number is compared to other causes of death in the United States for the year 2013, it would be the third leading cause of death behind heart disease and cancer (Makary & Daniel, 2016).

It was in 1998 that the IOM identified three categories of quality issues: underuse, misuse, and overuse (Chassin & Galvin, 1998; Moriates, 2014). Overuse relates to the medications or treatments that are prescribed without justification, such as antibiotics for viral infections. Underuse is when a patient is not provided with medically necessary or evidence-base care for treating known illnesses. The last concept is misuse, a term used to describe medical errors, occurring when a patient does not receive full benefit from a treatment because of a preventable problem, or simpler, when a patient is harmed by the treatment (Chassin & Galvin, 1998; NPWF, 2009). Medical errors in the hospital setting can further be broken down into

errors of commission, errors of omission, errors of communication, errors of context, and lastly diagnostic errors (James, 2013). Given the many contributing factors to medical errors, the focus of this project will be on errors related to communication, specifically hand-off communications between nurses at the change of shift.

Significance of the Problem

In recent years, poor quality hand-off communications have been identified as a critical safety problem in healthcare. It is estimated that approximately 80% of medical errors are directly related to miscommunication by healthcare providers at the time of patient transfer from the care of one provider to a new provider, or from one unit to another (The Joint Commission, 2012). Miscommunication has long been noted to be a major contributing factor to adverse and/or sentinel events in the hospital setting. The Joint Commission Center for Transforming Healthcare reported that breakdowns in communication was the leading root cause of sentinel events reported to The Joint Commission from 1995 to 2006 (The Joint Commission, 2014). Failed handoffs have been a longstanding problem in health care, which led The Joint Commission to establish a national patient safety goal in 2006, addressing handoff communications. This national patient safety goal requires that healthcare organizations implement a standardized approach to handoffs and have a process which allows for the receiving clinician to have a discussion with the clinician providing the patient information (The Joint Commission, 2007). Patient information refers to the patient's medical condition, treatment plan, services that are needed to care for the patient, and any changes or updates to any of this care (The Joint Commission, 2017).

Communication failure also has fiscal consequences. The CRICO insurance program, which insures 32 healthcare organizations in the New England region of the United States, reported in their 2015 annual benchmarking report, that communication was a factor in 30% of the malpractice insurance cases reported from 2009 to 2013. This time frame totaled 7,149 cases and $1.7 billion in total incurred losses (CRICO, 2015). New England is only a small portion of the United States and this is only one company, however, it is being highlighted to show the high healthcare costs associated with communication failures.

Problem Statement

It is widely known that communication errors can lead to an increase in the number of adverse and sentinel events, and it has been estimated that two-thirds of patient-care errors were related to communication (Hall, Robertson, Merkel, Aziz, & Hutchens, 2017; Volpp & Grande 2003). Use of a standardized tool to communicate patient handoffs between providers at the time of patient care transfers, has the potential to minimize the risk of preventable adverse events, such as injury or death (Clarke et al., 2017; Starmer et al., 2017). Utilization of a standardized electronic handoff tool for patient information, could help to communicate information more clearly and efficiently with all members of the care team (Caruso et al., 2017). The goal of using an electronic handoff tool at the time of patient transfer is to standardize communication between the advance practice providers (APPs) caring for the patient, therefore decreasing medical errors, preventable adverse events, sentinel events, healthcare associated spending, and an increase in provider satisfaction (Starmer et al., 2014; Studney et al., 2017).

Chapter Two

Introduction

This chapter will focus on the strategies used to perform a comprehensive literature review, followed by a synthesis of the literature. Following the synthesis of the literature, a description of the theoretical frameworks used to guide the implementation is described. The last section of this chapter will focus on the setting where the project will occur, followed by the goals and the aims of the project.

Search Strategy

Several databases were utilized in this literature review, including, CINAHL, SCOPUS, PubMed, Ovid/Medline, and the PAIS index. Prior to searching these databases, a concept map was created to aid in searching (see Figure 1). The concept map terms were *handoff communication, written handoff, verbal handoff,* and *electronic handoff*. Patient care areas were also searched in relation to the handoff, and included the operating room, emergency department, intensive care unit, post-anesthesia care unit, and the medical surgical floor. Lastly, different care groups were searched, which included, physicians (surgeons, anesthesiologists, attending physicians, and residents and fellows), advanced practice providers (physician assistants and advanced practice registered nurses), and registered nurses.

		AND	AND	AND
	Concept 1	Concept 2	Concept 3	Concept 4
	Academic medical centers	Handoff Communication	Clinicians	Improvement in errors related to communication
OR	Intensive care units	Written handoff	Nurses	Decrease in sentinel events
OR	Emergency departments	Verbal handoff	Advanced Practice Providers	Increased patient satisfaction
OR	Operating room	Bedside handoff	Physicians	Decreased healthcare costs
OR	Perioperative care areas	Electronic application used for handoff's	Interdisciplinary handoff's	Development of standardized communication handoff

Figure 1. Concept Map

After the development of the concept map and collection of the appropriate literature, a matrix was developed to help organize the literature. The matrix was also used to show relevant themes, notable gaps, reported adverse events, and relevant outcomes of the study. It was also used to help identify the relevance of the literature to the stated problem. The matrix headlines are listed below in Figure 2.

Reference	Aim of the study	Type of study reported (study design)	Care area (setting) Provider group(population)	Type of handoff tool used(intervention)	Types of adverse / sentinel events reported	Relevant / major findings

Figure 2: Matrix Headings

Synthesis of Literature

The process of a hand-off is defined as the transfer of a patient's information and condition from one health care provider to another, whether that be at the change of shift or when

the level of care is changed (i.e. from the ICU to step-down unit or vice-versa) (Riesenberg, Leitzsch, & Cunningham, 2010). However, as modern technology evolves, increased volume of health care providers, and patient care becomes more complicated, the frequency of hand-offs has increased (Barrett, Turer, Stoll, Hughes, & Sandhu, 2017). In a typical teaching hospital in the United States, it is estimated that greater than 4,000 handoffs occur daily between all caregivers (Vidyarthi, 2006). It is easy to understand why The Joint Commission (2006) made hand-off communication one of their National Patient Safety Goals. High quality handoffs are critical in providing safe, effective and efficient patient care. Handoffs that are not of high quality or accurate put patient safety at risk due to treatment delays or inappropriate treatments; they can also lead to a redundancy of tests, inefficiency, increased length of hospital stay, increased readmission rates, and increase in health care costs (Colvin, Eisen, & Gong, 2016).

Given the National Patient Safety Goal established in 2006, and the alarming rates of error presented in Chapter 1, it is not surprising that the amount of research on this topic is plentiful. There is consensus among many authors that handoff communications and processes need to be standardized to avoid miscommunication which can lead to errors, and to provide consistent and safe care to patients (Cornell et al., 2014; Dixon et al., 2015; Hoskote et al., 2017; Robinson, 2016; Segall et al., 2016; TJC, 2012; TJC, 2014). One of the inconsistencies in the literature review lies is in the *delivery* of the hand-off communication.

There are several tools now available for use by nurses and medical providers. A systematic review on handoff communication involving 46 articles published from 1987 to 2008 reported that there were 24 different handoff models being used across the country. Of those models, SBAR (Situation, Background, Assessment, Recommendation) was the most frequently cited (69.6%). Other models include IPASS (Illness severity, Patient summary, Action list,

Situation awareness and contingency planning, and Synthesis by receiver), ANTICipate (Vidyarthi et al, 2006), and HANDOFFS (Brownstein & Schleyer, 2006), with each model representing different types of patient information (Riesenberg, Leitzsch, & Little, 2009). The Reisenberg et al (2009) study stated that SBAR was most widely used, it also described the limitations in the studies with the other mnemonics. These limitations included sample size (less than 18 participants), anecdotal reports, and the lack of published researched on structured handoffs (Reisenberg, Leitsch, & Little, 2009).

There is evidence that the use of these standardized handoff communication tools is beneficial in reducing handoff miscommunication and medical errors (Colvin et al., 2016), and there are many models available to use during the handoff process. But there is no conclusive evidence that one is more effective than (Colvin et al., 2016). Several strategies have been used to implement these tools, such as quality improvement projects (Hoskote et al., 2017; Robinson, 2016), specifically designed checklists for patients transitioning from the OR to the ICU, and/or the perioperative area (Hall et al., 2017; Dixon et al., 2015; Segall et al., 2016), and the use of IPASS (Starmer et al., 2014). Results of several research studies and multiple systematic reviews have shown increased efficiency during handoffs, a more focused handoff, and an increase in time spent focusing on direct patient care (Abraham et al., 2014; Colvin et al., 2016; Cornell et al., 2014; Clark et al., 2017; Starmer et al., 2017).

Despite the consensus, there were discrepancies and gaps noted within the literature, and it was also discovered that several factors influence the handoff process. One of the disparities noted was the effectiveness of the accepted models (SBAR, IPASS) in the critical care setting, which Colvin (2014), concluded further testing needed to be done to determine the effectiveness of these models in the ICU setting. Hoskote (2017), concluded that the development of an

electronic handoff tool for use in a 21-bed surgical ICU had several limitations, including; lack of definition for a complete or efficient handoff, handoff accuracy that was less than ideal, and the use of the electronic medical record (EMR) for handoff was not widely favored in this population (Hoskote et al., 2017). In recognizing these gaps and research on different tools or checklists currently being trialed at different institutions, the use of a single standardized tool has not been identified. This raises the question of adaptability as it pertains to recognized communication tools in the specialized care settings, including the intensive care units, perioperative areas, the emergency department or step-down units. Can either SBAR or IPASS be adapted to meet the complex care needs of the patients in a busy acute care setting?

The acute care setting involves patients of high complexity with rapidly changing needs, in a fast-paced environment that. requires a handoff that is effective while also being efficient. Little research has been dedicated to this, despite it being noted that ongoing funding and research is needed (Abraham, Kannampallil, & Patel, 2014). Not only does more research need to be done on how clinicians handoff patients in the acute care setting, but research should focus on how APPs provide handoff to other providers at the change of shift, or when a patient is transferred to a different level care. The handoffs need to include all pertinent information about patients, but also the initial reasons for admission to the hospital, past medical history, cause of their injuries/illnesses, and treatment plans. Without that information, it can be difficult for the oncoming providers to do their job effectively, which can result in a cycle of inappropriate treatments, redundant care and inefficiency, leading to increased health care costs and errors in care.

The level and amount of education provided to clinicians concerning handoffs showed a gap in the literature, with studies focusing on the training of physicians, but minimal literature

focused on the education of APPs. The Accreditation Council for Graduate Medical Education (ACGME), now requires formal hand-off training as part of the resident physician's education (Barret et al., 2017). The expectation of the graduating resident is that he or she is not only capable of effective hand-off communication, but also takes responsibility for ensuring clear and effective handoffs among all members of the team (Barret et al., 2017). The critical nature of handoffs has garnered more attention as the restrictions on hours worked by resident physicians has been enforced, resulting in shorter shifts and an increased frequency of handoffs. The study done by Barrett (2017), assessed the effectiveness of handoffs and what the surgical resident physicians' thought was necessary for a safe and informative transition. The goal of this study was to create an educational model and assessment tool of what was most relevant to the resident physicians in facilitating handoffs, and to create a handoff tool specific to the institution's surgical residency. All the respondents felt that the EMR lacked the pertinent information necessary for an effective handoff. Over half of the respondents felt that more than 60% of the information that was important for handoffs was not contained in the written patient records. Interestingly, 78% of the residents confirmed they received formal education in handoffs, however, only 14% of them used one of the handoff tools when transitioning patient care. Furthermore, 90% of residents felt that the handoffs they delivered to another resident were either "very effective" or "completely effective;" yet, 42% of the same residents felt that the handoff they received was "not effective" or only "slightly effective" (Barrett et al., 2017).

These numbers in the above paragraph are both alarming and important, as the author states that the overestimation of one's abilities in delivering handoff likely contributes to the inadequacies of current handoff communication. While this study (Barrett et al., 2017) highlighted problems with perceptions in relation to handoff communication, which was a

demonstrated gap throughout the literature review, it also echoed the important elements of an effective handoff, which will be described in the coming sections. This study brought up two important questions, which were not adequately answered in the literature review: 1) What does or should the formal training consist of? Does it vary between hospitals or residency programs? Does the ACGME use a standardized training program? 2) Do advance practice nurses and physicians assistants have a similar handoff education requirement? There was significantly more research regarding the education of physicians as it relates to hand-off than that of APPs, however, there was minimal detail on how the resident physicians received the training.

It was evident throughout the literature review, that there was lack of research on the handoff process in the critical care setting. In fact, Hoskote et al. (2017), stated that in the ICU population there is no data on what constitutes an adequate or an efficient handoff. This article focuses on the implementation of an electronic handoff tool in the ICU and is highlighted because it directly relates to the problem statement. The research team first received input from the ICU medical providers by using a survey that asked which parts of the handoff they felt were critical, and which aspects they felt took up time without adding value to the handoff. They also assessed the providers level of satisfaction with the handoff process during this survey. The medical team in this study consisted of intensivists, fellows, residents, and APPS; nurses were left out of this study. Using the survey and direct observation, a standardized handoff tool was developed using existing EMR software. All members of the ICU medical team were provided with an Apple iPad, with the hospitals EMR accessible through custom designed applications built for the operating system. Implementation of the electronic handoff process showed an increase in the accuracy of the handoff, which was measured by agreement between data provided by the outgoing team and data understood/recorded by the incoming team. However, at

the completion of the study, agreement between the outgoing and incoming teams for the reason a patient was in the ICU was only 36.9%. Agreement on the most important information conveyed was only 21.6% and agreement on the tasks that needed to be followed up on was 31.3%. This study had several limitations, one being the use of agreement between tasks communicated as an index of measuring success of shift-to-shift handoff, as this is one of the first studies to use agreement as a unit of measurement (Hoskote et al., 2017). The authors also identified the lack of a definition for a complete or efficient handoff and stated that quality and efficiency were difficult to measure in this study. One interesting concept that was unique to this publication was preference of care providers to use printed patient list and checklist for sign out/handoff, despite the advantages of a real-time electronic system (Hoskote et al., 2017). This study suggests that there remains significant room for improvement regarding handoff standardization, and with the use of an electronic format for communication in the critical care setting. However, this study can also act as a guide for developing future studies that wish to use an electronic handoff format.

The success of a handoff tool was noted to be dependent on a collaborative and/or multidisciplinary approach (Hall et al., 2017; Hoskote et al., 2017; Robinson, 2016; Segall et al., 2016; Dixon et al., 2015); not only did it lead to a decrease in adverse outcomes, but it helped to foster a collaborative environment between provider groups. Collaboration between provider groups leads to an increase in communication, the feeling of being part of the team, and an increase in job satisfaction (Hoskote et al., 2017; Robinson, 2016; Dixon et al., 2015). Two articles in particular demonstrated good use of a team based or multidisciplinary approach: A quality improvement project was conducted in the post-anesthesia care unit (PACU), where a pilot project using the Iowa Model of Evidence-Based Practice and the principles of Lean Six

Sigma to institute a specific handoff tool was used (Robinson, 2016). The Perioperative PEARLS (P = patient information, procedure, pain; E = adverse intraoperative event, equipment used/needed: A= assessment, antibiotics, drains; R= relationship, radiology findings; L= labs, lines; S= unit, special needs), was designed to help decrease the adverse events in the perioperative phase, and is specific to the transition from the operating room to the PACU. The Iowa Model of Evidence-Based Practice integrates a team approach to collaborate and communicate on decisions and is initiated with an emphasis on knowledge or problem-based triggers that help to establish the project trajectory (Iowa Model Collaborative, 2017). The problem is clear, there is need for consistent patient information to be passed on in a structured manner from provider to provider. Lean Six Sigma is based on the core principles of standardized work and continuous improvement, both of which are needed when implementing a new model to facilitate a transition of care. A multidisciplinary team was assembled, which included a DNP student, OR nurse champion, PACU nurse champion, nurse anesthetist (CRNA), and the Directors of surgery of the OR and the PACU. The outcomes of this study showed an improved communication of essential elements of care in the immediate post-operative period and it also helped to standardize the handoff process for nurses in the PACU (Robinson, 2016). This practice change implemented strategies for effective nurse-to-nurse communication, which promoted positive patient outcomes. This study also demonstrated the way nurses can advocate for patient safety and implement a best practice initiative. It did have some limitations, which were discussed briefly and included the focus on the OR to PACU handoff and no other care areas. However, the principles of Lean Six Sigma and Perioperative PEARLS could easily be applied across the surgical care continuum.

Hall and his group at the Oregon Health and Science University (2017), hypothesized that a collaborative, comprehensive, structured handoff process from the intraoperative team to the ICU team would be associated with a decrease in postoperative complications in adult cardiac surgery patients. A multi-disciplinary team including nurses, anesthesiologists, intensivists, and surgeons developed a structured process for transfer of care. Each subgroup identified specific barriers to continuous excellent care, and interventions were designed to circumvent these barriers (Hall et al., 2017)**.** From these identifications, a scripted handover template that could be readily taught and used by providers, which included verbal acknowledgement using closed-loop communication ("my patient is now your patient," "our patient") was created. This study was performed over a three-year period and had a patient sample of 1,127, which including 550 patients prior to the intervention and 577 patients after the intervention. The main finding in this study was that the post-intervention group was less likely to suffer preventable complications ($p = 0.003$) (Hall et al., 2017). In the discussion, the authors stated that a standardized handoff process helped to diminish distractions and placed equal value on each team member, which allowed their questions to be answered without repercussions. They also reiterated that a comprehensive multidisciplinary approach to development and implementation of the handoff process is key to its success. However, as stated previously, there continues to be a need for further studies to help validate the improvement of patient safety.

Need for Further Research

The use of a standardized communication tool, such as SBAR or IPASS has demonstrated success in many studies, however, its generalizability remains unknown (Colvin, 2014). Furthermore, the development of a real-time electronic application seems to have several

advantages when described but has not been fully researched in the acute care setting, and when it has been tested, does not garner the support necessary to make a practice change (Hoskote, 2017). When tested, a standardized handoff process has decreased preventable adverse events in the surgical setting and it has led to more effective and efficient handoff, resulting in less redundancy, inappropriate tests and treatments (Abraham et al., 2014; Cornell et al., Starmer et al., 2017). It can be hypothesized that the introduction of a standardized handoff process will lead to a decrease in overall healthcare costs, not to mention the avoidance of adverse outcomes and a decrease in sentinel events.

Despite the advantages of a standardized approach, there has been little advancement in implementing this across hospital systems. Even within hospitals it is not uncommon that different provider groups or care areas use different handoff tools or processes. What is evident is the need for this process to be collaborative and include all members of the care team, from the bedside nurses to the attending physicians. Fostering a collaborative environment between provider groups had several advantages, including increased likelihood of adapting the handoff tool, increased job satisfaction, and importantly a decrease in adverse outcomes. Gaps in the evidence included the delivery of the handoff communication (verbal, electronic, or written) and which model was being used and was it being used across all care provider groups. Education of providers on handoff communication was clearly a disparity, with resident physicians being required to complete formal training on handoff communication and nursing seemingly not required to do so. Lastly, the effectiveness and adaptability of accepted handoff communication mnemonics and the way they are delivered in the acute care setting demonstrated a large gap in the literature. Further research needs to be done in these areas to determine effectiveness, the

specification of already acceptable handoff tools, and to explore the use of a real-time electronic form of communication.

Theoretical Framework

Given that this is an implementation project, the theoretical framework being used is an evidence-based practice model, specifically The Iowa Model Revised: Evidence-Based Practice to Promote Excellence in Healthcare (Iowa Model Collaborative, 2017). Permission for use of this model was obtained and granted by University of Iowa Hospital and Clinics. The Iowa Model Revised (IMR), is a widely used model for implementing evidence-based practice in the healthcare setting. The IMR uses a deductive reasoning approach to address quality and uses a stepwise process to develop and implement quality improvement initiatives (Titler et al., 2001; Iowa Model Collaborative, 2017). Along with the IMR, adding a change theory or model to help guide the project, especially in the implementation and evaluation phases will also be utilized. The change theory being used is Lewin's Three Step Change Theory (Burnes, 2004).

The emphasis of the Iowa Model is on organizational processes and consists of 10 stages, which follows an algorithm that is found to be intuitive and understandable to users (Gawlinski & Rutledge, 2008; Iowa Model Collaborative, 2017). The IMR focused on the identification of triggering issues and/or opportunities. Importantly, any of these triggers can set an evidence-based project (EBP) into motion (Gawlinski & Rutledge, 2008; White & Spruce, 2015; Iowa Model Collaborative, 2017). Once a trigger sets off a project, in the case of this project, instituting a standardized electronic handoff, the IMR asks if there is an institutional reason to focus on this problem or use this knowledge? If the answer is yes, then a team is formed, which

consists of key stakeholders (nursing directors, attending nurses, bedside nurses, and nursing administration), relevant research and literature is assembled, appraised, and synthesized (Iowa Model Collaborative, 2017). At this point in the algorithm it is determined if the evidence is sufficient. If the answer is no, then more research should be done, and other types of evidence should be investigated (Iowa Model Collaborative, 2017). In the case of using a standardized communication tool for the handoff process, there is a sufficient amount of high-quality research on its necessity. It would be appropriate to move to the next step in the model, which is to pilot the change in the practice setting. In this case, the setting for the pilot will be the neuroscience ICU and neuroscience floors.

Prior to piloting the project, the intended goals and outcomes need to be identified. The goal of the process is the implementation of an electronic handoff tool and the primary outcome is to have an efficient and effective handoff. Once the outcomes have been determined and using the literature synthesized above, the team will design guidelines to be implemented on the pilot unit. The pilot units will be the neuroscience ICU and the neuroscience floor, and the guidelines will focus on implementing a standardized electronic handoff for APP handoff at the time of patient transfer. The handoff will be completed by the ICU APP and placed in the medical record, the accepting provider will be paged when the handoff complete, and will have the opportunity to ask questions. Once implemented, the new process of handoff will have to be evaluated and depending on the feedback, the procedure may need to be modified. The third and last question asked in the algorithm is if the change is appropriate for the adoption in practice. If the pilot unit is successful, there is a possibility of implementing this change hospital-wide. During the project development phases and the pilot phase, Lewin's Three Step Change Theory, will also be implemented.

Lewin argues that a successful change project has three steps; Unfreezing, moving, followed by refreezing. In the unfreezing stage, Lewin believed that the equilibrium needed to be disrupted before the old behavior can be changed to adopt the new behavior. In the proposed pilot setting, there currently is no standardized handoff process and nurses verbally handoff patients, which would need to be disrupted before my proposed electronic handoff can be implemented. In the moving stage, change needs to be reiterated and the stakeholders and staff need to be involved to move the project forward. Lastly, in the refreezing stage the change is made permanent and the new behaviors are adopted. Change is successful when it is done as a group activity, "because unless group norms and routines are also transformed, changes to individual behaviors will not be sustained" (Burns, 2004, p. 986). This approach pays special attention to change at the individual and group level and is a good framework to use when trying to change the behaviors of a group. By using this model in conjunction with the IMR, it will help motivate the advanced practice providers to change their current handoff practice and adopt a new one.

Environmental Scan

The pilot will be completed in a large metropolitan academic and level one trauma center in New England. The facility consists of over 1,000 beds, with over 50,000 inpatient admissions, 1.5 million annual outpatient visits, 108,000 emergency room visits and 42,000 surgeries each year. The hospital aims to deliver the best healthcare in a safe manner and in a compassionate environment, to advance patient care through innovative research and educational programs and strives to improve the health and well-being for members of the local and global community. The hospital has ranked among the top hospitals in the United States, according to the *US News and World Report* since the rankings were published, and remains the only hospital nationally ranked

in all 16 of the report's specialties. (U.S. News, 2017). As a general hospital, there are several specialty services offered to patients, however, the setting for implementation of this project are the neuroscience floors and neuroscience ICU, both of which are dedicated to all aspects of the neurosurgical and neurology specialties.

Patient Population / Demographics

The neuroscience floors are located all in one building and occupy three separate floors; this same building also housed two floors of operating rooms, in which most of the neurological surgeries are performed. The neuroscience ICU is a 22-bed unit, caring for a variety of neuro-critical care patients, with diagnoses such as trauma of the head and spine, subarachnoid and subdural hemorrhages, stroke, aneurysm care, and post-operative craniotomy patients. Both neuroscience general care units are 32-private bed units, with each floor caring for a specific neurological population. One focuses on stroke and vascular diagnoses, while the other focuses on epilepsy, movement disorders, and neuro-oncologic patients. Each floor also takes care of neurosurgery patients, mostly post-operative craniotomies (for tumors, abscesses, or hemorrhages), post-operative spinal cases, aneurysm patients, and patients with non-operative head trauma.

The neurology service offers treatment for patients with Alzheimer's, Parkinson's Disease, epilepsy, amyotrophic lateral sclerosis (ALS), neuro-oncology (which includes treatment with chemotherapy), brain infections or abscesses, and stroke management. The neurology inpatient service is separated into two services, with one focusing on patients with a vascular type diagnoses, and the other focusing on non-vascular type diagnoses.

The neurosurgery department, which is separate from the neurology service, is one of the hospitals largest services and is one of the nation's leading neurosurgical centers, treating an average of 70-90 patients each day, and performing greater than 2,500 surgeries annually. The neurosurgery department has also been selected as one of the services to encourage growth over the next 3 to 5 years, increasing the amount of attending surgeons and advanced practice providers, as well as increasing surgical procedures by 10% annually.

Given the number of patients seen daily and yearly, it is easy to see why using a standardized communication tool is vital. These units were chosen as they are centrally located to each other, the APP staff on each of the floors are comfortable with the patient population, and they are relatively small departments in terms of employees (when compared to general surgery, cardiology or hospital medicine). Using a smaller department will help for project buy-in and initiation, as well as training that may be needed for the staff members.

Current Communication Tool

The hospital has transitioned to fully electronic health record using the EPIC platform, which includes a real-time communication feature, titled "Handoff Tool." However, the way it is currently being used, this handoff tool is not effective in communicating patient needs. Currently, the APPs and other providers in the neuro ICU and on the neuroscience, floor do not use any sort of handoff tool, and often, no handoff is provided between these providers at the time of transfer. There has been a push throughout the hospital to use the IPASS model for patient handoff, and for the project implementation and electronic version modeled off the IPASS mnemonic will be used. The IPASS mnemonic provides a framework for which the APPs can provide an effective and efficient handoff. It consists of five sections which focus on the

illness severity of the patient, a patient summary, an action list, situational and contingency planning, and the synthesis by the receiver (Starmer et al., 2011).

There are very minimal additions that need to be made to the platform to use it in the EPIC system. The IPASS tool is available to all clinicians, however, many do not know how to access it or are using it for other reasons. Part of this project was to educate staff on how to use the IPASS tool and how to place it in the medical record. The only change made to the platform, was with the synthesis portion of the IPASS. Once a clinician completes the electronic handoff, they were expected to page or text the accepting clinician alerting them that it was complete. They also provided a call back number, should there be any questions by the accepting clinician.

Stakeholders/Administration

Prior to initiating a standardized handoff tool, the buy-in of several stakeholders and administration was required. Their support and guidance was necessary to ensure successful completion of this project. The primary stakeholders were the chief of neurosurgery, ICU director, nursing directors on the units, the ICU clinical nurse specialist, APPs on all three units, and nursing administration, such as the Associate Chief Nursing Officer for Surgical Services. As this project could have direct impact on improving patient safety; representatives from the Department of Quality and Safety were included. This project also had the collaboration with a member of the Information Technology (IT) department. There was a dedicated member of the IT department in the neurosurgery department, who was vital in helping to build the smart phrase used for implementation. Each of these people were vital to the implementation and success of the project and all agreed to the proposal prior to implementation.

Overall Goals of the Project

The goal of this project was to implement a standardized electronic handoff for patients transferring from the Neuro ICU to the neuroscience units, using the IPASS model for APP handoff. Part of this process included implementing the handoff into the patient's electronic medical record, allowing it to be viewed by all the patient's providers. By using an electronic version of the handoff, it allowed the handoff to be referenced by other medical providers and nurses who needed more detailed information about the patient's condition. The primary outcome of this project was to have more efficient and effective communication at the time of patient transfer; the secondary goals were to increase provider satisfaction and increase time spent with direct patient care. While the goal was to implement a standardized handoff, it did so with the intention to reduce medical errors that occur because of miscommunication at the time of patient transfer.

Aims of the Project

1. Complete a detailed review of current evidence on handoff tools and standardized handoff communication.
2. Implement a pre-project needs assessment of the APPs in both the neuro ICU and neurosciences floor.
    a. The focus of this aim is to evaluate the APPs comfort with handoff's, satisfaction or dissatisfaction with the current process, and overall thoughts on the current handoff procedure.
3. Implement the handoff tool into the electronic health record for all neurosurgery patients transferring from the neuro ICU to the neurosciences floor.
4. Evaluate provider satisfaction, communication, and perceived decrease in medical errors as it relates to the electronic handoff tool and new handoff process.

Chapter Three

Introduction

Chapter three will focus on the methods for achieving each of the four aims, as well as the evaluation and analytic plan for implementation of the aims. A brief description of the implications of the overall project for the intended population will be outlined. Lastly, a description of the immersion objectives and timeline will be provided at the end of the chapter.

Methods

Aim 1. Complete a detailed review of current evidence on handoff tools and standardized handoff communication.

The first step in development of this project was to develop search terms and begin the literature search, which would lead to the review for evidence. Using landmark publications from the IOM, such as, *To Err is Human* (1999) and *Crossing the Quality Chasm* (2001), the literature search began, and a concept map was developed by using the terms; handoff communication, verbal handoff, electronic handoff, nursing, physicians, intensive care units, and operating rooms. To see the full concept map and use of terms, please refer to the concept map on page 10 in chapter two. These terms were searched on several databases, including CINAHL, PubMed, SCOPUS, Ovid/Medline and the PAIS index. The search field was narrowed by limiting the literature to publications after 2010, excluding the seminal works mentioned above.

The search was started in September 2017, and the bulk of matrix was completed by December 2017. The exclusion criteria included publications prior to 2010; literature that was related to outpatient healthcare centers, skilled nursing facilities and rehab facilities; and literature that included handoffs by allied health professionals, including; respiratory therapy, physical therapy, occupational therapy, speech therapy and nursing assistants. Abstracts that

included any type of handoff, from IPASS to SBAR, and even *homegrown* handoff tools used for quality improvement projects were used. Literature related to nursing, nurse practitioners, physician assistants and physicians were included. Lastly, many care areas were searched, and included emergency departments, operating rooms, post-anesthesia care units, intensive care units, step-down units, and general medical/surgical floors.

Over this time several hundred abstracts were reviewed, and in the end 110 publications were included. Initially, titles and abstracts were reviewed to determine their inclusion. After the inclusion was determined, the articles were read, and a matrix was developed. The matrix included the reference, the aim of the study, the care area and provider group, type of handoff tool used, adverse/sentinel events reported, and major findings (See figure 2, chapter 2, pg. 11). The goal of the creating the matrix was to have a standardized format to evaluate each article. A full synthesis of the literature was prepared with results organized by themes, and recommendations for handoff tools were identified (please refer to chapter two of this proposal).

Aim 2. Implement a pre-project needs assessment of the APPs in both the neuro ICU and neurosciences floor.

a. **The focus of this aim is to evaluate APPs comfort with handoff's, satisfaction or dissatisfaction with the current process, and overall thoughts on the current handoff procedure.**

The goal of the needs assessment was to determine how the APPs on each of the units felt about the usual process and what they thought could be improved. The assessment was done using Qualtrics and was e-mailed to all the APP's in the neuro ICU and the neurosurgery department (floor APP's). The participants were provided with a brief introduction to the survey,

the purpose of it, and the goals of the project. The participants were given one reminder one week after the initial request to complete, and had a total of two weeks to complete the assessment. The needs assessment questions include yes/no, Likert scale, and select all that apply questions. Prior to sending the needs assessment to the APPs, the questions were validated by a separate group of APPs at an outside hospital, and with their input the questions were adjusted. The questions asked were:

- How long have you been a practicing Advanced Practice Provider (APP)?
- What is your current handoff process; specific to neurosurgery patients?
- Are you satisfied with your current handoff process?
- Have you had training related to handoff's?
- What is important to you about patient handoff's? (Select all that apply)
    - Easy to use
    - Reduces redundant tests
    - Helps ensure patient safety
    - Helps provide clear communication of the patient's hospital course
    - Provides receiving providers with goals of care
    - Provides receiving providers with clear treatment plans
    - Provides receiving providers with issues concerning families
    - Helps care for patients more effectively
- Do you think a standardized electronic handoff tool will lead to a more clear and concise handoff, this increasing patient safety?
- Do you think the use of a standardized electronic handoff tool will increase staff satisfaction?

Historically, the neuro ICU APP's provided little, if any handoff to the neurosurgery APP's on the floors. By not participating in handoff, vital patient information was missed, which included the patient's stability level, disposition planning, new information and/or medications, and what the general needs of the patients were. The pre-project needs assessment was meant to determine what information was important to all the neuro APP's, to gain information on the participants comfort level with handoff, and if they thought a standardized handoff process would lead to increased patient safety.

The goal was to complete the assessment within two weeks of the initial request. It was anticipated that the initial needs assessment would take one month to completely review and analyze the results. The analysis included: descriptive results using the Likert scale, summary of any common themes reported in the open-ended questions, and the average years of experience of the APP's.

Prior to distributing the assessments in the pilot population, the questions were reviewed and sampled in a different ICU that is staffed with APPs. This other group also provided additional questions and suggested that irrelevant questions be removed from the assessment. By doing this, it allowed for feedback and adjustments before implementing them in the neuro ICU.

Aim 3. Implement the electronic handoff tool into the electronic health record for all neurosurgery patients transferring from the neuro ICU to the neuroscience floors.

As stated, the IPASS model was used to develop the electronic handoff tool. The original tool was modified to fit the needs of the patient population, as well as the need for an electronic implementation. Prior to implementing the electronic handoff, the smart phrase was created and

coded in the EPIC system, and distributed to the APPs (see appendix A for example). This part of the project was divided into three stages.

1. *The first stage of this aim focused solely on planning for the project implementation of the project, including the development of a brief training course, and delivering the training course*. Planning for the implementation will begin with the nursing director (ICU and floor), ICU medical director and the chief of neurosurgery. Prior to any implementation, the timeline for training (if needed), and the potential target date for the implementation to begin. During this stage, a discussion of the needs assessment results, how to overcome any perceived barriers, and how the brief training course will help to prepare the APPs for success before and during implementation.

2. *The second stage focused on the development of the training materials for the APPs prior to implementation.* As part of the training materials, a review of the pre-implementation needs assessment was provided to the advanced practice providers. A brief overview of the importance of using IPASS as a model for the standardized handoff tool, emphasizing increased patient safety, increased time spent with direct care, and increased efficiency. Next the training discussed what the IPASS model stands for and why it is pertinent to the patient population. The next part of the training focused on how to use the handoff tool in the EPIC medical record system. Currently, the hospital uses the EPIC platform for patient's medical records and documentation purposes. As part of the EPIC platform, there is a handoff section imbedded into it using the IPASS model. The APPs will be provided with a *smart phrase* that will make it easier and keep the basic template of the handoff standardized. In order to create the smart phrase, help from a technology

specialist for the was enlisted. Each of the clinicians had access to a flash drive with all of this necessary information, which provided a step by step guide of how access the smart phrase and how to place the handoff in EPIC (see Appendix A, for an example of the handoff tool). The goal was to keep the training all electronic, however, should there was a need for a brief in-person training which was provided to those who asked for it.

3. *The third stage of this aim was the launching of the electronic handoff tool*. Implementation of the project was started after completion of the pre-implementation needs assessment and satisfactory training of the APPs. The project coordinator, with the guidance of the above-mentioned team determined the timing of implementation, which went live on December 1, 2019. The project coordinator was present for the first 3 days of the implementation, to answer any last-minute questions, and to monitor how the first handoffs go. After the initial three days, the project coordinator was available via email or phone, for any questions or concerns. The implementation of the project continued for a two-month period, ending on January 31, 2020. During that time, the project coordinator was available for questions, concerns, or the need for further training. The project team met at least monthly, where discussions were focused on any pertinent issues that, doing audits to ensure that the nursing staff is continuing to do the handoff, and is doing it effectively. The APPs were routinely emailed with progress updates and continued motivation to help complete the implementation.

Aim 4. Evaluate provider satisfaction, communication, and perceived decrease in medical errors as it relates to the electronic handoff tool and new handoff process.

Much like aim number two above, this aim was completed by a survey. At the end of the project implementation, the same group of providers were emailed a survey via Qualtrics. Unlike the previous assessment, this one focused on the evaluation of the implementation of the handoff tool. Much like the initial assessment, this one included open ended questions using a Likert scale, yes/no questions, as well as follow up questions. Prior to sending out the assessment, the questions were validated by a group of APPs at an outside hospital, their input helped to formulate these questions. The questions asked in the assessment were:

- Do you think the handoff process was an improvement over the handoff method you previously used?
- Did the handoff tool include all of the information relevant to your patient population?
- Was anything missing in the handoff tool? *If yes, what was missing?*
- Are changes needed in the handoff tool? *If yes, please describe.*
- How satisfied are you with this new handoff process?
    - Extremely satisfied
    - Slightly satisfied
    - Neither satisfied or dissatisfied
    - Slightly dissatisfied
    - Extremely dissatisfied
- Did you think there was a decrease in medical errors because of the new handoff process?
    - Yes
    - No

    - Unsure
- Do you think the handoff process should continue?
    - Yes
    - No
    - Yes, with revisions. Please leave comments in the next question
- Lastly, are there any other comments you would like to provide related to the project implementation?

As part of the evaluation phase of this project, the results were descriptively summarized and the themes of the open-ended questions were reported. These questions aim to highlight staff satisfaction and adherence to a new standardized handoff process. They were used to see if the new electronic handoff process could be sustainable and continue despite the implementation phase being completed. And lastly, the assessment evaluated if the APP's perceived there to be a decrease in medical errors.

The participants were given two weeks after the initial email was sent, and there was also a reminder email sent one week after the initial one. The results were analyzed and reported to the participants one month after completion of the post-implementation assessment.

Evaluation/Analytical Plan

Each one of the above stated aims had its own unique type of evaluation. Aim number one focused on reviewing and synthesizing the literature, which is described in depth in chapter two of this document. It included the development of a concept map, search terms, and inclusion/exclusion criteria. After the abstracts were gathered and critiqued, a matrix was developed to include elements that are pertinent to the project. This included types of handoff's

that were evaluated, the population where the handoff was implemented, and the staff that handoff was used for. Using the matrix, the literature was synthesized and presented in detail in chapter two of this proposal. For this aim to be successful, a complete review and synthesis of literature, including any gaps in the literature, and implications for future practice was presented in a concise and clear manner. The literature used included seminal works as well as current literature, which is defined as anything published after 2010.

In order for the pre and post assessments to be successful, there had to be active participation of as many APPs as possible. The goal was 100% completion of all staff on both assessments, however, this is likely an unrealistic goal. Literature showed that internal surveys, where the questionnaire comes from an employee to another employee, has a higher response rate, an average of 30-40% (or more), compared to 15% for external surveys (Fryrear, 2017). Evaluation of the assessments included a descriptive analysis of the results and an analysis of their importance. It is also important to see how the staff responds to the post-implementation assessment, and to see where themes arise; Were they satisfied with the new handoff? Do they think it should continue? Did they think all necessary information was present in this handoff? When analyzing the pre and post assessments, the goal was to have high quality answers to the open-ended questions, which provides good feedback and constructive criticism. Using a Likert scale for many of the questions, will provide a range of answers, however, it will also provide a general consensus on how the APP's view the project. Using high quality questions will help to determine if the project was successful and/or what modifications should be made in order to maintain it on the floor and possible disseminate to other provider groups throughout the hospital. The answers to the assessments will be reported by percentages to the Likert scale questions, as well as the major themes that arose from the open-ended questions.

Aim three related to the implementation of the project, which included the development of brief electronic training materials for the APP's. Training consisted of a brief introduction to the electronic handoff tool, the smart phrase used, and how to place into the patient's electronic chart. Only, after the needs assessment was completed and the APP staff reviewed it, and all of the training has been completed, did the project will go live. The project was implemented over a 2-month period. Bi-weekly over the time period, the project coordinator briefly checked in with the APP's in person and/or via email, to help circumvent issues, to keep them involved and excited about the project. During the project implementation, the project coordinator completed weekly audits of the handoffs to ensure that they are being done, that they are done correctly, and to keep a running tally of the handoffs completed. At the end of the two months, the post-implementation assessment will be distributed to all participants.

Using the results of the pre-assessment and comparing them to the post-implementation assessment, the new handoff process was evaluated. Ideally there will be a positive outcome and the staff will want to continue to use this new process. However, there is also an opportunity to listen to the staff and improve the handoff process to better fit their needs. Once the results are analyzed, the results will be provided to the APPs, nursing leadership, ICU leadership, and neurosurgery leadership in a final wrap up meeting and summary presentation. For those who are unable to attend the meeting, an e-mail summarizing the results and thank you was also sent out. The needs assessments were designed to report qualitative data, regarding the satisfaction level of the APP staff. The results of the post-implementation assessment were directly related to the implementation, and was crucial to determine if the new handoff process will be accepted on the unit as the new standard and if it could be disseminated to other units in the hospital.

Implications

One of the goals of this project was to promote a clear and concise handoff between APP's in the ICU and APP's on the floor at the time of patient transfer, potentially leading to a decrease of communication-based errors, and an increase in staff satisfaction. As stated in previous chapters, medical errors contribute a significant amount of cost to the health care system, often in the billions of dollars. Aside from the large cost medical errors accrue, there is also the cost to the patients and their loved ones, as they are the ones directly affected by the errors.

This project has several positive implications associated with it; implications for the patients, for providers, and for the institution where the project is being performed. This project aimed to increase clear and concise communication between providers, improve time spent with direct patient care, improve job satisfaction, and a potential to decrease communication based medical errors.

For the patients, the implications of this project lead to increased safety and a decreased chance of errors. As Dr. Mark Lazenby described in his book *Caring Matters Most* (2017); when patients enter any healthcare setting, they are at their most vulnerable, as they place their trust in the healthcare providers caring for them. By creating an electronic handoff tool using the IPASS mode as guidance, APPs may be able to communicate more clearly, more concisely, and by placing it in the medical record, it allows all medical teams involved in the patients care to view the handoff. It allows for clinicians to refer back to previous handoffs before ordering tests or treatments which have already been completed, and, it allows them the chance to view completed procedures or studies related to the patient's care, which can prevent duplication. The

implication of this project as it relates to direct patient care is to provide a safer and possibly shorter hospitalization.

For the APP's, the goal of this project was to improve communication, increase time spent caring for patients, increase efficiency, increase satisfaction, and see if the they perceived a decrease in medical errors. By creating a standardized electronic handoff, it allowed the APPs an opportunity to create a running checklist of procedures or tests that have been completed, and which ones remain outstanding. One of the goals of this project was to decrease duplication of studies, tests, and procedures by making communication more clear and able to be viewed at any time.

Regarding the implications for the hospital, a clear and concise handoff tool used by clinicians, could lead to increased patient and staff satisfaction, a decrease in medical errors, and lastly, a decrease in healthcare costs. The literature shows that medical errors lead to a significant amount of cost to the healthcare system; in fact, 32 health care organization in New England incurred a total of $1.7 billion in losses over a four-year period (CRICO, 2015). Literature from the IOM and The Joint Commission reports that breakdowns in communication was a leading root cause of sentinel events reported over an 11-year period (TJC, 2014). It was reports like these that prompted The Joint Commission to establish a national patient safety goal in 2006, and continues to reiterate its importance today (TJC, 2007). While this project is only being performed on one unit and in one department, it has the potential to decrease errors and decrease costs, and more importantly it could help keep patient's safe.

Statement on Human Subjects

This project was determined to be a quality improvement project, as it sought to improve clinical care and improve patient safety. To do this, as described above, the use of assessments

was important to evaluate how APPs feel about the new handoff process as compared to the previous method. There was no use of identifiable staff information on either the patient side or the clinician aspect of this survey. The individual provider will input patient information into the EPIC sign off, no other records will be exported for this study. This project had minimal risk to patients or the clinical staff, thus did not require IRB approval. This project meets the guidelines for a quality improvement project, identified using an IRB provided checklist from the hospital.

Immersion Objective

The objective of the project was to pilot a new standardized electronic handoff for APPs at the time of patient transfer, using the IPASS model, and to evaluate its effectiveness on provider satisfaction, improved efficiency, and a decrease in medical errors. The overall timeframe for the immersion portion of the project was May 2019 – February 2020. This included the initial presentation of the implementation proposal, time spent developing the smart phrase, time spent developing the pre and post assessment, along with the implementation period, and lastly the time spent evaluating the results.

Description of Immersion Plan

The location for the immersion was at large metropolitan academic medical center, specifically in the neuro ICU and the two neuroscience units. The project was targeted towards the APPs on these units, which consists of one neuro ICU and two neuroscience units. There are 12 APP's between the units, all of which work 12-hour shifts. The implementation phase was broken down into the following stages:

- *August 2019 – September 2019:* Development of an educational tool, which will cover a description of the IPASS model, how to complete the handoff using the provided smart

phrases, and how to place into the electronic medical record. Ideally, this will also be done electronically using portable flash drives, which can be used for quick reference at any time, or if a new APP is hired during the immersion period.

- *September 2019 – November 2019: Development of the* needs assessment, including validation from external APPs; which culminated in the distribution of the assessment and review and explanation of results.
- *December 2019 – January 2019:* Pilot of the new handoff system on the neuroscience unit.
- *February 2020:* Post-implementation survey will be e-mailed to the APP staff, be reviewed, and the results reported.
- *March 2020 – May 2020*: Manuscript and final presentation preparation.

Immersion Evaluation

Evaluation of the immersion took place after the initial needs assessment is completed. The results of the assessment were calculated and were used for further teaching needs, to better understand providers understanding of and level of comfort with handoffs. The post-implementation survey was used to evaluate the objectives of the immersion, and helped to answer if the providers perceive that medical errors have decreased, that the time spent doing handoff is meaningful, and that overall satisfaction increased during the pilot time-period. The post-implementation assessment was used to evaluate if perception of handoff changes after the implementation of the project.

Chapter Four

Introduction

This section will focus on the results from the implementation of the electronic handoff process, which was implemented over two months between December 2019 and January 2020. It will start with a brief section on the participants demographics, followed by results from the pre-implementation assessment, detailed results on the number of handoffs completed, and results from the post-implementation assessment (see Appendix B, for a table comparing pre and post implementations results). Lastly, this chapter will include a discussion of the results, limitations, application for practice / dissemination, and finished with future considerations.

Demographic Information

There is a total of 12 APPs between the neuro ICU and neurosurgical floors and consist of 11 nurse practitioners and one physician assistant. There is no difference in the job duties between the nurse practitioners and physician assistant. All participants were agreeable to participate in the implementation of the electronic handoff for the specified time.

Number of years as a practicing APP	Number of Participants / % of total group
Less than one year	1 person: 9%
Between 1 and 3 years	5 people: 45%
Between 3 and 5 years	2 people: 18%
Between 5 and 10 years	1 person: 9%
Greater than 10 years	2 people: 18%

Figure 3. Participant demographic information.

As seen in the table above, the greatest population of participants have been practicing between 1 and 3 years. Due to the nature of the implementation, there is no need to report statistics on race, gender or ethnicity, as they are not relevant to the implementation results.

Pre-Implementation Assessment Results

The pre-implementation assessment was provided to the participants in October 07, 2019, and they were given 14-days to complete the assessment, with one week to calculate the results and one last week to make any necessary changes to the electronic handoff. Based off the results, no changes needed to be made to the EPIC *smart phrase* used for the handoff.

The pre-implementation assessment provided results, which showed that over 50% of handoffs were completed via text message to the receiving provider. These text messages, which were done either using personal cell phones or over the hospital provided cell phone system, communicated that the patient had a ready bed and that transfer orders needed to be reconciled. It is the responsibility of the receiving APP to enter the transfer orders. Prior to the implementation, there was also no handoff note written. Sixty-four% of participants reported that they were unsatisfied with their current handoff process, and 82% felt that a standardized handoff would lead to a more clear and concise handoff, which had the possibility to decrease medical errors. Lastly, 73% of APPs felt that this type of handoff could increase their job satisfaction.

When asked what is most important about a handoff, 11 out of 12 (89%) participants felt that it was most important for the tool to be easy to use and helps ensure patient safety. Ten out of 12 (83%), felt that it was also important that the handoff provide clear communication of the patient's hospital course, provides receiving APPs with current treatment plans, and helps the

APPs care for their patients more effectively. Other notable important information included, providing receiving APPs with issues concerning families and the patients' goals of cares. According the participants, the least important aspect of the handoff should focus on reducing redundant tests (5 out of 11or 45% of respondents).

Results from the Implementation of the Handoff

The electronic handoff was implemented for a two-month time period between December 2019 – January 2020. During that time, all APPs were asked to complete the electronic handoff for all neurosurgery patients transferring to and from the neuroscience ICU. They completed the handoff using a standardized electronic smart phrase, which was completed and placed in the electronic record for all members of the care team to review. Once the electronic handoff was completed, the receiving APP was notified via text or phone call, allowing the opportunity to ask questions once the handoff was reviewed.

Over the total implementation time period, there was a total of 168 patient transfers out of the ICU. It is important to recognize that this total includes more than just neurosurgery patients, but also neurology patients and other patients boarding in the ICU. Electronic handoffs were only completed for neurosurgery patients, this excluding other services from participating. There was a total of 105 neurosurgery patients transferred out of the ICU during the same time period, and a total of 66 electronic handoff notes were completed. The number of completed electronic handoff notes accounted for 63% of all neurosurgery patients that were transferred. More details surrounding this number will be discussed later in this section, as there were many factors that contributed to this number.

There was one complication with the smart phrase, which was noticed during the first round of audits. One of the "select all that apply" tabs, specifically focusing on medications that were held at the time of transfer, was not working adequately. It would automatically select all of the most common choices instead of letting the user choose the one he or she wanted to select. Below, is a breakdown of the handoffs completed weekly.

Dates of Audit	Completed Handoffs	Observations
12/01/2019 – 12/07/2019	11 completed, representing 55% of all neurosurgery patients transferred.	All of the handoffs were completed Monday – Friday.
12/08/2019 – 12/14/2019	11 completed, accounting for 42.3% of all neurosurgery patients.	Along with being completed only during the week, the patients transferred after 7pm are not included, as there is no APP coverage between 7p – 7a.
12/15/2019 – 12/21/2019	9 completed, equaling 63% of all neurosurgery transfers.	The patient population was lower this week, due to a decrease in elective surgeries.
12/29/2019 – 01/04/2020	15 completed out of 23 transfers, equaling 65%.	Many patients were missed because they weren't covered by APPs, instead by MDs.
01/05/2020 – 01/11/2020	8 completed, representing 57% of all neurosurgery transfers.	This week, there were 6 patients that were transferred between 7p – 7a, thus missing an opportunity.
01/12/2020 – 01/18/2020	0 handoffs completed.	Only 4 neurosurgery patients transferred from the ICU, all after 7p. There were many patients discharged directly from the ICU, due to a large census on the floors.
01/19/2020 – 01/25/2020	4 handoffs completed for 10 neurosurgery patients, equaling 40%.	Again, due to high patient census on the floors, 13 neurosurgery patients were discharged directly from the ICU.

01/26/2020 – 01/31/2020	8 completed, totaling 42% of all neurosurgery patients.	Again, census was high, also, many of the patients had MD responding clinicians.
12/01/2019 – 01/31/2020	66 total handoffs completed and 105 total neurosurgery patients transferred, equaling 63% of patients with completed electronic handoffs.	Missed opportunities for completed electronic handoffs: • Hours worked by APPs. • Patients cared for by MD clinicians. • Patients discharged directly from the ICU.

Figure 4: Detailed table of completed handoffs with observations.

The above table represents amount of completed handoffs and the associated percentages of neurosurgery patients transferred with a completed electronic note. As noted, 63% of neurosurgery patients had a completed electronic handoff note. However, important to note, the neuro ICU cares for other patient populations, such as neurology / stroke patients, non-operative head traumas, as well as other ICU borders. There were several missed opportunities for completion of the electronic handoff. The first is the hours worked by the APPs; both groups of APPs work a 12-hour shift from 7a – 7p, which leaves 12 hours where patients are covered by MD providers. During the standard 5-day work week (Monday – Friday), there are 3-4 APPs staffed, however, on the weekend that number decrease to one APP. Given the lower number of APPs on the weekend, generally just one APP in the ICU and one on the neuroscience floor, the electronic handoff was initially forgotten or missed due to a high census of patients and other responsibilities. However, as the implementation continued, it became a more routine part of the work flow and more were completed. Second, there are MD clinicians who work alongside the APPs and share the responding clinician responsibilities. For the month January, there were 18 patients transferred that were under the care of MDs while in the ICU. Since this implementation was only for APPs, the patients being covered by the MD providers were excluded. That last

missed opportunity was an unexpected one; due to a high census on the inpatient neuroscience floors, many of the neurosurgery patients were discharged directly from the ICU rather than transferring. During the month of January, there were 33 patients discharged directly from the ICU, with the majority occurring between 01/12/2020 – and 01/25/2020.

Post-Implementation Assessment Results

The part of the implementation was the completion of a post-implementation assessment. The assessment was used to evaluate the APPs thoughts on the electronic handoff, their satisfaction, perceived decrease in medical errors, and if the handoff should continue. Each of the participants were emailed an 8-question assessment using the Qualtrics platform. It was emailed to them on 02/01/2020, and they were given 10-days to complete it, with a reminder on the 5th day.

There were 9 responses to the survey, which represents 75% of the total APP group. Eighty-nine% of the APPs felt that the electronic handoff was an improvement over their previously used handoff method and included all of the relevant information needed for the neurosurgical patient population. When asked if anything was missing from the handoff, all of the participants responded with a "no" answer, with one person stating that it was a "great addition to the patient transfer process." The next question asked if any changes were needed to improve the handoff tool, to which, the responses were mostly "no." However, there were two suggestions; one felt that the handoff may be too lengthy and includes information that may not be relevant, such as the radiology section. This person pointed out that the handoff takes into account all radiology results from the whole admission and some may be outdated. When asked if there was any information missing from the handoff, 100% of respondents said no.

The next question focused on whether the APPs were satisfied with the electronic handoff process. They were given five choices for answers; Extremely satisfied, slightly satisfied, neither satisfied or dissatisfied, slightly dissatisfied, and extremely dissatisfied. Importantly, none of the APPs were dissatisfied with the new electronic handoff process. Eighty-nine% of participants were either extremely satisfied or slightly satisfied and only 11% were neither satisfied or dissatisfied. Building off that question, the participants were asked if they felt the handoff process should continue. One person responded that they felt the process should not continue, however, 67% felt that the handoff should continue as is. Interestingly, 22% of respondents felt that the electronic handoff should continue, but only with revisions. The participants who felt that it should continue with revisions, they added in helpful comments. One person felt that it was extra step for the APPs in the neuro ICU and that for it to be successful it should be shortened. Another person reiterated that parts of the handoff were redundant and long, specifically the radiology and microbiology section, which included all of the imagining done for the patient's entire admission, which for some patients was rather extensive. This feedback will be extremely helpful in the evolution of the electronic handoff tool. The other comments were positive, with one person saying they thought the tool was "extremely helpful" and that the felt in "helps improve patient safety and prevents errors/misses in patient care" (Post-implementation assessment, 2020).

Part of this handoff process was to determine if there is was perceived decrease in medical errors related to the implementation of the electronic handoff tool. When compared to the pre-implementation assessment, where 82% of participants felt a standardized electronic handoff will lead to a more clear and concise communication between the two groups, which could lead to a decrease in medical errors. When the same participants were asked if they

thought there was a decrease in medical errors during the implementation, only 33% responded that they definitely felt it decreased medical errors. Fifty-six% of participants reported that they were unsure if the electronic handoff led to a decrease in errors, and only 11% felt that the handoff definitely did not lead to a decrease in medical errors.

Discussion

The results discussed above demonstrate that there was increase in satisfaction among the APP group with the electronic handoff process. While there are revisions to made to the electronic tool, the majority of participants felt that the process should be continued, helping to ensure its longevity. While the majority of the APPs were unsure if medical errors were decreased, many felt that the handoff was good addition to the transfer process and ultimately could lead to a safer hospital course. By placing the electronic handoff in the medical record, it allows the patients ICU course to be viewed by all providers, including nurses, physicians and physical/occupational therapists.

When comparing this implementation to the studies outlined in the literature review, the results from the post implementation assessment indicates that there was a focused handoff and a more efficient handoff. This was confirmed in several research studies and systematic reviews, which showed that standardized handoff tools have shown increased efficiency, more focus, as well as an increase in time spent on direct patient care (Abraham et al., 2014; Cornell et al., 2014; Colvin et al., 2016; Starmer et al., 2017). Important to note, that this implementation did not focus on time spent providing direct patient care, going forward, it will be interesting to assess if direct patient care time was increased with a more standardized handoff.

One of the studies in the literature review focused on an electronic handoff (Hoskote et al., 2017), and was one of the few studies that implemented an electronic handoff. There were similarities between this project and the Hoskote et al. (2017) study, including; the size of the ICUs was similar, their study had a 21-bed ICU and this implementation had a 22-bed study and they included APPs in their study along with physician providers. The differences primarily were in the results; their handoff was reported to lack definition for a complete and efficient handoff, and the participants felt the accuracy of the handoff was less than ideal, and the use of the EMR was unfavorable. For this implementation, the feedback showed that for some participants there may be too much information, however, being able to view it in the EMR was seen as favorable and valuable to all members of the care team. Also, the use of smart phrases and checklists imbedded in the electronic handoff was perceived as efficient, thus making it easier and quicker to complete.

Strengths

One of the strengths of this implementation was the design of the study. Prior to implementing the electronic handoff, all of the participants were surveyed on what was most important to them in a new handoff process. Using the results from the pre-implementation assessment, the handoff was edited to include what was important. While it was a small population, each participant was able to voice their opinion and have it heard. It was also important to determine the satisfaction of the participants, which showed that they were relatively dissatisfied with their lack of a standardized handoff. The other strength in this project was the comprehensive literature review that was completed prior to designing the handoff. The development of a comprehensive concept map and development of a search matrix used to log and concise the

information, helped to log over 90 articles. These articles helped to determined that there was a need for more research which focused solely on APP handoff. Using examples from previous handoff tools that were trialed helped strength the design of this electronic handoff.

Limitations

One of the limitations to this implementation is that it only took place on one service within a large hospital. Focusing on one small specialized service, the electronic handoff may not be generalizable to other services or units with the hospital. With a sample size of 12 APPs, the project only relied on a small amount of people to evaluate it. Also, there were two APPs who started in the department on January 1st, and while they benefitted from viewing the electronic handoff, they were not included in the post-assessment, as their input could not be correlated to the results from the pre-implementation assessment. The other limitation is the setting of the project, which took place on one specialized intensive care unit, and two specialized care units. This handoff may not be generalizable to other units, and to be used outside of neuroscience specific units it would need be edited to fit the needs of other units. There was also a large population of patient transfers that were not captured, and should this handoff continue, it would be important to include the physician providers who work alongside the APPs. Along with serving as the responding clinicians during the day, the physician providers also cover at night and the weekend when the APPs are not fully present. Lastly, this project was only implemented for two months and to fully evaluate a decrease in medical errors and given the implementation time period the ability to do a pre and post assessment of medical errors, sentinel events or mortalities was not done.

Clinical Implications for Practice

This project was designed to fill a need in a specific intensive care unit, specifically for neurosurgical patients who have recently undergone surgery. Prior to this implementation there was no standardized form of handoff communication. Receiving providers would often get a page or text stating that the patient had a ready bed, and would occasionally be provided with a small handoff, but it was not consistent. The electronic handoff was created to fill a gap and to possibly lead to a decrease in medical errors, increase communication, and lead to an increase in job satisfaction. Using data from the needs assessment, the APPs indicated that a need for a standardized communication existed, and indicated that they felt one would lead to improved communication and improved job satisfaction. The needs assessment was validated in the post-implementation assessment, where the APPs reported both an improvement in their satisfaction and an improvement in communication. The implications for patient care were notable in the research, stating that it could lead to a decrease in medical errors, decrease in health care costs, increased time spent on patient care, increased communication, and an increase in job satisfaction (Starmer et al., 2014; Studney et al., 2017). With revisions, a re-implementation, as well as pre and post assessment of medical errors, this electronic handoff tool could achieve each one of those important implications.

Recommendations for Future Research

This implementation was successful at measuring satisfaction among its APPs participants and showed that the use of a standardized handoff increased the satisfaction in this population. This implementation also filled a gap that was noticeably present, as there was previously no handoff process used. Going forward, more research has to be done to help

determine if there was a decrease in medical errors as a direct result of the electronic handoff. In order to evaluate that, data will need to be extracted prior to implementation and after implementation of a standardized handoff. More time should be dedicated to the implementation phase of the project to ensure that sufficient data can be obtained.

There also needs to be further research on the APP role in providing handoffs. APPs are often vital members of care teams and there was minimal literature prior to this implementation on their role in providing handoffs. There was an abundance of literature on handoffs for registered nurses and physicians, which demonstrates a clear need for further research. Lastly, this is an opportunity to focus on the educational preparation of APPs. When compared to our physician colleagues, who are required by the ACGME to complete training on handoffs, APPs do not have a similar training, and most often receive no formal training specific to handoff (Barret et al., 2017)

Conclusion

The physical and emotional cost of medical errors continues to be a problem that all medical centers struggle with. It is hard to refute that medical errors can cost lives and can take an emotional and/or financial toll on patients and their families. For hospitals, errors can cost them billions of dollars, as well as affect their business due to quality concerns. Medical errors also have an effect on medical providers, which can lead to burn out or satisfaction issues within their jobs. This projected was implemented to fill a need; to help improve communication between an ICU and a general care floor and improve on a process that was lacking in standardization. The secondary effect of the project was to improve the job satisfaction of the APPs working on these units. The literature repeatedly stated that the implementation of a

standardized handoff increases job satisfaction and leads to a decrease in medical errors. The goal of this project was successful, in that it improved communication between the APP groups, it created a standardized process for patient handoff, and demonstrated that the APPs were more satisfied with a dedicated handoff tool. However, this tool does require revisions and more research needs to be done to evaluate its effectiveness in decreasing medical errors.

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Appendix

Appendix A: Handoff model

Below is an example of how the electronic handoff will look in the electronic medical record. This was the exact format of the note used in the medical record. Participants were able to access this using the smart phrase, NSGYELECTRONICHANDOFF. Neither image contains private information and are personal photographs.

Neurosurgery Electronic Transfer Note

Patient: @NAME@
DOB: @DOB@
MRN: @MRN@
Attending Surgeon: @ATTPROV@
Admit Date: @ADMITDT@
Illness Severity: {Blank multiple:19197::"Stable", "Watcher", "Unstable"}
Code Status: @RRCODESTATUS@

Surgery:
@PHSRRSURGERY@.
Date of Surgery: @PHSRRSURGERY@.

History of Present Illness:
@BRIEFSUMMARY@

Past Medical History:
@PMH@
@PROB@

Past Surgical History:
@PSH@

Allergies:
@ALLERGY@

@HPIEND@

@MEDSBEGIN@
Home Medications:
@PTAMEDSIP@

Hospital Administered Medications:
@IPMEDS@

@MEDSEND@

@OBJECTIVEBEGIN@
Vitals:
Current: @FLOW(6::1)@ | P @FLOW(8::1)@ | BP @FLOW(5::1)@ | RR @FLOW(9::1)@ | SpO2 @FLOW(10::1)@ | @FLOW(250026:LAST:1)@ | FiO2 @FLOW(301550::1)@ @FLOW(14::1)@

Physical Exam:
Weight: @LASTWEIGHT96@
***

@IOBRIEF@

LDA: @IPLDA@

Data:

BMP:
@PHSLABRCNT(na:3,k:3,cl:3,co2:3,bun:3,cre:3,glu:3,mg:3,phos:3,ca:3)@

LFTs/Chemistries: @PHSLABRCNT(ALB:3,ALKP:3,TP:3,ALT,:3,AST:3,DBILI:3,TBILI:3)@

CBC:
@PHSLABRCNT(wbc:3,hgb:3,hct:3,plt:3)@

COAGS:
@PHSLABRCNT(pt:3,ptt:3,inr:3)@

Microbiology
@MICROBIORESULT@

Radiology
@IPRISRSLT@

@OBJECTIVEEND@

@ASSESSMENTBEGIN@
Assessment and Plan:
@BRIEFSUMMARY@

Transfer to: {Blank multiple:19197::"Lunder 6", "Lunder 7", "Lunder 8"}
Essential Medications held? {Blank multiple:19197::"Yes", "No"}
If medications held, which ones? ***
New medications initiated: {Blank multiple:19196:: "***", "Decadron taper", "Keppra", "Captopril", "Nimodipine", "Valtrex", "Aspirin", "3% Saline", "Plavix", "Prasugrel"}

Floor / Transfer Bundle
DVT prophylaxis: {IP DVT PROPHYLAXIS:22062}
Telemetry: {Blank multiple:19197::"Low Risk", "Moderate Risk", "High Risk", "N/A"}
O2 monitoring: {Blank multiple:19197::"Low Risk", "Moderate Risk", "High Risk", "N/A"}
Diet: @RRDIET@
Disposition: not medically ready for discharge, anticipate *** days

Communication of Transfer to Primary Team: {Blank multiple:19197::"Yes, via page", "Yes, via text", "No", "Unable to contact"}

Signed:
@MECRED@
@FDATE@ @NOW@

Appendix B: Pre and post assessment result comparison.

Pre-Implementation Assessment	Post-Implementation Assessment
Return Rate: 11/12: 92%	Return Rate: 9/12: 75%
Most respondents (45%) had between 1-3 years of APP experience.	89% of people felt that the electronic handoff was an improvement over the previous method.
55% of people reported that the current handoff process was done via text.	89% also felt that the handoff tool included all of the information relevant to the patient population.
64% of respondents were unsatisfied with their current handoff process.	89% were satisfied with the new standardized handoff, 12% was neither satisfied or dissatisfied.
64% of respondents had not had any training related handoffs.	When asked if they felt there was a decrease in medical errors: • 56% of people were unsure • 33% felt there was a decrease in errors

	• 11% felt that there was not a decrease in errors
The most important aspect of patient handoff included: • Easy to use • Helps to ensure patient safety • Provides clear and concise communication • Provides receiving providers with current treatment plans • Helps care for patients effectively	89% of respondents felt that the handoff process should continue or should continue with revisions.
82% felt that a standardized handoff would provide a clear and concise communication and potentially decrease medical errors.	
73% of people felt that a standardized electronic handoff would increase their job satisfaction.	
Comments: • Great addition to patient transfer process. • The note itself is comprehensive. • Unclear if it's read in the end and the loop of communication may still be open. • Less information could be helpful, for example; radiology interpretation is pulled in, regardless of the time it was completed. This info may be old, and wordy, which cloud the overall information relevant to the patient's transfer. • Incredible improvement over the previous handoff process.	