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Abstract

Inpatient hospitalizations for children are often costly. Children often transition from one setting to the next while hospitalized, therefore their provision of care is also transferred from one care team to the next. This transition presents a vital time for the child, that may be associated with adverse events and medical error. Adverse events can lead to poor outcomes for the child. Despite efforts to improve patient handoffs, communication failures are still abundant in healthcare. Research indicates that the use of a standardized handoff tool from one setting to the next is an effective method for improving the patient's transition. This project will focus on implementation of a standardized handoff tool from an OR to a PICU to improve staff communication and patient outcomes.

Keywords: handoff, handover, operating room, pediatric intensive care unit, and cardiac surgery

Executive Summary

The patient handoff is an important time in which patient care and accountability are transferred from one team to another. During this time there is a high risk for adverse events and medical error to occur. An estimated 80 percent of sentinel events that occur in the hospital have been linked to the quality of the patient handoff (Sochet, Siems, Ye, Godiwala, Hebert, Corriveau, 2016). Thus, the patient handoff has been a major focus for institutions such as the Joint Commission, the Institute of Medicine, the Agency for Healthcare Research and Quality, and the National Transitions of Care Coalition. Specifically, the intensive care setting is an area where numerous individuals from various disciplines collaborate to support the care of critically ill patients. Given the complexity of the patients and number of individuals caring for these patients, there is tremendous need for a structured and standardized approach to the handoff of patient care. This paper has identified opportunities for improvement in the handoff process from the OR to the PICU in a freestanding midwestern children's hospital through an organizational needs assessment.

A review of the literature found that the use of a standardized handoff tool from the OR to the PICU in children post-cardiac surgery improved patient outcomes and staff satisfaction of the handoff following implementation. A standardized handoff tool improved knowledge exchange, communication completeness, and transfer of information (Agarwal et al., 2012; Craig et al., 2011; Karakaya et al., 2013; Vergales et al., 2015, & Zavalkoff et al., 2011). Furthermore, a standardized handoff tool improved 24-hr patient outcomes and decreased post-operative complications, such as unplanned extubations, cardiopulmonary resuscitation, need for mediastinal reexploration, and development of severe metabolic acidosis (Agarwal et al., 2011; Kaufman et al., 2013; & Zavalkoff et al., 2011).

Considering the results of the literature review, the use of a standardized handoff tool has been chosen as a quality improvement initiative for the children's hospital. This paper will further explain the project plan including purpose, objectives, setting and resources needed for successful implementation. In addition, the implementation strategies and steps that will be utilized to implement the standardized handoff tool will be discussed. Implementation strategies will include educating providers, modeling the use of the standardized handoff tool through simulation, and continuously auditing and providing feedback to staff throughout the implementation process. Lastly, implications for practice as well as plans for dissemination of the quality improvement initiative will be discussed.

Introduction

Improving the Patient Handoff from OR to PICU in Children Who Have Undergone Cardiac Surgery Using a Standardized Handoff Tool

Approximately two million children are hospitalized annually in the United States, accounting for more than 40 percent of pediatric healthcare expenditures (Leyenaar et al., 2016). Essential to all hospitalizations is the patient handoff, which occurs between units as well as in the transition from hospital to home (Leyenaar et al., 2016; Agarwal et al., 2012). Transitions of care involve patient transfer between locations or providers as well as transfer between varying levels of care in the same location (National Transitions of Care Coalition, 2008). Poor inpatient transitions can lead to delayed treatment, inappropriate tests, and lengthened hospital stays, which inadvertently leads to an increase in healthcare costs. In addition, there are many risks associated with poor handoffs that may lead to detrimental effects for the patient and their families. An estimated 80 percent of sentinel events that occur in the hospital have been linked to the quality of the patient handoff (Sochet, Siems, Ye, Godiwala, Hebert, Corriveau, 2016).

Transitions of Care- Background

The Institute of Medicine (IOM) report *To Err is Human: Building a Safer Health System,* published in 1999, called for action by healthcare providers to work to improve preventable errors (Korn, Corrigan, & Donaldson, 1999). The report concluded that as many as 98,000 deaths a year in the United States could be contributed to medical error. IOM stressed the importance of a safe and trustworthy healthcare delivery system where patients are offered comfort and healing, rather than harm. Therefore, a goal was set to reduce the occurrence of preventable errors by 50 percent over five years. In order to reach this goal, systems, processes, and conditions that provide for a safer workplace were focused upon (Korn et al., 1999).

Consequently, in 2006 the Joint Commission recognized the importance of handoff communication and issued a recommendation that health care providers use a standardized handoff that includes an opportunity to clarify handover information with dedicated time for questions and answers (Joint Commission, 2006). The Joint Commission revised the procedure in 2010 and made handoff communication a Provision of Care standard. This meant that hospitals are required to have a process to receive or share patient information when a patient is being transferred internally within the hospital (Joint Commission, 2010).

According to a National Transitions of Care Coalition work group (2008), there are several important steps to consider when implementing and evaluating a plan to improve transitions. This includes selecting what you plan to study; assessing the current process; and determining the current level of performance. After the initial assessment, steps are taken to determine an intervention strategy; implement the intervention strategy; and evaluate the degree of success. Modifications to the intervention may be made as needed. Imperative to this process is determining what should be communicated and transferred during the patient handover (National Transitions of Care Coalition, 2008). Healthcare providers work every day to provide the best quality care possible to the patients they are caring for. Unfortunately, adverse situations arise, as patient and healthcare system are complex, and responsibilities for communication exchange are often not clearly defined.

When a child is transferred from the operating room (OR) to the pediatric intensive care unit (PICU) after surgery, the movement of equipment and technology, sharing of patient information, and a complete changeover of clinical staff occurs (Agarwal et al., 2012). Because of the errors that occur with handover communication, there have been numerous efforts to

observe the transition and develop a handover process that reduces technical errors and improves patient outcomes.

This Doctor of Nursing Practice (DNP) project will focus on the needs assessment of an organization in order to analyze the current practice related to handoff communication. The setting for this DNP project is the PICU in a freestanding midwestern children's hospital. The PICU is where handoff communication from the OR team to the PICU team takes place. This is an ideal setting, because of the children's complexity following cardiac surgery. The patient's transition presents challenges to providers and nurses on both teams, and all team members are accountable for providing safe, patient-centered care in the critical hours that follow. In addition to an organizational assessment, a review of the literature regarding safe and effective handoff communication tools between the OR and the PICU in children who have undergone cardiac surgery was conducted. This project will discuss strategies for implementing a standardized handoff tool to improve staff communication, with the potential to reduce morbidity and mortality and improve patient safety.

Assessment of the Organization

It is important to conduct a need and feasibility assessment of an organization, in order to be successful in implementing and sustaining a quality improvement project. This involves learning about the organization and learning what is most important to the people within the project setting. Building rapport with staff improves the likelihood that staff will be supportive of making a change in workflow. The organizational assessment also helps identify facilitators and barriers of implementation. Assessing these components of an organization can be difficult, therefore having a framework to guide the assessment is important. The Burke-Litwin Causal Model of Organizational Performance and Change (see Appendix A) was used as a guide for the

organizational assessment, as well as an analysis of the organization's strengths, weaknesses, opportunities, and threats (see Appendix B).

Burke-Litwin Causal Model

The Burke-Litwin Model provides a guide to assess the internal and external factors affecting performance in an organization. There are two concepts in which the model originated: the organizational climate and the organizational culture. According to Burke and Litwin (1992), the climate is the psychological state that affects the organization, and the culture includes the values and norms of the organizational system. The factors that make up the organizational climate are defined as transactional, and the factors that make up the organizational culture are defined as transformational.

The transactional factors are structure, management practice, systems, work unit climate, tasks and individual skills, motivation, individual needs and values, and individual and organizational performances. The transformational factors are the external environment, mission and strategy, leadership, organizational culture, and individual and organizational performance (Burke & Litwin, 1992). Analyzing these factors in this children's hospital was helpful in identifying the organizational need and whether or not a quality improvement project was feasible.

According to the mission and values, this children's hospital strives to promote a culture of excellence, accountability, compassion, integrity, respect, and teamwork. Unfortunately, several staff members in the PICU feel that the culture of teamwork and respect is lacking, which hinders interprofessional collaboration and communication. This can then lead to adverse events and poor patient outcomes. Overall, individual performance and motivation is excellent,

however, staff feel that organizational performance could be improved through better communication in the immediate post-operative period.

Strengths Weaknesses Opportunities and Threats Analysis

In order to further evaluate an organization, it is important to understand the internal strengths and weaknesses as well as the external opportunities and threats. This was done through a strengths, weaknesses, opportunities, and threats (SWOT) analysis. The internal attributes or strengths have a positive influence on the project outcome, whereas the internal weaknesses could be harmful to the project. The external opportunities and threats may be community initiatives that could help the project or have a catastrophic effect on the desired outcomes; all of which need to be addressed in order for implementation to be successful.

Strengths. There are numerous strengths to consider within this organization. There are several cardiologists with various heart specialty areas that can cover a wide range of congenital heart conditions. New registered nurses attend core classes in cardiac education including a course on acquired heart disease, rhythm analysis and pacemakers, cyanotic and acyanotic lesions, cardiopulmonary bypass, and extracorporeal membrane oxygenation (ECMO). They are also well versed in cardiac education, as nurses are involved in monthly simulations of which half involve cardiac scenarios. The survival rates pre- and post-cardiac surgery are above the national benchmark. There is willingness from staff to be more of a collective team. It is important to have positive attitudes and motivation to make a change within the cardiac team. In addition, there is a checklist of the care and education that needs to be provided to the patient and family as they transition through the intensive care and cardiology units.

Another strength of the organizations is the expertise that has been demonstrated by the health care team. The chief of cardiology and his colleagues recently announced the successful

integration of computed tomography and echocardiography to print a hybrid 3-D model of a patient's heart, which was used to form a 3-D anatomic model of the patient's heart. This advancement in technology will help future endeavors by allowing a more precise and efficient procedure.

An additional strength that was provided by the Virtual Pediatric Systems 2016 report was related to the PICU discharge delay. The PICU had a statistically significantly shorter discharge delay compared to other mixed PICUs. This means that the average time between the physician discharge or transfer order and the actual time of discharge was shorter in the PICU at this organization. Because of the costs associated with a PICU, the shorter the length of stay in the PICU, the more cost that is saved for the organization. However, it is important that the transition process is not rushed so much that vital handoff information is left out.

Weaknesses. In the lectures mentioned above for new nurses, there are no cardiologists that present on a regular basis, and there has not been education from a cardiologist in almost two years. Even though survival rates are good, there are not quality metrics in place to measure outcomes other than mortality. There are mixed emotions between physicians and nurses on whether discharge education and information is adequate for patients and their families and whether or not advanced practice providers (APPs [nurse practitioners (NPs) and Physician Assistants (PAs)]) are spending enough time with the patient and family before discharge. Furthermore, there are not as many APPs as other hospitals for the cardiac patients that are admitted each day. As mentioned above, the congenital heart team consists of three pediatric cardiac surgeons, 13 congenital cardiologists, and nine APPs. These numbers are small in comparison to a neighboring hospital that employs 4 pediatric cardiac surgeons, 37 pediatric

cardiologists, 18 fellows, and 26 NPs, with 12 clinic locations. There is a great need for more cardiac providers in this PICU, specifically APPs.

In addition, there will always be nursing turn-over, and it is often challenging to assure the competency level in nursing is high as there are numerous novice nurses that require training and education in their new roles. Management in the PICU strives to hire registered nurses with experience in a PICU or pediatric setting, but that is not always the case, and nursing turnover is typically higher in the PICU then in other units of this hospital. The last weakness important to mention is that the hospital organization as a whole will be going through a change in electronic health record systems. This may make it difficult for staff to focus on yet another change and be fully invested in this quality improvement project.

Opportunities. There are many opportunities that exist if quality improvement projects are successful. This includes informing patients and families in the surrounding community of the excellent health care system that is provided in their area. Reporting to organizations such as the Society of Thoracic Surgeons can provide data and information to consumers around the country. This can further market and promote the heart center within this children's hospital. There is also the opportunity for better coordination of care, which will benefit the community and surrounding population as a whole.

Threats. There is always the threat of competition with other heart centers in the state. However, it is important to learn how to work and learn from other organizations that have excelled in certain areas. In addition, there is the threat that some children with CHDs are not easily treated and may have outcomes that are unpreventable.

Current Practice

The current handoff communication process between the OR and the PICU was observed. One goal of observing this transition was to learn about the current handoff process including what information is exchanged in the handoffs and who is involved in reporting that information. Another goal was to learn the roles and responsibilities of the different team members involved in the transfer of care. Through observations of the current handoff process, it was hoped that opportunities for improvement would arise. Currently, communication during the handoff does not include use of a standardized handoff tool.

The handoff process starts in the OR when a nurse in the OR calls and updates the charge nurse regarding the child's surgical procedure and medical history. This first phone call is initiated when the patient comes off cardiopulmonary bypass. A second phone call is made 30 minutes prior to transfer, and a third call occurs just prior to the patient transfer to the PICU. Upon arrival of the patient in the PICU, nurses and respiratory therapists secure the lines and chest tubes, and check the ventilator settings. The handoff report from the anesthesiologist and the cardiac APP/surgeon is communicated when all essential staff from the OR and PICU teams are present in the room. The essential staff includes the anesthesiologist, the cardiac APP/surgeon, two respiratory therapists, a primary and secondary PICU nurse, an APP in the PICU and medical residents involved in care of the child.

Minimal communication was observed between the OR team and the PICU team in regard to immediate post-operative goals of care. During the handoffs that were observed there was no time spent on questions or review of important handoff information. Following conclusion of the handoff, members of the OR team left the room and the APP responsible for the child's care assessed the patient. The primary and secondary PICU nurses were then

responsible for drawing labs, re-taping tubes, stabilizing the patient's vitals, and connecting with the family.

In addition to observations of the handover communication process, a report provided by the Virtual Pediatric Systems from 2016 to 2017 was reviewed. According to this PICU report, there were 289 cases, with 193 cases (66.8%) having a primary cardiovascular diagnosis in 2016. Of the cardiovascular diagnoses, 154 (79.8%) were patients with a congenital heart defect (CHD). Out of all the patients who died in this PICU in 2016, a majority (54.6%) of the children died within 48 hours of admission to the PICU (Virtual Pediatric Systems, 2017). This indicates the importance of the postoperative period.

Interviews of staff in the OR and the PICU were conducted to further understand current practice related to the handoff. According to the nurse navigator in the PICU, a standardized handoff tool is available, but not utilized. The PICU nurses that were interviewed either did not realize that the handover tool existed, or were unable to identify where to find it. One nurse reported that the tool is not used, because the anesthesiologists and cardiac APPs are familiar with what information needs to be included in the handoff, so a checklist is not necessary. Another nurse admitted that the standardized handoff tool is not used, because a majority of staff did not realize it is available and/or do not see it as essential. Furthermore, staff identified a need for more nursing education related to caring for the postoperative cardiac child. There is extensive training for nurses hired into the PICU, however, the education is not specific to how a child should be cared for during the postoperative period.

Problem Statement

According to Moran and colleagues (2017), the problem statement, in the context of the DNP project, is a phenomenon of interest that is examined with the purpose of developing a

possible solution. The problem statement provides an introduction to the intent of the DNP project (Moran et al., 2017). CHD is the most common birth defect; an estimated 1 out of 100 newborns are born with CHD. In addition, it is the number one cause of death in children born with a birth defect, and the cost of caring for a child in the hospital is greater than 6 billion dollars annually (Pediatric Congenital Heart Association, 2017). Therefore, it is of utmost importance to develop an infrastructure of collaborative quality improvement initiatives in order to improve patient outcomes by reducing post-surgical complications, reducing preventable morbidity and mortality, and decreasing health care expenditure (Gaies et al., 2015).

An organizational assessment of a freestanding midwestern children's hospital revealed the opportunity to improve the handoff process from the OR to the PICU. This transition is a critical and valuable time where important information is handed off to a new care team. As mentioned earlier in this paper, the mortality rate for cardiac surgery patients in this PICU is highest during the first 48 hours following patient arrival to the PICU. There is opportunity to improve handoff communication and decrease patient morbidity and mortality within this organization.

A literature review regarding handoffs and transitions among children who have undergone cardiac surgery from the OR to the PICU was conducted to identify an evidence-based practice intervention that will improve patient outcomes. Conceptual frameworks for the evaluation and implementation of the intervention were selected as a guide for the DNP project. Following the literature review and selection of practice improvement, key stakeholders will need to approve the intervention.

Literature Review

To determine the best practice for handoff communication, a literature review was conducted. The primary focus of the DNP project will be to improve patient outcomes post-cardiac surgery while simultaneously improving teamwork and communication through better information exchange. Thus, evidence-based methods that effectively improve handoff communication were reviewed in the literature. The use of a standardized handover tool was fundamental to this literature review.

Aim

The aim of the literature review was to report on components of the patient handoff that supported an effective transition from the OR to the PICU. Specifically, the review focused on pediatric patients who had undergone cardiac surgery. The findings of this review could guide the implementation of a standardized handoff process or tool for organizations that have identified an opportunity for improvement in the transition of care for children post cardiac surgery.

Methods

Search methods. A comprehensive electronic search of the Cochrane Library, CINAHL, PubMed and Google Scholar databases was conducted from 2010 to present. Keywords included handoff, handover, operating room, pediatric intensive care unit, and cardiac surgery. The Boolean operator OR was used to include articles that used handover or handoff, and the Boolean operator AND was used to narrow the search to articles that were relevant to this review. The search was conducted using the keywords “handoff OR handover AND operating room AND pediatric intensive care unit AND cardiac surgery.”

Search Outcomes. The search yielded 166 studies (see Appendix C). One was retrieved from the Cochrane Library, three from CINAHL, four from PubMed, and 156 from Google Scholar. Two articles were identified through review of the reference list of an article. Six duplicates were found. After removing duplicates, the title and abstract of 160 studies were screened. After review of titles and abstracts 125 studies were excluded. The remainder of the articles were screened using inclusion and exclusion criteria developed from the population, intervention, comparison, and outcome (PICO) format (van Loveren & Aartman, 2007). Using these criteria another 28 articles were excluded from this review.

Inclusion and Exclusion Criteria

Population. For this review, handoffs between the OR and a PICU or cardiac intensive care unit (CICU) following pediatric cardiac surgery were included. Articles that involved the child or adolescent transferring to an adult care provider or the child undergoing a surgical procedure other than cardiac were excluded. Articles in which patients were transferred to a post-anesthesia care unit before the PICU or were transferred directly to a general cardiac floor were excluded.

Intervention. Studies that involved a standardized handoff tool were included. Those that did not utilize a handoff tool from the OR to the PICU were excluded.

Comparison. Articles that were chosen for this review compared results of a standardized handoff protocol before and after implementation. Articles that did not compare results pre- and post- intervention were excluded.

Outcome. Outcome measures that were included were information transfer, postoperative complications, 24-hr patient outcomes, handoff-related care failures, medical errors, handoff

duration and comprehensiveness, staff satisfaction, communication, and teamwork. Articles were excluded if the purpose and outcomes of the article were not clear.

The preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) Guidelines were used to guide the selection of the articles for the review (Moher et al., 2009). Titles were assessed for relevance for inpatient transitions. Then the abstract of the articles were read in order to determine if the article met inclusion criteria for the literature review. Reference sections of each paper that met inclusion criteria were analyzed to determine if additional articles were applicable to this review. A total of seven studies were identified as relevant and included in this literature review (see Appendix D).

Results

Study design. All of the articles were observational studies with convenience samples. All of the articles evaluated outcomes prior to and following implementation of the intervention.

Study Characteristics. Six of the articles were conducted in the United States (Agarwal et al., 2012; Craig et al., 2011; Joy et al., 2011; Kaufman et al., 2013; Vergales et al., 2015; & Zavalkoff et al., 2011). One was conducted in Belgium (Karakaya et al., 2013). All of the studies took place in an acute care hospital setting, within a PICU. One article studied the role of the PICU nurse in the OR before the children were transferred to the PICU (Vergales et al., 2015). All of the studies involved the transfer of pediatric patients (18 years of age or less) from the OR to the PICU following cardiac surgery. Sample sizes ranged from 31 to 1,507 patients.

In addition, there were no significant differences reported in age, gender or severity of illness between pre- and post- observational groups in six of the seven studies (Agarwal et al., 2012; Craig et al., 2011; Karakaya et al., 2013; Kaufman et al., 2013; Vergales et al., 2015; & Zavalkoff et al., 2011). One study did not report information on demographics (Joy et al., 2011).

Five of the observations took place within a year (Craig et al., 2011; Joy et al., 2011; Kaufman et al., 2013; Vergales et al., 2015; & Zavalkoff et al., 2011). One article analyzed three years of clinical data for all pediatric patients who underwent cardiac surgery and transferred to a PICU (Agarwal et al., 2012). Another article included a 41-month study period for pre- and post-observation (Kaufman et al., 2013).

Interventions. All of the articles examined the effect of a standardized handoff tool. The interventions were structured so that information exchange and communication could be transferred efficiently from the OR team to the PICU/CICU team. All of the standardized handoff tools incorporated a formal checklist or protocol to be used upon arrival of the child to the PICU/CICU.

Two of the articles included interventions with more than one step (Agarwal et al., 2012; & Craig et al., 2011). Agarwal and colleagues (2012) used a handover process that involved two steps. The first step incorporated a standard form for phone communication between the anesthesia team in the OR and CICU bedside nursing staff 30 minutes prior to patient transfer. The second step included a checklist for face-to-face report on arrival in the CICU for anesthesia and cardiac surgery. Similarly, Craig et al., (2011) had a three-phased standardized handover. The first phase related to pre-patient readiness in which the reports and necessary equipment was set up and checked at the bedside. The second phase was the pre-handover readiness that involved transferring patient monitors, ventilator, and pumps and making sure the patient is stabilized before the start of the verbal handover. The third phase was the information handover that took place when all staff was free to listen and involved the transfer of operative information.

One of the interventions utilized a checklist of steps to take 30 minutes prior to the transfer, just prior to the departure, immediately upon arrival, and during the handoff huddle (Vergales et al., 2011). In the 30 minutes prior to the transfer, anesthesia or the OR nurse sent out a page to staff who were going to be present at the huddle to inform them that the patient would be transferring to the PICU. Report was called to the primary nurse in the PICU, who reported information to the physician in the PICU. Immediately upon arrival in the PICU, radiology was paged, and a period of uninterrupted time, was spent by the RN assessing and stabilizing airway, lines, and drains. Before the handoff huddle started, all key members of the huddle were present and attentive. The information that was relayed during the handoff was discussed using cues on a checklist. This included an overview of the case, type of surgery performed, anesthetic issues, pre-op information, post-op imaging results, physiologic/anatomic concerns, consensus and confirmation of plan, special parameters, and when to call the cardiologist and/or surgeon. Finally, if there were further questions, they were asked and answered prior to the huddle concluding (Vergales et al., 2014).

Outcomes. A variety of outcome measures were examined in the articles. These outcomes included completeness of knowledge or information exchange, post-operative complications, 24-hr patient outcomes, handoff-related care failures, handoff omissions or technical errors, handover duration, feasibility, staff satisfaction and communication.

Completeness of knowledge exchange. Five articles measured the effect of a standardized handoff on knowledge exchange, communication completeness, or transfer of information (Agarwal et al., 2012; Craig et al., 2011; Karakaya et al., 2013; Vergales et al., 2015, & Zavalkoff et al., 2011). The use of a structured handoff improved information related to patient details, preoperative details, anesthesia details, surgical details, post-surgery details, and

laboratory values from 57% pre-intervention to 84% post-intervention (Agarwal et al., 2012). Moreover, the standardized handover tool significantly improved observed scores in pre-patient readiness (2 to 3; $p<.001$), pre-handover readiness (1 to 5; $p<.001$), and information handover (13 to 17; $p<0.001$) (Craig et al., 2011). Karakaya and colleagues (2013) found that following implementation of a standardized checklist, the overall data transfer increased from 48% to 73% ($p<0.001$).

Vergales and colleagues (2015) found that the handoff process improved adherence to critical process steps. Prior to the patient transfer, anesthesia reviewed cases with the accepting PICU nurse 98% of the time. The accepting PICU nurse reviewed the case with the accepting PICU physician 97% of the time. Upon completion of the huddle, all questions were answered 98% of the time (Vergales et al., 2015). There was significant improvement in attentiveness, organization, and flow of information with the implementation of a structured handover process (Vergales et al., & Craig et al., 2011).

Zavalkoff and colleagues (2011) evaluated handover completeness by measuring scores related to preoperative, medical intraoperative, and surgical intraoperative data. The total handover score improved from 28.2 to 33.5 (maximum 43 points) significantly ($p=.002$) following implementation of the handover tool. There was also significant improvement in the medical intraoperative scores ($p=.024$) and surgical intraoperative information scores ($p=.002$).

Post-operative complications. Three articles measured outcomes related to post-operative complications, such as unplanned extubations and mean ventilator time, and 24-hr patient outcomes (Agarwal et al., 2011; Kaufman et al., 2013; & Zavalkoff et al., 2011). Agarwal et al., (2011) found that before intervention, there were a total of 167 (24%) complications (cardiopulmonary resuscitation, need for mediastinal reexploration, and development of severe

metabolic acidosis) in the first 24 hours of admission to the PICU out of 600 observed patients. These complications were significantly reduced post-intervention with 46 (12%) complications observed in 378 patients. There were also significantly more patients who underwent successful extubation in the first 24 hours of admission with implementation of the structured handoff (43.2% to 50%; p=.04) (Agarwal et al., 2012).

Kaufman and colleagues (2013) found that the handover process significantly decreased extubations that were not planned, with 15 events in the 17 months prior to the handoff initiative compared to 7 events in the 24 months following (p=.02). The median ventilator time per patient for the pre-handoff period was 17 hours and 12.8 hours for the post-handoff period (p = .02). Zavalkoff and colleagues (2011) also found a trend toward more patients being free from health-risk events (HREs) in the post-intervention group (31.2% vs. 6.7%).

Handoff omissions or technical errors. Two articles measured improvement in the loss of information or handoff omissions as well as technical errors including handoff interruptions (Craig et al., 2011; & Joy et al., 2011). Joy and colleagues (2011) found technical errors were reduced from 6.24 to 1.52 ($p < .0001$), and omissions of critical verbal handoff info were reduced from 6.33 to 2.38 ($p < .0001$). A reduction in the number of interruptions was also significantly reduced (Craig et al., 2011; Joy et al., 2011).

Handover duration. There were four articles that measured handover duration. Using a standardized handoff tool did not increase the average handoff time (Craig et al., 2011; Joy et al., 2011; Karakya et al., 2013; and Zavalkoff et al., 2011). In fact, one study found that having a protocol or checklist for handing off information significantly decreased the duration of the handoff time by at least 2 minutes (Karakaya et al., 2013).

***Staff satisfaction*.** Two of the studies measured staff satisfaction in the handoff following implementation of a standard checklist (Vergales et al., 2015; and Karakaya et al., 2013). Ultimately, providers were more satisfied and felt that the standardized handover improved patient care from 19% prior to the intervention compared to 94% following the intervention. Furthermore, 69% of providers felt the process was efficient following the intervention compared to 58% prior to the intervention, and 75% of providers felt comfortable asking questions following the intervention compared to 53% prior to the intervention (Vergales et al., 2015). Karakaya and colleagues (2013) found that the nursing assessment of the handoff improved following implementation (p=.004).

Discussion

All seven studies supported the implementation of a standardized handoff tool to improve handoffs. Improvement in the outcomes occurred in each study. An increase in the adequacy, accuracy, and the quality of information were captured with a handover tool, as well as the amount of information and data transferred from the OR team to the PICU team.

The literature suggests that there is benefit in having a structured handoff or transition from the OR to the PICU. This requires teamwork and collaboration on behalf of the surgery, anesthesiology, critical care team, nursing, respiratory therapy, and support staff. A limitation was that these observational studies consisted of small sample sizes in single institutions so the generalizability is somewhat limited, however, it is important to know that this practice based research approach could not have been conducted in any other manner. It is also important to consider that the population included pediatric cardiac patients with various levels of complexity, thus, findings may be challenging to generalize to other populations.

Furthermore, there is no research addressing the clinical question of whether or not patients with poor, unstructured handovers do worse and if there is limited information transferred for patients who are unstable or medically compromised (Segall et al., 2012). It is also important to consider the experience level of the providers handing off information. It may be the case that an experienced provider can relay information more succinctly. An experienced provider may also be less apt to use a checklist or protocol for handoffs if they know what information needs to be communicated. However, they may also be practicing under the assumption that others are familiar with caring for patients of varying levels of complexity and, therefore, forget to share information (Segall et al., 2012).

Lastly, it is imperative to examine the sustainability of a standardized handoff process. The articles reviewed found positive results of a structured handover post-implementation. However, only two studies have addressed sustainability of this intervention. Chen and colleagues (2011) and Chenault and colleagues (2016) found that the use of a checklist to improve the handover process after pediatric heart surgery is a sustainable intervention. Notably, the standardized handoff significantly reduced errors during the sustainability period.

Conclusion

The patient transition from one hospital setting to the next is a crucial time when adverse events may occur. IOM, Joint Commission, and the National Transitions of Care Coalition have all stressed the importance of effective handoff communication. One area of major importance is the transfer of postoperative cardiac patient from the OR to the PICU. There are numerous studies focusing on this transition and the importance of standardized handoff tools. This review demonstrates how patient outcomes may be improved with a standardized process. Each setting is different. Therefore, the process should be developed according to the stakeholders within

each setting. Not only does a standard handoff improve patient outcomes, but it also improves communication among health care providers working with critically ill patients.

Evidence-based DNP Project

The current literature supports the implementation of a standardized handoff tool to improve handoff communication. Improvement in the measured outcomes occurred in each study that was reviewed. An increase in the adequacy, accuracy, and the quality of information was captured with a standardized handover tool, as well as the amount of information and data transferred from the OR team to the PICU team.

Conceptual Models

The important aspects of the DNP project can be connected using a conceptual framework. The conceptual framework that has guided this project is the Donabedian model, which focuses on the structure of a project, the process, and the outcomes (Donabedian, 1988). The structure involves the setting in which a project will be implemented, including the people involved. Focusing on the process involves identifying the intervention and how it will be delivered. In order to evaluate the outcome, measures need to be identified including the tools that will be used to assess the outcome measures (Donabedian, 1988). Furthermore, a theoretical model will be used to define key concepts involved in the patient handoff, and an implementation model will be used to guide the project methodology.

Theoretical Model- The Linear Model of Communication

Handover communication can be best viewed through the Linear Model of Communication, or the Linear Model (see Appendix E). Claude Elwood Shannon and Warren Weaver developed the Linear Model in 1949 (as cited in Mohorek & Webb, 2015). Its original intent was a mathematical model of communication, however, it has been used extensively in the

social sciences. The Linear Model describes communication starting from a source and ending at a destination. The source is the person responsible for producing the message or information intended to be communicated. The transmitter is responsible for encoding the message to a signal, which is conveyed through a channel. The receiver then decodes the signal back into a message in order to reach its destination (Shannon, 1948). The effectiveness of the communication is determined by the ability of the transmitter and receiver to encode and decode respectively, as well as the amount of internal and external noise present. Furthermore, the Linear Model helps to identify where errors in handoff communication occur in order to develop methods of improvement (as cited in Mohorek & Webb, 2015).

Encoding errors. Encoding occurs when thoughts are translated to words. Errors may result if the transmitter does not have adequate knowledge, experience, or communication skills to properly encode the message. Internal noise that can be physiological and/or psychological can also lead to encoding errors. Physiological noise includes factors such as fatigue, hunger, pain, or a necessity to void. Psychological noise includes barriers that may occur due to hierarchy or personal relations (as cited in Mohorek & Webb, 2015).

Transmission errors. Transmission occurs when a signal is conveyed through a channel. Errors may occur if external noise interrupts the signal. This type of error occurs with distractions that may be either essential or non-essential. Essential distractions include phone/pager interruptions, clarification/learning interruptions, overhead pages, or monitor alarms. Nonessential distractions include extraneous staff distractions, irrelevant side conversations, and TV/radio/computer noise (as cited in Mohorek & Webb, 2015).

Decoding errors. Decoding occurs when words are translated to thoughts. Decoding errors result from similar factors influencing encoding errors, such that the receiver lacks the

knowledge or experience to properly decode the message. Physiological and psychological noise barriers, as mentioned previously, may also exist. In addition another type of internal noise, semantic noise, occurs when a word or expression is decoded as a different message than it was initially intended. This may occur because of differing mental models, cultures, and educational backgrounds, among others (as cited in Mohorek & Webb, 2015).

Implementation Model- Promoting Action on Research in Health Sciences Framework

The Promoting Action on Research in Health Sciences **(**PARiHS) framework is a three-dimensional organizational tool developed to guide the implementation of evidence in practice (Kitson, Harvey, & McCormack, 1998) (see Appendix F). The framework was created to address the numerous factors influencing successful organizational change. In order for evidence to be successfully implemented into practice, researchers and clinicians must simultaneously evaluate the existing evidence, the qualities of the context in which the evidence will be implemented, and the facilitation process. These dimensions were incorporated into an equation for successful implementation, in which successful implementation is a function of the interrelations between evidence, context, and facilitation (Kitson et al., 1998).

Evidence. Evidence includes a combination of information derived from research, clinical experience, and patient preferences. With each of these in mind, it is important to understand evidence that is considered high quality compared to low quality. For example, descriptive, unsystematic evidence is low evidence, whereas randomized controlled trials are high evidence (Kitson et al., 1998). For successful implementation, evidence needs to be rigorous and systematic with high levels of professional consensus as well as a partnership and acceptance among patients.

Context. The context is the proposed setting or organization where the project implementation will occur. Context involves the culture of the setting, teamwork and leadership roles, as well as how the organization measures the system and the services that are provided. Change is more likely to occur in a patient-centered organization where people are valued, and effective teamwork and leadership are employed. Successful implementation requires established systems of measurement that monitor performance and provide feedback (Kitson et al., 1998).

Facilitation. The term facilitation incorporates the support necessary to help people change. It is necessary for an organization to have facilitators who are respectful, credible, and empathetic. Facilitators help people understand the processes required to promote change and how to go about change effectively. They are consistent and flexible and focus on interpersonal and group skills in order to successfully implement transformation within the setting (Kitson et al., 1998).

Project Plan

Purpose

The purpose of this DNP project is to implement a standardized handoff tool into the standard of care in order to improve handoff communication for children who have undergone cardiac surgery in this hospital. This project will seek to answer the clinical question: Does a standardized handoff tool from the OR to the PICU, compared to current practice, improve patient outcomes post-cardiac surgery, while simultaneously improving staff satisfaction in terms of teamwork across units and handoff communication?

Objectives

The objectives of this DNP project are to:

- Improve handoff communication between the OR and PICU teams post-cardiac surgery

- Improve nursing and provider satisfaction of the handoff information that is exchanged
- Provide safer care for children post-cardiac surgery
- Improve completeness of handoff exchange

Type of Project

This DNP project is a quality improvement project that will focus on improving handoff communication in order to provide safer care for children following cardiac surgery. Quality improvement is essential in a healthcare organization in order to promote actual change in the organization. Quality improvement projects often start small with one process on one unit, and have the opportunity to be embedded into the culture of the organization and across other units if improvements in staff satisfaction and patient care are achieved (Agency for Healthcare Research and Quality, 2017).

Settings and Resources Needed

This DNP project will take place at a freestanding midwestern children's hospital. The most valuable resource that will be needed to complete this project is time. It will require staff to spend time completing a survey pre- and post- intervention. Time will be needed to educate stakeholders about the standardized handoff tool and how to implement it into the workflow. Time will also be needed to simulate the use of this tool. Educational materials that will be required include a laptop and screen to present education. It will require paper to print the handoff tool and have it available in the rooms of the PICU that are dedicated to the cardiovascular patients.

It is possible that this project will need assistance from staff in information technology if the standardized handoff tool is to be embedded into the electronic health record (EHR). As mentioned above, the hospital is currently changing their EHR system, so this may be an

opportune time to embed the standardized handoff tool into the EHR, because changes in workflow are already underway.

Design for Evidence Based Intervention

The design for the evidence-based intervention will be an observational pre- post-intervention based on the Linear Model. Using the three communication errors that were highlighted in the Linear Model, an intervention that can improve these errors was designed. A standardized handoff tool is an evidence-based intervention that can help reduce errors in communication.

Encoding errors. Errors that occur with encoding a message can be improved with the use of a standardized handoff tool. If the transmitter is unsure how or what to communicate in the handoff, because they lack the knowledge or communication skills to effectively get the message across, a standardized tool will guide communication so that every important message is exchanged. This intervention will clearly specify the pertinent information that needs to be relayed from the OR team to the PICU team about the patient's medical and surgical history as well as goals for patient care in the next 24-28 hours.

Transmission errors. Transmission errors may also improve with the use of a standardized handoff tool. Part of the standardized tool will include ensuring that the patient is stable upon arrival to the PICU, making sure that everyone that is required for the handoff communication is present in the room, and minimizing distractions by shutting the door and limiting extraneous conversations.

Decoding errors. Decoding errors will be improved through the use of a standardized form. At the end of the handoff, it will be important for the receiver to summarize patient care needs through reading back the information exchanged and the patient goals for the next 24-28

hours. A standardized handoff tool will have standardized vocabulary that is understood by both the transmitters and the receivers. At the end of the handoff report, it will be important for members of the PICU team to ask questions and clarify any information that is unclear.

Participants

The participants of this quality improvement project include staff from the OR and the PICU team of a freestanding midwestern children's hospital. This will include the anesthesiologist, CV surgeon or APP, primary and secondary RNs, respiratory therapists, and APP in the PICU. Patients undergoing cardiovascular surgery who are transported from the OR to the PICU will be participants in the quality improvement project as well.

Measurement: Sources of Data and Tools

The sources of data collection for this DNP project include observations, chart review, and a pre and post survey (see Appendix G). Pre and post surveys will be administered to the OR and PICU teams to evaluate the existing handoff process. The statements in the survey will be evaluated on a Likert-scale from strongly agree to strongly disagree. Statements include information "falls between the cracks" when transferring postoperative cardiac patients from the OR to the PICU; the CV surgeon/APP waits for everyone to be ready before starting hand-off in the room; I have all of the information I need to safely and effectively care for my patient (history, intraoperative medications, active problems, anticipatory guidance, notification parameters, priority setting); A summary of the handoff was provided with an opportunity for questions following handoff conclusion; the cardiovascular surgeon is present for the handoff; the OR team and PICU team work well together to provide the best care for patients. The post-survey questions will be the same as the pre-survey questions and will be evaluated 60 days after implementation

Chart reviews will be conducted to measure the number of times a patient required an ECMO procedure two months prior to the intervention compared to two months post intervention. Chart review will be conducted on patients who have undergone cardiac surgery to determine if there were improved patient outcomes following implementation of the structured handoff tool.

Implementation Strategies

According to a panel of implementation and clinical experts, there are 73 discrete implementation strategies that can be used as "building blocks" for varying levels of implementation (Powell et al., 2015). In order to meet the objectives of this DNP project, three of the implementation strategies will be utilized.

1. Educate the providers, RNs and other key stakeholders involved in the standardized handoff process prior to implementation in January 2018.

Educating staff is a vital strategy in the implementation process. It is a chance for staff to become aware of the quality improvement project and the key components of the new intervention (Powell et al., 2018). Steps to meet this objective:

- Meeting with the multidisciplinary OR and PICU teams in December 2017. The objectives of the meeting will be to briefly report evidence from the literature supporting the use of a standardized handoff tool and to present the tool.

2. Model and simulate change prior to implementation in January 2018.

The use of simulations is health care is becoming increasingly popular. In 2006, AHRQ awarded $5 million to research involving simulation research to improve patient safety (AHRQ, 2008). Simulations provide a hands-on method to help employees learn and practice a new skill. Steps to meet this objective include:

- A staff simulation conducted in January 2018 will model the use of the standardized handoff tool.
- The simulation will be video recorded and emailed to the multidisciplinary OR and PICU teams to view.

3. Audit and provide feedback throughout the implementation process.

Auditing a hospital unit involves collecting and summarizing clinical performance data for providers (Powell et al., 2015). Steps to meet this objective include:

- Weekly staff meetings to encourage continued use of the standardized handoff tool and update staff on patient throughout implementation.
- Evaluate the standardized handoff tool starting in January 2018 and ending by March 1, 2018.
- A final report on how implementation strategies helped meet the objectives and purpose of the project will be delivered by April 1, 2018.

Guiding Framework for Implementation

The PARiHS framework will guide the implementation of this project. The timeline for the project can be viewed in Appendix H. The concepts in the PARiHS framework that were mentioned above are evidence, context, and facilitation.

Evidence. A review of the evidence-based literature related to handoffs in children following cardiac surgery from the OR to the PICU began in October 2017. The synthesized literature review was completed November 2017. The evidence supported the use of a standardized handoff tool in order to provide effective handoff communication.

Context. An assessment of the organizational needs and culture began in September 2017. The organizational assessment will be an important part of the project, as the DNP student

continues to learn about the current practices in the OR and the PICU and builds relationships with providers and nursing staff on the units. The DNP student met with key stakeholders in the children's hospital at weekly touch-base meetings on September 29, 2017 and October 13, 2017 to listen to provider and nursing concerns. The DNP student met with a CNS on the PICU who has extensive experience as a nurse in the PICU as well as in quality improvement projects in the PICU. Several meetings were held with the CNS, an APP in the PICU, the nurse navigator for the PICU, members of the SLC, and nursing staff to gain further insight and begin planning the project. The DNP also spent a day observing in the OR to learn more about the steps taken before the patient is transferred to the PICU. These meetings and observations helped the DNP student identify the opportunity for improvement in the handoff process.

Facilitation. The CNS, nurse navigator, and co-chair of the SLC have been identified as leaders in the PICU. They have agreed to help facilitate the implementation of a standardized handoff tool. The DNP student created the vision of the project in November 2017. This happened through meetings and conversations with the organizational team member, nursing staff and the SLC. Education about the intervention will be provided at the December staff meeting. Modeling of the new standardized handoff tool will be done in January 2018 through multidisciplinary simulations.

Ethics and Human Subjects Protection

The Institutional Review Board (IRB) in the health system determined the project was quality improvement (see Appendix I). Similarly, the Grand Valley State University Human Research Review Committee determined the project was quality improvement (see Appendix J).

Budget

A budget for this project was considered (see Appendix K). As mentioned above the most valuable resource for this project is staff time to educate and simulate the intervention. The DNP student will be contributing time in order to transform the current handoff tool to a one-page tool with a checklist of information that should be communicated in the handoff. The DNP student will also be contributing time to educating staff about the handoff tool and organizing the simulations. Time will also be spent by the DNP student in observing the handoffs after the education and simulation of the standardized handoff tool. Because this quality improvement project is part of the DNP student's education, time spent implementing the intervention will not cost the organization any money.

In addition to time spent by the DNP student, time will be needed from staff in the CV and PICU teams in order to learn about the standardized handoff tool. The CNS that works in the PICU will be an important part of implementation and will be consulted frequently. The current median hourly wage of a CNS in the United States is $48 (Salary.com, 2017a). Approximately 2 hours of the CNS's time will be needed. This would cost the organization $96. There are approximately 90 nurses employed in the PICU. The current median hourly wage of an RN working in an ICU setting in the United States is $34 (Salary.com, 2017b). Approximately 30 minutes of the RNs time will be needed for education of the intervention. Educating 60 nurses for 30 minutes at an hourly wage of $34 would cost the organization $1,020.

It will also be important to consult members of the CV team regarding project implementation and assistance with the simulation. The members of this team include the cardiac surgeons, cardiac APPs, and anesthesiologists. The current median hourly wage of a cardiothoracic surgeon in the United States is $215 (Salary.com, 2017c). Approximately 30 minutes of the surgeon's time will be needed to help simulate the handoff. This would cost the

organization $107.50. The current median hourly wage of an anesthesiologist in the United States is $177 (Salary.com, 2017d). This would cost the organization $88.50. Approximately 30 minutes of the anesthesiologist's time will be needed to help simulate the handoff. The current median salary for a nurse practitioner in the United States is $49 (Salary.com, 2017e). Approximately 30 minutes of the APP's time will be needed to help simulate the handoff. This would cost the organization $24.50. The project would cost the organization a total of $1,336.50 for provider and nursing staff time.

The project has the potential for a return on investment (ROI) if patient outcomes and staff satisfaction are improved. For example, ECMO may be instituted in children after cardiac surgery for cardiopulmonary arrest, failure to wean from bypass, ventricular dysfunction, and/or pulmonary hypertension (Mahle, Forbess, Kirshbom, Cuadrado, Simsic, & Kanter, 2005). The average cost of an ECMO procedure is $73,122 (Mishra et al., 2010). Therefore preventing one procedure could save tens of thousands of dollars. In addition to improving patient outcomes, the standardized handoff tool has the potential to improve staff satisfaction, which could lead to staff retention. The turnover of a bedside RN costs the hospital on average between $37,700 and $58,400 (Nursing Solutions Inc., 2016). According to a conversation from the CNS in the PICU, the PICU has a high turnover rate compared to the rest of the hospital. Thus, improving staff satisfaction with better teamwork and communication could be a great ROI for the hospital.

Stakeholder Support and Sustainability

Stakeholders are individuals or groups who have an interest in the project. They may be individuals who can affect the project or who the project may have an affect on (Moran, 2017). It is important to identify the key stakeholders in an organization, because they may present unique perspectives on the project that has not already been thought of. Stakeholders in this children's

hospital are the staff including the physicians, physician's assistants, nurse practitioners, RNs, nurse techs, and administrative staff. Other stakeholders are the patients and their families. It is also important to consider that the overall children's hospital may be affected by the changes that are made in this quality improvement project, so the director of operations, the director of pediatric inpatient services, and other chief executives may benefit from the project.

Stakeholder support is essential for success in this DNP project. Meetings with the co-director of the congenital heart center, the chief of cardiology, the director of pediatric inpatient services, the CNS, several APPs and RNs in the hospital and in the PICU have indicated opportunities for improvement in the current handoff process. The PICU's SLC has also identified the handoff from the OR to the PICU as the number one priority according to a staff survey.

Sustainability is also an important aspect to consider after implementation. The standardized handoff tool will be available for staff on the unit to access after project completion. Embedding the tool into the EHR and requiring staff to chart on the handoff may also be an option if management feels that the tool has been successful. It is likely that a new DNP student will be continuing within this setting to further improve the handoff process and outcomes post-cardiac surgery.

Implications for Practice

Handoff communication occurs numerous times throughout the day as children are transferred between various levels of inpatient care. These transitions are a vital time for children, thus standardizing the handoff process is essential to communication. It may be beneficial for the patient, family, and health care providers if a standardized handoff tool is utilized when any patient is transferred from the OR to the PICU. A standardized handoff tool

may improve the transfer and patient outcomes, limit the amount of information lost, decrease handover duration, and allow for questions to be answered related to the immediate care of the pediatric postoperative patient.

Further research should address whether the use of a standardized handoff tool is sustainable several years following implementation.

Plans for Dissemination of Outcomes

The outcomes of this DNP project will be disseminated in various ways. A scholarly paper describing the project will be uploaded to Scholar Works and outcomes will be reported to the organization during a staff meeting. During this time, the student will discuss sustainability of the intervention and steps to take for further quality improvement in patient handoff. This may also lead to implementation of a standardized handoff tool to be utilized hospital-wide when patients are transferred between units and then discharged home. In addition, the DNP student will present a PowerPoint of the project as part of the final project defense to the team members, faculty, organizational members, and anyone in the community that would like to attend. The DNP will look for nursing conferences locally and nationally to present the project at and may submit a manuscript for publication of the quality improvement initiative.

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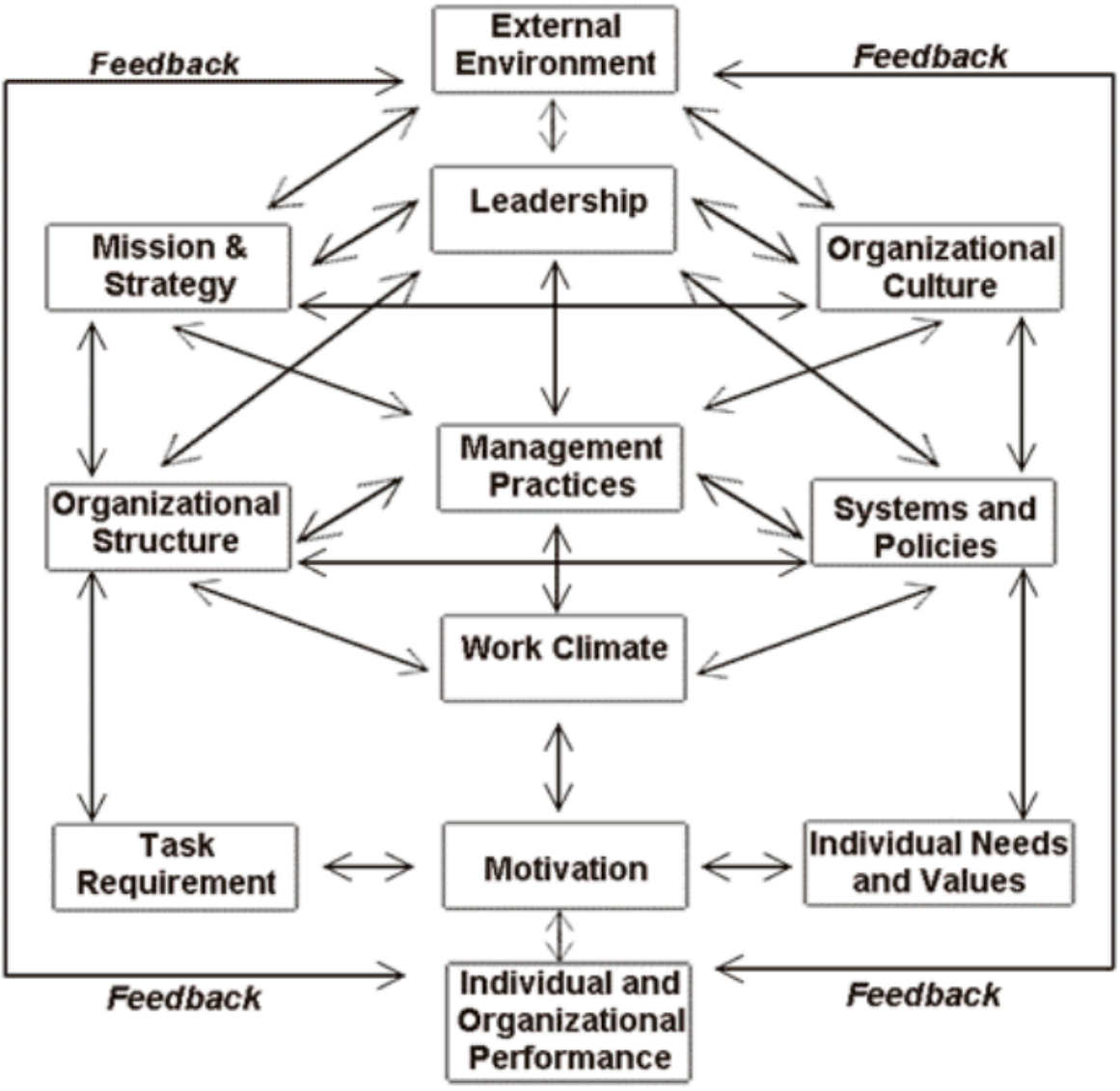
Appendix A

Burke-Litwin Causal Model



Adapted from "A Causal Model of Organizational Performance and Change," by W. W. Burke and G. H. Litwin, 1992, *Journal of Management, 18*, 528. Copyright 1992 by Southern Management Association.

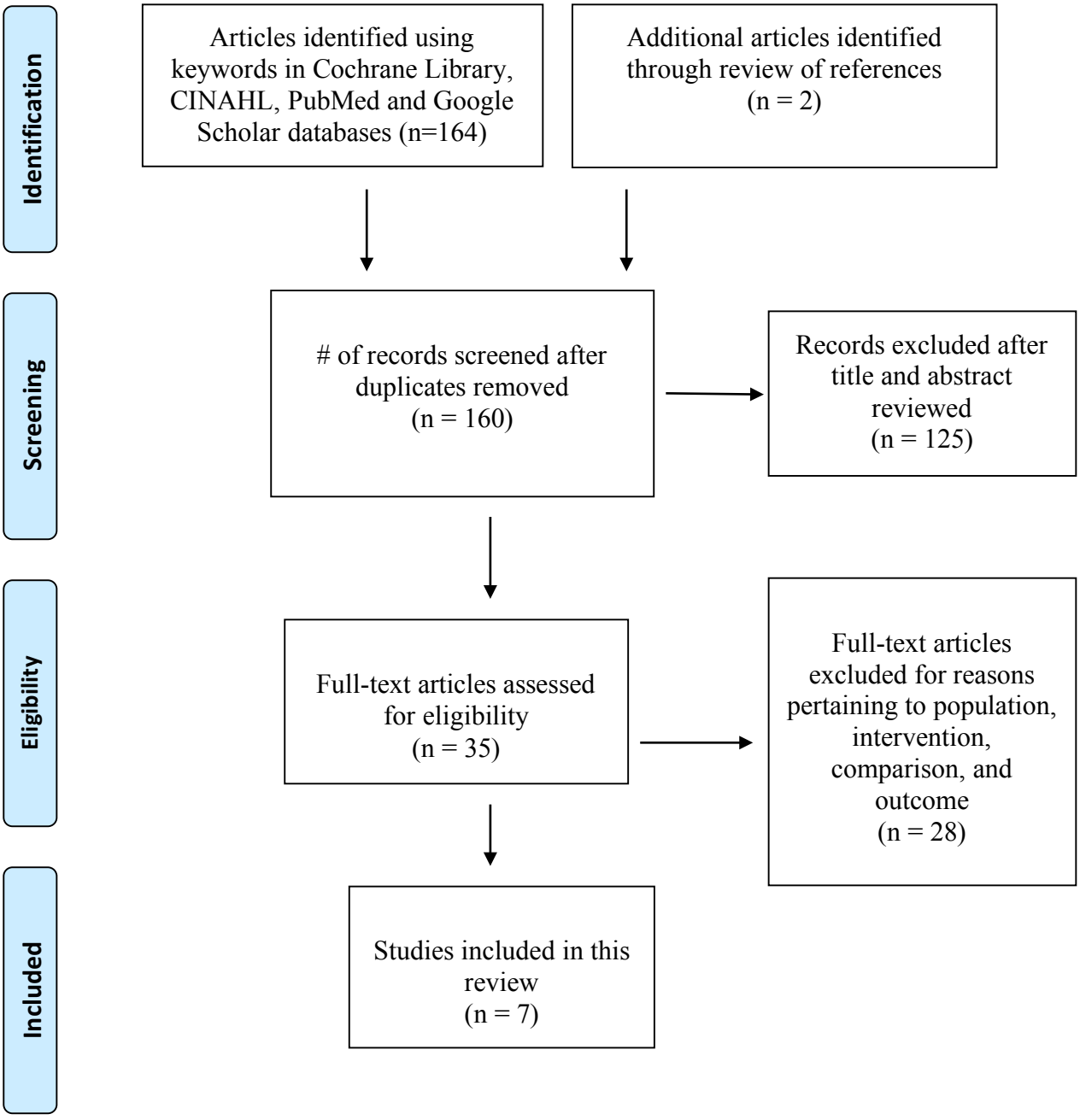
Appendix B

SWOT Analysis

	Helpful	Harmful
Internal	Strengths • Several cardiologists with various heart specialty areas • New nurses attend core classes in cardiac education • Monthly simulations with cardiac scenarios • Survival rates pre- and post-cardiac surgery are above the national benchmark • 3-D anatomic model of the patient's heart • PICU at HDVCH had a statistically significantly shorter discharge delay compared to other mixed PICUs	Weaknesses • CV team not part of new nurses education • Discrepancies between nurses and physicians related to discharge education • Small number of APPs for the # of patients • High nursing turnover in PICU • Not always able to staff nurses who are familiar with CHD and associated surgeries
External	Opportunities • Marketing excellent care provided by CHC • Reporting to organizations such as the Society of Thoracic Surgeons can provide data and information to consumers around the country • Better coordination of care which will benefit the community and surrounding population as a whole.	Threats • Competition with other CHCs in Michigan and nearby • Some children with CHDs are not easily treated and may have outcomes that are unpreventable.

Appendix C

PRISMA Flow Diagram of Systematic Search



Adapted from "Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement," by D. Moher, A. Liberati, J. Tetzlaff, D. Altman, and PRISMA Group. Copyright 2009 by PLoS Medicine.

Appendix D

Table of Evidence

Author (year) Purpose	Design (setting, sample)	Intervention	Results	Conclusion
Agarwal (2012) evaluated a structured handover process (OR to PICU) on loss of information transfer, quality of communication exchange, postoperative complications, and 24hr patient outcomes including cardiopulmonary resuscitation, mediastinal exploration, metabolic acidosis, and early extubation following pediatric cardiac surgery	Pre-post observational study (1-US Hospital PICU; N=1078)	A structured multidisciplinary handover process: Step 1: Standard form for phone communication between OR and PCICU Step 2: Standardized checklist for face-to-face report on arrival in the PCICU	Significant improvement in proportion of survey items with adequate information related to 1) patient details, 2) preoperative details, 3) anesthesia details, 4) surgical details, 5) post-surgery details, and 6) laboratory values using the standardized handover tool (84%) compared to the verbal handover process (57%). Quality of structured handover process was excellent (4.4 on a 5-pt Likert scale) Cardiopulmonary resuscitation decreased 5.4% to 2.6% (p=.043). Mediastinal reexploration decreased 9% to 5.5% (p=.043). Metabolic acidosis decreased 6.7% to 2.6% (p=.004). Early extubation increased from 43.2% to 50% (p=.04).	A structured handover process improved information transfer, quality of communication, postoperative complications, and 24hr patient outcomes including cardiopulmonary resuscitation, mediastinal exploration, metabolic acidosis, and early extubation following pediatric cardiac surgery.
Craig (2011) evaluated a structured handover	Pre-post observational study (1-	A structured multidisciplinary handover process with 3:	Improved scores in the 3 phases of the handoff in pre-patient readiness (p<.001), pre-handover readiness (<	A structured handover process improved knowledge

process (OR to PICU) on knowledge transfer, staff perceptions of the handover, handover duration, number of interruptions, attentiveness, organization, and information flow following pediatric cardiac surgery	Belgium Hospital PICU; N=43)	<u>Phase 1: Pre-patient phase</u> 1). Echo and cardiac conference reports at bedside 2). Blood and radiograph forms at bedside 3). Ventilator and suction for chest drains set up <u>Phase 2: Pre-handover phase</u> 1). Transfer of patient monitoring to PICU monitors 2). Endtidal CO2 monitor in place 3). Ventilator transfer 4). Chest drains secured and on suction 5). Pumps transferred <u>Phase 3: Information handover phase</u> 1). Starts when transfer of equipment complete and staff free to listen 2). Anesthetist in charge of patient until after handover 3). Anesthetist then theater nurse then cardiac surgeon hand over salient points and suggest plan and potential complications uninterrupted 4). Plans confirmed by PICU staff with time for questions 5). PICU assumes control of patient- baseline blood tests, radiographs, and ECGs	.001), and information handover (p=.006). Improvement of observer scores: • attentiveness (4 to 7; p<0.001) • organization (5 to 7; p<0.001), and • information flow (5 to 6.5; p<0.001). Reduction in number of interruptions (4 to 1; p<0.001) No change in handover duration (p=0.283).	transfer, staff perception of the handover, organization, attentiveness and information flow of the handover, as well as decreased the number of interruptions without increasing handover time for patients transferring from the OR to the PICU after cardiac surgery.

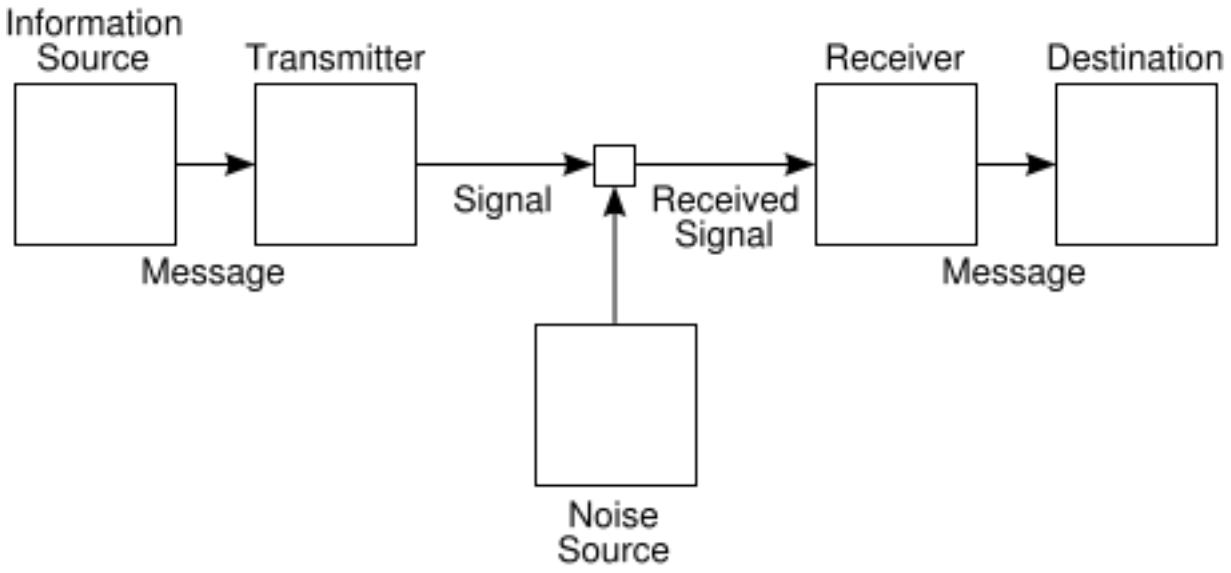
Joy (2011) examined a standardized handover protocol (from OR to CICU) on the number of technical errors (including interruptions) handoff omissions, and handoff duration following pediatric cardiac surgery.	Pre-post observational study (1-US Hospital CICU; N= 79)	A multidisciplinary standardized handover template: Patient details: name, age, weight, pre-op diagnosis, allergies Operative course: anesthesia technique, operation performed, access type and location, cardiopulmonary bypass course, pulmononary artery pressures, arrhythmias, echo findings, blood products given, and bleeding issues Present status: vitals, pacing wires, plans for extubation, and medications/infusions	Technical errors were reduced from 6.24 to 1.52 ($p < .0001$), and omissions of critical verbal handoff info were reduced from 6.33 to 2.38 ($p < .0001$). No change in handover duration (8.8 min to 9.8 min; $p=0.27$). Time required to transition central venous pressure monitoring to the bedside monitor was reduced (20.5 mins to 6.3 mins; $p<.0001$). Caregiver surveys measured on a 5-pt Liker scale showed improved teamwork (4 to 5; $p<.05$) and information received (4 to 5; $p<.05$).	A structured handover protocol for pediatric patients transitioning from OR to CICU after cardiac surgery reduced technical errors, omission of critical information with fewer handoff interruptions and disruptions. The handover protocol improved caregiver's perception of teamwork and information received.
Karakaya (2013) examined the effects of a standardized checklist (OR to PICU) on postoperative data transfer, handoff duration, and ICU staff's assessment	Pre-post observational study (1-Belgium Hospital PICU; N=48)	A standardized checklist on patient-specific information, including preoperative history, details of anesthesia and surgery, and information about the postoperative status.	Data transfer increased from 48 to 73% ($p<0.001$). Handover duration decreased from 6 to 4 min ($p=.04$). Nursing assessment of the handoff improved ($p=.004$).	A transfer checklist in postoperative pediatric cardiac surgery patients resulted in a more complete transfer of information, with a decrease in the handover duration.

of the handover after congenital cardiac surgery.				
Kaufman (2013) examined the effects of a handoff protocol (OR-CICU) on unplanned extubations and mean ventilator time post cardiac surgery	Pre-post observational study (1-US Hospital CICU; N= 1507)	A standardized handoff protocol outlined in a bedside laminated flow chart. The template outlined the detailed responsibilities for those involved, as well as their physical position around the bedside.	There were 15 unplanned extubations in the 17 months before and 7 in the 24 months after (p=.03). The median ventilator time per patient for the pre- was 17.0 hours and 12.8 hours post-handoff- period (p = .02).	The handoff protocol was associated with a reduction in unplanned extubations and mean ventilator time (improvements beyond the immediate post-op period).
Vergales (2015) examined the effects of a face-to-face handoff process (OR-PICU) on feasibility, reliability, provider beliefs on the handoff organization, how providers felt the handoff affected patient care overall, and their comfort speaking up when items were not being addressed appropriately after	Pre-post observational study (1-US Hospital OR and PICU; N= 79)	A face-to-face standardized handoff process. PICU nurse part of the patient transport from the OR to the PICU. The PICU nurse learned the nursing specifics to the patient in addition to securing and dressing lines, verifying drips and rates, and performing an initial assessment prior to the arrival of the patient into the PICU. PICU roles and positions were mapped out. The huddle began with reporting of the patient's initial arterial blood gas and a brief overview of the	Duration of time for the PICU nurse to travel to the OR, receive initial sign-out, stabilize and dress lines, verify drips, and transport back to the ICU was 27.5 minutes and did not differ across RACHS categories (p=.95). It took an average of 8.7 min from patient arrival in PICU until handoff completion. Handoff improved care 94% of the time post-pilot compared to only 19% pre-pilot. 69% of providers felt the process was efficient compared to 58% before and 75% felt comfortable asking questions compared to 53% before pilot.	A structured, uniform, multidisciplinary handoff model for transferring children following both simple and complex congenital heart surgery can be implemented and completed in an efficient manner. Involving all stakeholders in the process overhaul led to improved provider comfort, a more open environment for

pediatric cardiac surgery		surgical course and pertinent background issues. After the huddle team members were allowed to offer additional information and then an immediate postoperative plan was decided on by all disciplines.		asking questions, and a pervasive belief in providing overall improved patient care.
Zavalkoff (2011) examined the effects of a handover tool (OR to PICU) on handover completeness, handover duration, and postoperative health-risk events (HREs) after pediatric cardiac surgery.	Pre-post observational study (1-US Hospital PICU; N=31)	A fill-in-the-blank, one-page multidisciplinary tool guided information transmitted by the surgeon and anesthesiologist to the PICU team during handover of post cardiac surgery patients. 4 sections: 1). Preoperative info. (7 points) 2). Medical intraoperative info. (14 points) 3). Surgical intraoperative info. (11 points) 4). Current (immediate post-op) status (11 points)	Total handover score improved from 28.2 to 33.5 (maximum 43 points) significantly (p=.002). Medical intraoperative info improved 8.3 to 10.3 (p=.024). Surgical intraoperative information improved 7.5 to 9.3 (p=.002). Use of the tool did not prolong handover duration.	Use of a simple tool during handover of pediatric post cardiac surgery patients resulted in a more complete exchange of critical information with no significant prolongation of the handover duration.

Appendix E

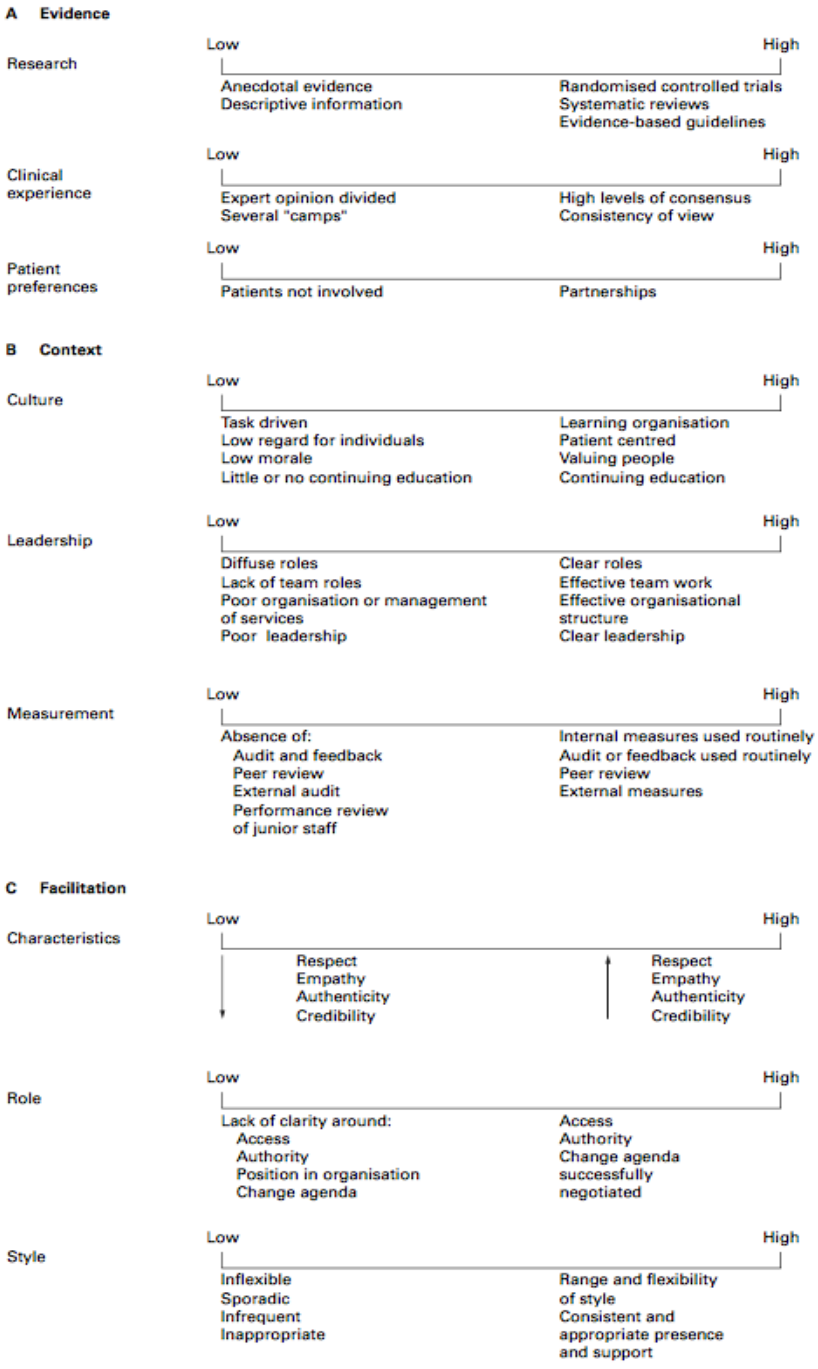
The Linear Model of Communication



Adapted from "A Mathematical Theory of Communication," by Shannon, C. E., 1948, *The Bell System Technical Journal, 27.* 381

Appendix F

The PARiHS Framework



Adapted from "Enabling the implementation of evidence based practice: A conceptual framework," by A. Kitson, G. Harvey, and B. McCormack. Copyright 1998 by Quality and Safety in Health Care.

Appendix G

Pre/Post Survey

Information “falls between the cracks” when transferring postoperative cardiac patients from the OR to the PICU.

Strongly agree **Agree** **Neither Agree/Disagree** **Disagree** **Strongly Disagree**

The CV surgeon/APP waits for everyone to be ready before starting hand-off in the room.

Strongly agree **Agree** **Neither Agree/Disagree** **Disagree** **Strongly Disagree**

I have all of the information I need to safely and effectively care for my patient (history, intraoperative medications, active problems, anticipatory guidance, notification parameters, priority setting).

Strongly agree **Agree** **Neither Agree/Disagree** **Disagree** **Strongly Disagree**

A summary of the handoff was provided with an opportunity for questions following handoff conclusion.

Strongly agree **Agree** **Neither Agree/Disagree** **Disagree** **Strongly Disagree**

The cardiovascular surgeon is present for the handoff.

Strongly agree **Agree** **Neither Agree/Disagree** **Disagree** **Strongly Disagree**

The OR team and PICU team work well together to provide the best care for patients.

Strongly agree **Agree** **Neither Agree/Disagree** **Disagree** **Strongly Disagree**

Appendix H

Project Timeline

Activity	**October 2017**	**November 2017**	**December 2017**	**January 2018**	**February 2018**	**March 2018**
IRB Approval	X					
Prospectus	X					
Organizational Assessment	X	X				
Literature Review	X	X				
White Paper		X				
Project Proposal Defense			X			
Implement Project				X	X	
Final Project Defense						X
Submit Project to Scholar Works						X

Appendix J

GVSU IRB Determination

GRAND VALLEY STATE UNIVERSITY
www.gvsu.edu

DATE: October 19, 2017

TO: Sandra Spoelstra
FROM: Office of Research Compliance and Integrity
STUDY TITLE: Transitions of Care in a Children's Hospital from Operating Room to Outpatient: A Quality Improvement Project
REFERENCE #: 18-082-H
SUBMISSION TYPE: HRRC Research Determination Submission

ACTION: Determination: Not Research
EFFECTIVE DATE: October 18, 2017
REVIEW TYPE: Administrative Review

Thank you for your submission of materials for your planned scholarly activity. It has been determined that this project does not meet the definition of research* according to current federal regulations. The project, therefore, does not require further review and approval by the Human Research Review Committee (HRRC).

A summary of the reviewed project and determination is as follows:
The purpose of this project is to improve the transitions of care at Helen DeVos Children's Hospital (HDVCH) for children who have undergone cardiac surgery, from the operating room to the intensive care unit to the inpatient surgical floor and then to the outpatient setting. This is a quality improvement study to improve patient care at HDVCH and is not generalizable. Therefore, this study does not meet the federal definition of "research" per 45 CFR 46.102(d).

An archived record of this determination form can be found in IRBManager from the Dashboard by clicking the "_ xForms" link under the "My Documents & Forms" menu.

If you have any questions, please contact the Office of Research Compliance and Integrity at (616) 331-3197 or rci@gvsu.edu. Please include your study title and study number in all correspondence with our office.

Sincerely,
Office of Research Compliance and Integrity

*Research is a systematic investigation, including research development, testing and evaluation, designed to develop or contribute to generalizable knowledge (45 CFR 46.102 (d)).

Human subject means a living individual about whom an investigator (whether professional or student) conducting research obtains: data through intervention or interaction with the individual, or identifiable private information (45 CFR 46.102 (f)).

Scholarly activities that are not covered under the Code of Federal Regulations should not be described or referred to as *research* in materials to participants, sponsors or in dissemination of findings.

Appendix K

Budget for DNP Project

Improving the Patient Handoff from OR to PICU in Children Who Have Undergone Cardiace Surgery Using a Standardized Handoff Tool

Revenue	
Project Manager Time (in-kind donation)	2,520.00
Consultations	
Statistician	100.00
Cost mitigation	
RN turnover	37,700.00
Prevention of 1 ECMO procedure	73,122.00
Presidential Grant	300.00
TOTAL INCOME	113,742.00
Expenses	
Project Manager Time (in-kind donation)	
Team Member Time:	
Director of Inpatient Pediatric Services	670.00
Registered Nurses (60)	1,020.00
Advanced Practice Providers (9)	220.50
Cardiac Surgeons (3)	322.50
Anesthesiologists (1)	88.50
Clinical Nurse Specialist (1)	240.00
Consultations	
IT Consultation	60.00
QI Data Consultation	18.47
Nursing Consultation	150.00
Cost of Printing Handoff in Color	30.00
Cost of Laminating Handoff	20.00
Professional Printed White-Paper	25.00
TOTAL EXPENSES	2,864.97
Net Operating Plan	110,877.03

Appendix L

Standardized Handoff Tool

Date: _____ Patient Name : _____ Pt. ID: _____Surgeon: _____ Room: _____

OR Preparation Call

- ☐ Weight (kg) _____
- ☐ Age _____
- ☐ ETT Size: _____
- ☐ Isolation: Yes / No
- ☐ Intubated: Yes / No
- ☐ Code Status
- ☐ Procedure / Diagnosis:
- ☐ Allergies:
- ☐ Extubation Plan:

IV Access / Monitoring

A-Line PIV CVP NG Tube Foley

Airway / Respiratory:

- ☐ Taped: Gums or Lips
- ☐ Laryngoscope blade used: _____
- ☐ Ventilator Settings:
  - PIP: _____ FiO2: _____ TV: _____
  - Rate: _____ PEEP: _____ PS: _____
  - Target SaO2: _____ I:E Ratio: _____
  - Nitric Oxide: _____ Nitrogen _____
  - Tracheostomy Y N Size _____
- ☐ Difficult Intubation Yes / No
- ☐ Fiberoptic / special technique?
- ☐ Confirmed Placement
- ☐ Extubation Plan: Today _____
- ☐ ABG Assessment:
- ☐ **DIFFICULT AIRWAY sign at bedside:** Y / N
- ☐ If wired, wire cutters at bedside? Y / N

Cardiovascular:

HR: _____ S/D BP range: _____ MAP: _____ CVP: _____ Vasoactive infusions/concentration rates: _____

Pacemaker settings: Rate: _____ Mode: _____ Atrial mA: _____ Ventricular mA: _____ Target SaO2: _____

Pleural/Mediastinal Tube:

Intraoperative ECHO Assessment: Summary (hemodynamics, rhythms, perfusion)

Neurological Assessment:

Preop Baseline: _____ GCS Baseline / Current: _____ Ventriculostomy or VP Shunt present: _____

Ventriculostomy / VP Shunt Management Plans:

Fluid Management:

Intake: Blood Products _____ Colloid _____ Crystalloid _____

Losses: EBL _____ NG Output _____ Urine _____

Pain Management Plan:

- ☐ Mode: IV _____ Regional: Central / Epidural / Peripheral Local infiltration: _____
- ☐ Service Managing Pain: ICU: _____ Acute Pain Service: _____ Surgery: _____

Medication Last Dose (time) :

- ☐ Antibiotics _____ Analgesics _____ Sedatives _____
- ☐ NM Relaxant _____ Antiemetics _____
- ☐ Maintenance: CV _____ Seizure PPX: _____ Resp. RAD: _____

NOTES / SPECIAL CONSIDERATIONS:

DNP Project Results

JOURNAL OF DOCTORAL OF NURSING PRACTICE

Title Page

Title: Improving the Patient Handoff from OR to PICU in Children Who Have Undergone Cardiac Surgery Using a Standardized Handoff Tool

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Author Primary Affiliation: Kirkhof College of Nursing, Grand Valley State University

Advisory Committe: Sandra Spoelstra, PhD, RN, FGSA, FAAN; Marie VanderKooi, DNP, RN; Caryn Steenland, MSN, RN

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Disclosures/disclaimers: All authors indicate no conflict of interest or competing interests.

Abstract

Background: Hospitalizations for children are costly, and handoff transition from one inpatient setting to the next may negatively impact health outcomes. Handoffs are often associated with adverse events and medical error. Despite efforts to improve patient handoff, communication failure remains a significant problem. Research shows use of a standardized handoff tool improves patient transition. **Objectives:** This project focused on use of a standardized handoff tool from the operating room to the pediatric intensive care unit in children undergoing cardiac surgery to improve duration of handoff, postoperative goal review, patient complications, and staff satisfaction. **Methods:** The quality improvement project was an observational pre-post improvement in a Midwestern children's hospital with a convenience sample of 13 handoffs for patients 0-18 years of age. **Results:** Handoff tool use improved 100% while duration decreased 0.63 minutes. Postoperative goals (8) improved from 0% to 20-80%. Patient complications decreased 94.2% post-implementation. Nurse satisfaction of handoff information exchanged improved (p=.03). **Conclusions:** A standardized handoff tool decreased postoperative complications and improved information exchange and staff satisfaction.

Keywords: Handoff, Handover, Operating Room, Pediatric Intensive Care Unit, and Cardiac Surgery

Introduction

Medical error is the third leading cause of death in the U.S. accounting for 250,000 deaths per year, according to an 8-year study conducted by a team of patient safety experts at John Hopkins University (McMains, 2016). In 1999, Institute of Medicine (IOM) report *To Err is Human: Building a Safer Health System* called for action by healthcare providers to reduce preventable errors. As there were over 98,000 deaths a year in the U.S. due to medical error at that time, a goal was set to reduce preventable errors by 50 percent (Korn, Corrigan, & Donaldson, 1999). Although this goal has not yet been attained, healthcare providers remain focused on safety and prevention of medical errors.

The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) acknowledged the importance of handoff communication in preventing medical errors, and issued a recommendation for health care providers to use a standardized handoff process (2007). The recommendation included an opportunity to clarify handover information, with dedicated time for questions and answers. JCAHO revised the recommendation in 2010 and made handoff communication a "Provision of Care" standard. This means hospitals were required to have a process to receive or share patient information when patients are transferred within the hospital system (JCAHO, 2010). Healthcare providers work every day to provide high quality care. Unfortunately, communication exchange responsibilities are not defined and adverse situations arise, as patients and healthcare systems are complex (National Transitions of Care Coalition, 2008).

Strategies to Improve Handover Communication

Numerous studies support the use of a standardized handoff tool to improve handoff communication for patients transitioning from the operating room (OR) to the pediatric intensive

care unit (PICU) post cardiac surgery. A standardized handoff tool improved patient-related information on preoperative, anesthesia, surgical details, and overall data transfer (Agarwal et al., 2012; & Karakaya et al., 2013). In addition, improved attentiveness, organization, flow of information, and handoff completeness occurred with use of a structured handover process (Vergales et al. 2015, Craig et al., 2012; & Zavalkoff et al., 2011).

Handoff omissions or technical errors. Use of a standardized handoff tool reduced technical errors and omissions of critical verbal handoff information (Joy et al., 2011). The number of interruptions also reduced with the use of a standardized handoff tool (Craig et al., 2012; Joy et al., 2011). As a result, fewer errors and omissions occur with use of a standardized handoff process.

Handoff duration. Use of a standardized handoff tool did not increase average handoff time (Craig et al., 2011; Joy et al., 2011; Karakya et al., 2013; Zavalkoff et al., 2011). One study found use of a protocol or a checklist for handoff information decreased handoff duration by 2 minutes (Karakaya et al., 2013). Use of a standardized process may reduce handoff time.

Postoperative complications. Use of a standardized handoff tool decreased postoperative complications. Cardiopulmonary resuscitation, need for mediastinal reexploration, and development of severe metabolic acidosis, in the first 24 hours of admission to the PICU were reduced using a standardized handoff tool (Agarwal et al., 2012). In addition, increased number of patients were successfully extubated in the first 24 hours of admission after use of a standardized handoff tool (Agarwal et al., 2012). Another study found use of a standardized handoff process decreased unplanned extubation and median ventilator time (Kaufman et al., 2013). Finally, health-risk events declined after use of a standardized handoff tool (Zavalkoff et al., 2011). A standardized process significantly reduced postoperative complications.

Staff satisfaction. Providers were more satisfied and felt standardized handoffs improved patient care (19% to 94%) and increased efficiency (Vergales et al., 2015). Providers also felt more comfortable asking questions (53% to 75%) with use of a standardized tool (Vergales et al., 2015). Additionally, nurse satisfaction regarding the handoff improved following use of a standardized handoff tool (Karakaya et al., 2013). Both provider and nurse handoff satisfaction improved after use of a standardized handoff tool.

Conceptual Frameworks

Two frameworks guided this project. First, the Linear Model of Communication examined communication starting from a source and ending at a destination (Mohorek & Webb, 2015). Communication effectiveness is determined by the ability of the transmitter and receiver to encode and decode respectively and the amount of internal and external noise present. The model identifies where errors in handoff communication occur to develop methods of improvement (Mohorek & Webb, 2015). During the handoff process, thoughts are translated to words or words are translated to thoughts; words may be decoded differently than initially intended, thus errors may occur. Other barriers such as hierarchy or personal relations, distractions, and physiological noise such as fatigue or hunger may occur. Second, the Promoting Action on Research in Health Sciences **(**PARiHS) framework, a three-dimensional tool guided implementation of evidence in practice (Kitson, Harvey, & McCormack, 1998). PARiHS addresses numerous factors influencing successful organizational change. Successful implementation is a function of the interrelations between evidence, context, and facilitation. For successful implementation of evidence into practice, simultaneous evaluation of the evidence, the qualities of the context in which the evidence will be implemented and the facilitation process need to occur (Kitson et al., 1998).

Purpose and Objectives

The purpose of the project was to implement a standardized handoff tool as the standard of care to improve handoff communication for children undergoing cardiac surgery. The project answered the following clinical question: *Does a standardized handoff tool from the cardiovascular OR to the PICU, compared to current practice, improve patient outcomes post-cardiac surgery, while improving staff satisfaction?* Objectives were to improve:

1. Handoff communication between cardiovascular OR (CV) and PICU teams, post-cardiac surgery by using a standardized handoff tool, without disrupting the workflow.
2. Nurse knowledge of the child's postoperative goals.
3. Patient outcomes post-cardiac surgery.
4. Staff satisfaction of the handoff information exchanged.

Methods

The design was a quality improvement, observational, pre- post- improvement in the PICU. Inclusion criteria were male and female children aged 0-18 years who had undergone cardiac surgery and transitioned from the OR to PICU. This included three groups of professionals, the PICU RNs (N=110), the PICU providers (called intensivists; N=18); and the CV team of cardiothoracic surgeons (N=3) and advanced practice providers (APPs; N=7).

Practice Improvement

Implementation of a standardized handoff tool for patients who transitioned from the OR to the PICU, focused on immediate postoperative goals, occurred. The tool was derived from a prior tool used in the PICU several years ago, and modified using evidence in the literature. In addition, a section on postoperative goals was added to the standardized handoff tool after several PICU RNs requested information regarding immediate postoperative patient goals.

Improvement was facilitated using several evidence-based implementation strategies (Powell et al., 2015). Educational meetings were conducted in morning huddles to educate PICU RNs on the new version of the standardized handoff tool and supporting evidence. Emails were sent to providers (CV [surgeons and APPs]; and intensivists) and RNs to educate and provide the new handoff tool. In addition, the standardized handoff tool and supporting evidence were posted on the quality improvement bulletin board and in the staff lounge. The clinical nurse specialist (CNS) and DNP student facilitated implementation through verbal encouragement of handoff tool use in morning huddles. RNs were prompted, by the student, to ask questions regarding immediate postoperative goals if the information was not addressed during the handoff exchange. Audit results and feedback were provided to PICU RNs after each handoff occurred, on whether handoff tool information exchange occurred or not.

Data were collected during observation of handoffs from the OR to the PICU team, via two Virtual Pediatric Systems (VPS) reports, and on pre-/post-implementation surveys. Observation data were collected using a handoff tool as a checklist and compiled on a table of measures spreadsheet. The first VPS report included data on patient complications in the 6 months pre-implementation, and the second VPS report included data on the 5 weeks post-implementation. Surveys on handoff information exchange satisfaction were administered to the CV team (surgeons and APPs) and PICU RNs and intensivists.

Measures

Measures included primary RN use of the standardized handoff tool, handoff duration, prompting use of the handoff tool, postoperative goals addressed during the handoff, postoperative patient complications, and staff satisfaction with the information exchanged.

RN use of the tool was measured by whether or not the RN obtained the tool prior to the

handoff or if the use of the tool had to be prompted. Handoff durations were measured at three time points: from time of patient arrival in the PICU room, start of the handoff, and at handoff conclusion. The start of the handoff was defined as when "all" staff (RNs, intensivist, APP, and CV surgeon) were ready to provide and receive information, and the end of the handoff was defined as when all questions were addressed.

Postoperative goals were measured post-implementation as addressed or not, between the start and end of the handoff. Goals included: extubation plan, blood pressure parameters, what to do if the pressures are outside parameters, central venous pressure (CVP) parameters, short-/long-term patient goals, complications in the OR, and fluid restrictions.

Patient complications were measured pre- and post-implementation. They included displaced/dislodged tube, unplanned cardiac reoperation, bleeding requiring re-operation, venous thromboembolism (VTE), clotted/thrombosed, cardiorespiratory arrest, mechanical assist device, and hypoxia.

Surveys examined if RNs received adequate information during the handoff. The RN pre-/post-surveys included 10 questions evaluated on a 5-point Likert-scale (1=never to 5=every time). The provider pre-/post-surveys were for CV and PICU providers and included 3 questions on a 5-point Likert-scale (1=strongly agree to 5=strongly disagree). Pre-surveys were administered 3-weeks prior to the implementation, and post-surveys were administered 1-week post-implementation.

Analysis

Descriptive statistics were used to analyze handover duration, the number of times the handoff tool was used by RNs and if a prompt occurred, and the percent of times postoperative information was addressed. T-tests determined whether there was a significant change in patient

complications and pre-/post-survey results. The site and university Institutional Review Boards determined the project to be quality improvement.

Results

A convenience sample of 13 cardiac handoffs from the OR to the PICU, were observed over 7 weeks. This included 3 handoffs pre-implementation and 10 handoffs post-implementation. There were 110 pre-/post-surveys administered to PICU RNs (90 staff RNs, 18 educators, the CNS and manager) and 28 to providers. There were 89 cardiac cases in the VPS data retrieved prior to implementation and 10 cases after implementation.

No handoff tools were used pre-implementation (0 of 3; 0%). Post-implementation, the handoff tool was used 100% (10 of 10) of the time. The tools were present in the room for the handoff 100% (10 of 10) of the time; 90% (9 of 10), without a prompt and once (10%; 1 of 10) with a prompt. The mean handoff duration, start to finish pre-and post- implementation were 6.33 (standard deviation [SD] 1.79) and 5.7 (SD 1.89) minutes (p=.318). The mean duration of time from when the patient entered the PICU room to completion of the handoff for the pre- and post- implementation were 9 (SD 2.16) and 9.8 (SD 3.16) minutes (p=.36).

No postoperative goals were addressed during observed handoffs pre-implementation (0 of 3; 0%). Post-implementation, each of the 8 postoperative goals addressed are discussed. For patients who were intubated (n = 7 of 10), upon transfer to the PICU, a plan to extubate was addressed 85.7% (6 of 7) of the time. Mean arterial pressure and blood pressure parameters were addressed 50% (5 of 10) of the time. However, only 40% (2 of 5) of those occurrences did a provider address what to do if the patient was not within the parameters. The central venous pressure goals were addressed 70% (7 of 10) of the time. Short-term goals were addressed 60% (6 of 10) of the time, while long-term goals were addressed 40% (4 of 10). Complications in the

OR were addressed 70% (7 of 10) of the time. Fluid restrictions were addressed 20% (2 of 10) of the time. Overall, postoperative goals were discussed in 57.3% (47 of 82) of the handoffs observed post-implementation.

Comparison of patient complications pre- to post-implementation are shown in Table 1. Displaced/dislodged tube 15.7% (14 of 89) to 0% (0 of 10), unplanned cardiac reoperation 8.99% (8 of 89) to 0% (0 of 10), bleeding requiring re-operation occurred 5.62% (5 of 89) to 0% (0 of 10), VTE 4.49% (4 of 89) to 0% (0 of 10), clotted/thrombosed 3.37% (3 of 89) to 0% (0 of 10), cardiorespiratory arrest 3.37% (3 of 89) to 0% (0 of 10), mechanical assist device required 3.37% (3 of 89) to 0% (0 of 10), and hypoxia 1.12% (1 of 89) to 0% (0 of 10). Of the cases (N=89) measured pre-implementation, 46% (41 of 89) experienced one of the complications listed above, compared to 0% (0 of 10) of the post-implementation cases experiencing a complication.

As shown in Table 2, 35% (38 of 110) of RNs completed the pre-survey and 15% (17 of 110) completed the post-survey. As shown in Table 3, 32% (9 of 28) of providers completed the pre-survey and 21% (6 of 28) completed the post-survey. Significant improvement ($p=.03$) in RN satisfaction regarding information exchanged using the standardized handoff tool were found, however, provider satisfaction was not ($p=.39$).

Discussion

Use of the standardized handoff tool improved the OR to PICU handoff. Handoff duration time decreased, postoperative goals review increased, patient complications were reduced, and staff satisfaction on the information exchanged during handoff improved. Use of a standardized handoff tool without disrupting workflow was achieved, as the duration declined by 0.63 minutes. Karakaya and colleagues (2013) had similar reduction in handoff duration with use

of a standardized tool. It is possible that time from when the patient arrived in the PICU room to the end of the handoff may have increased due to an increase in questions and answers post-implementation of the standardized handoff tool. As no data for review of postoperative goals occurred pre-implementation, comparisons were challenging. There was a decrease in postoperative patient complications, which is similar to evidence showing a standardized handoff tool reduced patient complications in the first 24 hours of admission to the PICU (Agarwal et al., 2012). In addition, there was significant improvement in RN satisfaction of the information exchange. Similar studies demonstrated use of a standardized handoff tool improved provider and RN satisfaction of patient information exchange (Karakaya et al., 2013; Vergales et al., 2015).

Limitations

Limitations included education for RNs and providers was primarily via email, which is not the most effective method. Staff meetings were cancelled due to a record number of patients in the PICU, which required mandating nurses for extra shifts. Another limitation was the number of handoffs observed pre- and post- implementation, as the implementation phase was 5 weeks, limiting generalizability.

Conclusion

Patient transitions with handoff of care are vital times for children during cardiac surgery with great potential for errors and adverse outcomes to occur. A standardized handoff tool in this improvement project revealed increased use of the tool, decreased handoff duration, immediate postoperative goals were addressed, patient complications were reduced, and RN knowledge regarding care of postoperative cardiac patients was improved. IOM and JCAHO called upon healthcare providers to take action to reduce preventable errors and improve patient safety. A

standardized handoff process using a tool may be a way to increase communication exchange and provide safe, high-quality care for children post-cardiac surgery. It is recommended that the organization implements a policy change that would require the standardized handoff be documented in the electronic health record. In addition, having the standardized handoff tool available within the organization's internet site may improve project sustainability, decrease use of paper, and improve nursing shift handoffs.

Implications for Practice and Further Study in the Field

For future improvement, face-to-face education regarding use of the standardized handoff tool using simulation, so that staff can practice tool use prior to implementation, is recommended. Simulation to educate staff is growing in popularity and may be a more effective way to trial the use of a standardized handoff tool while incorporating ideas from all disciplines involved in the handoff (Berkenstadt et al., 2008; Bhabra, Mackeith, Monteiro, & Pothier, 2007). Additional time to teach pertinent handoff information can help to improve handoff communication between the CV and PICU teams. In addition, key stakeholders working collaboratively to improve the handoff process may promote a multidisciplinary team approach, thus promoting good communication during handovers. With communication, comes improved information exchange and staff satisfaction, which may lead to higher quality care received by patients, a decrease in adverse events, and improved patient outcomes. Trusting relationships between RNs and physicians are important, physicians need to feel comfortable that care is being provided to patients is competent, and RNs need to feel comfortable asking questions and clarifying patient information. Further projects could focus on how these relationships can affect the quality of the handoff.

Tables

Table 1: Patient complications pre-/post- implementation and percent improved

Complication (N=8)	Pre (N=89)	Post (N=10)	% improved pre- to post-
Displaced/dislodged	15.7% (14 of 89)	0% (0 of 10)	84.6%
Unplanned cardiac reoperation	9% (8 of 89)	0% (0 of 10)	91.0%
Bleeding requiring re-operation	5.6% (5 of 89)	0% (0 of 10)	94.4%
Venous thromboembolism	4.5% (4 of 89)	0% (0 of 10)	95.5%
Clotted/thrombosed	3.4% (3 of 89)	0% (0 of 10)	96.6%
Cardiorespiratory arrest	3.4% (3 of 89)	0% (0 of 10)	96.6%
Mechanical assist device required	3.4% (3 of 89)	0% (0 of 10)	96.6%
Hypoxia	1.1% (1 of 89)	0% (0 of 10)	98.9%
Total	5.8% (41 of 712)	0% (0 of 80)	94.2%

Table 2: RN pre-/post-handoff tool satisfaction ratings, summed score and p-Value

Survey questions*	Pre- mean (SD) range	Post- mean (SD) range	p-value
I receive all of the information I need to safely and effectively care for my patient during the patient handoff.	3.45	3.82	
I am provided anticipatory guidance regarding how long providers expect the patient will be intubated and a potential plan regarding when to extubate.	3.23	3.76	
I receive parameters related to mean arterial pressures and blood pressures and what to do if pressures are outside parameters (in terms of antihypertensive medications/fluids/inotropes).	3.36	3.53	
I am told the goals for CVP, RAP, or other intracardiac pressures, such as a Glen pressure.	3.34	3.47	
Short-term and long-term goals are expressed in the handoff. For example, in the next couple hours, I would like to see this... In 12 hours, I would like to see this…	2.79	3.23	
I am told what to anticipate regarding arrhythmias and a potential plan for arrhythmias.	2.63	3.06	
If the patient is actively being paced, I am told what the underlying rhythm is.	3.84	4.18	
I am told what complications the child had in the OR and what was done for the complication.	3.63	4	
If the patient has a fluid restriction, I am told specifically what that restriction may be. For example, 60 ml/kg/day, or 80 ml/kg/day.	3.97	4	
A summary of the handoff was provided with an opportunity for questions following handoff conclusion.	3.21	3.82	
Summed score	3.3 (0.4) 2.63-3.97	3.7 (0.3) 3.06-4.18	p=.03

*Questions were scored on a scale of 1 to 5 with 1 being never and 5 being every time

Table 3: Provider pre-/post-handoff tool satisfaction ratings, summed score and p-Value

Survey questions*	Pre- mean (SD) range	Post- mean (SD) range	p-value
The handoff of care is efficient and follows a standard written format when transitioning patients from one unit to another.	3	3.67	
Information that is exchanged in the handoff helps to improve postoperative patient care.	4.22	4.33	
The handoff process reduces the need for additional clarification from nursing staff, after the handoff, regarding postoperative patient management.	3.89	3.5	
Summed score average (SD) range	3.7 (.5) 3-4.22	3.8 (.35) 3.5-4.33	p=.39

*Questions were scored on a scale of 1 to 5 with 1 being strongly disagree and 5 being strongly agree

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DNP Project Oral Defense Presentation

Improving the Patient Handoff from OR to PICU in Children Who Have Undergone Cardiac Surgery Using a Standardized Handoff Tool

Amanda Taylor
DNP Project Final Defense
April 6th, 2018

Grand Valley State University, Kirkhof College of Nursing

Acknowledgements

- Advisory Team:
  - Sandra Spoelstra, PhD, RN, FGSA, FAAN: Advisor
  - Marie VanderKooi, DNP, RN: Advisory Committee
  - Caryn Steenland, MSN, RN: Advisory Committee and Site Mentor
- Funding:
  - The GVSU Graduate School Presidential Award
  - The Graduate School: Graduate Assistantship

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Objectives for Presentation

1. Review the clinical problem: handoffs
2. Review the organizational assessment and evidence-based solutions
3. Review the project plan and results
4. Discuss implications for practice
5. Reflect on DNP Essentials

The Problem

- IOM *To Err is Human: Building a Safer Health System*
  - 98,000 deaths a year in U.S. contributed to medical error (Korn, Corrigan, & Donaldson, 1999)
- 80% of sentinel events- linked to quality of the patient handoff (Sochet, Siems, Ye, Godiwala, Hebert, & Corriveau, 2016)
- Poor inpatient handoffs lead to:
  - delayed treatment
  - inappropriate tests
  - lengthened hospital stays
  - increase in healthcare costs (Sochet et al., 2016)

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Efforts to Improve Handoffs

- In 2006 Joint Commission recognized importance of handoff communication (Joint Commission, 2007)
  - Issued a recommendation: health care providers use a standardized handoff
    - Opportunity to clarify handover information
    - Dedicated time for Q&A
- In 2010 Joint Commission made handoff communication a Provision of Care standard (Joint Commission, 2010)
  - Required hospitals have a process to receive or share patient information when patients are transferred internally within the hospital

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Organizational Assessment

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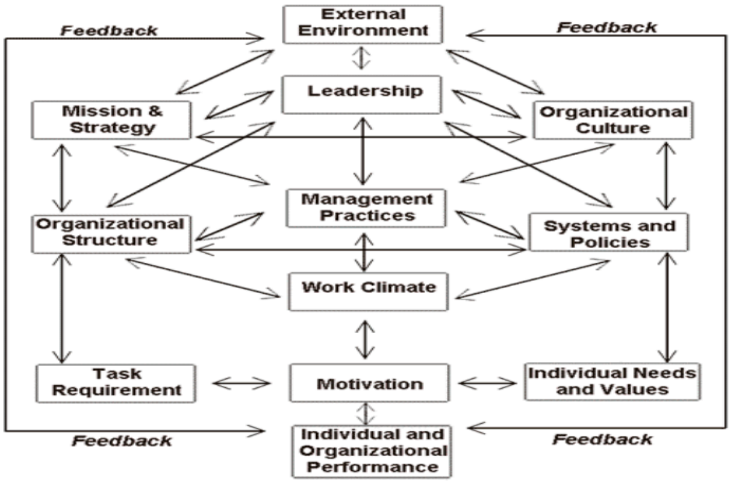
Burke-Litwin Change Model



Adapted from "A Causal Model of Organizational Performance and Change," by W. W. Burke and G. H. Litwin, 1992, *Journal of Management, 18*, 528. Copyright 1992 by Southern Management Association.

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SWOT Analysis

	Helpful	Harmful
Internal	Strengths • …l cardiologists with various heart specialty • …core classes in cardiac education • …ns with cardiac scenarios • …al rates pre- and post-cardiac surgery are • …patient's heart • …stically significantly • …pared to other mixed	Weaknesses • CV team not pa… • Discrepancies b… • …are familiar with
External	Opportunities • Marketing excellent care provided by CHC • …ganizations such as the Society of • …ons can provide data and information • …ound the country • …tion of care which will benefit the • …surrounding population as a whole.	Threats • Cor… …nd nearby • Son… …ated and may have

Experts in the field- Survival rates above national benchmark (2016)

98.8%

In-depth cardiac education for nurses- high competency levels

CV team not involved in nursing education

Staffing- not enough APPs, high nursing turnover

New EHR!

Competition

Complex patients unable to control complications

Ability to identify quality metrics and report to STS

Better care coordination!

Current Practice

- Handoff starts in OR
- Patient arrives in PICU
  - lines and chest tubes secured and ventilator settings checked
- Handoff report from cardiac APP/surgeon and anesthesiologist
  - medical and surgical information
- No standardized handoff tool used
- Minimal communication regarding immediate post-op goals of care
- Observed handoffs: no time spent on questions nor review of important handoff information
  - CV team leaves and PICU RNs responsible for drawing labs, re-taping tubes, and stabilizing patient vitals
- Staff identified a need for more nursing education related to caring for the post-op cardiac child

Virtual Pediatric System Report: 2016-2017

- 289 cases occurred
  - 193 of 289 (66.8%) had a primary cardiovascular diagnosis in 2016
    - 154 of 193 (79.8%) were patients with a CHD
- Of patients who died in PICU (2016), 54.6% died within 48 hours of admission (Virtual Pediatric Systems, 2017)

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Literature Review

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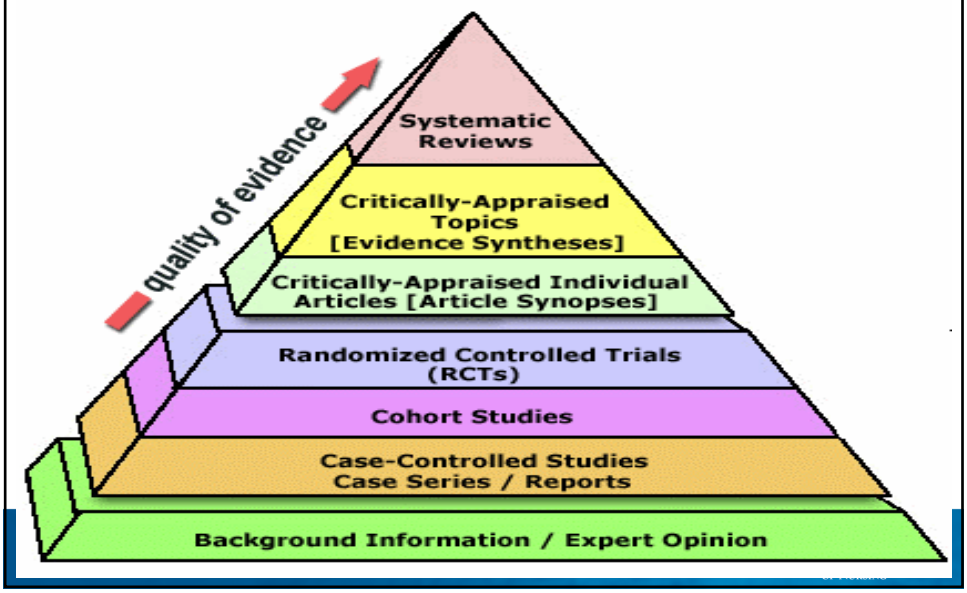
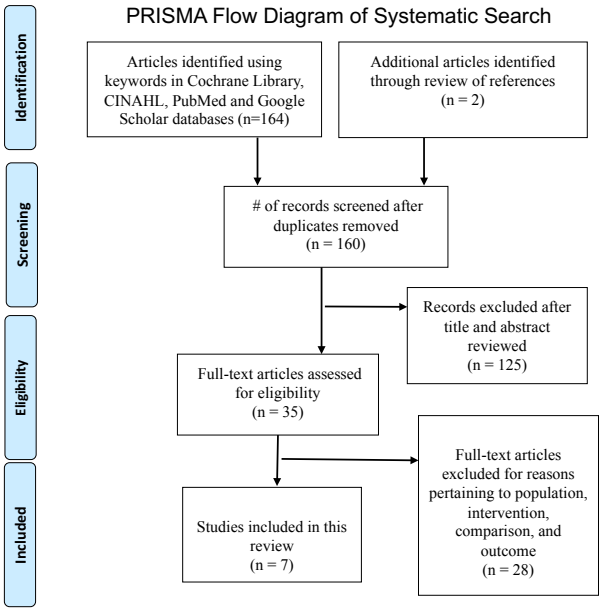
What Does the Literature Say





Adapted from "Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement," by D. Moher, A. Liberati, J. Tetzlaff, D. Altman, and PRISMA Group. Copyright 2009 by PLoS Medicine

Findings

Intervention- a standardized handoff tool

- Decreased handover duration (Joy et al., 2011; Karakaya et al., 2013)
- Improved patient outcomes:
  - Decreased complications in first 24 hrs (Agarwal et al., 2012)
  - Decrease in unplanned extubations (Kaufman et al., 2013)
  - Decrease in median ventilator time (Kaufman et al., 2013)
- Improved information exchange:
  - Patient details, preop details, anesthesia & surgical details, post-surgery details, and lab values (Agarwal et al., 2012)
  - Significant improvement in attentiveness, organization, and flow of information (Karakaya et al., 2013; Vergales et al., 2015)
- Improved staff satisfaction:
  - Providers more satisfied (Vergales et al., 2015)
  - Nurses more satisfied (Joy et al., 2011; Karakaya et al., 2013)

Clinical Question

Does a standardized handoff tool from the OR to PICU, focused on post-op goals, decrease complications in children post-cardiac surgery, while improving communication exchange of immediate post-op goals?

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DNP Project Plan

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Project Plan

- Purpose:
  - Implement a standardized handoff tool into standard care
- Type:
  - Quality Improvement- translating an evidence-based initiative into practice to improve delivery of care
- Setting:
  - PICU
- Resources:
  - TIME!
  - Technology
  - Printed materials
- Participants:
  - Children who have undergone cardiac surgery
  - Nurses and providers in PICU and CV teams

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www.gvsu.edu

DATE: October 19, 2017

TO: Sandra Spoelstra
FROM: Office of Research Compliance and Integrity
STUDY TITLE: Transitions of Care in a Children's Hospital from Operating Room to Outpatient: A Quality Improvement Project
REFERENCE #: 18-082-H
SUBMISSION TYPE: HRRC Research Determination Submission

ACTION: Determination: Not Research
EFFECTIVE DATE: October 18, 2017
REVIEW TYPE: Administrative Review

Thank you for your submission of materials for your planned scholarly activity. It has been determined that this project does not meet the definition of research* according to current federal regulations. The project, therefore, does not require further review and approval by the Human Research Review Committee (HRRC).

A summary of the reviewed project and determination is as follows:
The purpose of this project is to improve the transitions of care at Helen DeVos Children's Hospital (HDVCH) for children who have undergone cardiac surgery, from the operating room to the intensive care unit to the inpatient surgical floor and then to the outpatient setting. This is a quality improvement study to improve patient care at HDVCH and is not generalizable. Therefore, this study does not meet the federal definition of "research" per 45 CFR 46.102(d).

An archived record of this determination form can be found in IRBManager from the Dashboard by clicking the "_ xForms" link under the "My Documents & Forms" menu.

If you have any questions, please contact the Office of Research Compliance and Integrity at (616) 331-3197 or rci@gvsu.edu. Please include your study title and study number in all correspondence with our office.

Sincerely,
Office of Research Compliance and Integrity

*Research is a systematic investigation, including research development, testing and evaluation, designed to develop or contribute to generalizable knowledge (45 CFR 46.102 (d)).

Human subject means a living individual about whom an investigator (whether professional or student) conducting research obtains: data through intervention or interaction with the individual, or identifiable private information (45 CFR 46.102 (f)).

Scholarly activities that are not covered under the Code of Federal Regulations should not be described or referred to as *research* in materials to participants, sponsors or in dissemination of findings.

Office of Research Compliance and Integrity | 1 Campus Drive | 049 James H Zumberge Hall | Allendale, MI 49401
Ph 616.331.3197 | rci@gvsu.edu | www.gvsu.edu/rci

Site IRB available upon request.

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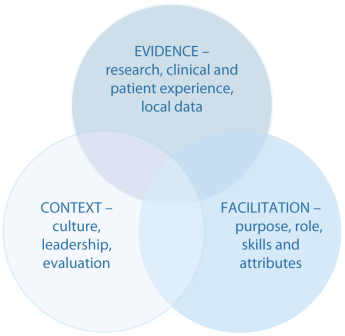
Project Design

- PARiHS Framework (Kitson, Harvey & McCormack, 1998)
  - Evidence
  - Context
  - Facilitation
- SI= f (E, C, F)



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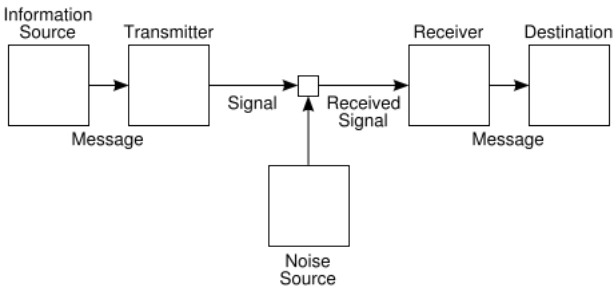
Theoretical Framework

- The Linear Model of Communication



Adapted from "A Mathematical Theory of Communication," by Shannon, C. E., 1948, *The Bell System Technical Journal, 27.* 381

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Project Objectives

1. Improve handoff communication between CV and PICU teams without disrupting workflow.
2. Improve nurse knowledge of the child's postoperative goals.
3. Improve patient outcomes post-cardiac surgery.
4. Improve staff satisfaction of the handoff information exchanged.

Project Implementation Strategies

- Education:
  - Meetings in morning huddles to introduce and educate RNs on evidence supporting use of a standardized handoff tool
  - Emails sent to providers and RNs to further explain practice change and provide handoff tool
  - Copies of tool and supporting evidence posted on QI board and in staff lounge
- Facilitation:
  - By CNS and DNP student encouraging use of tool in morning huddles
- Audit and provide feedback:
  - Feedback provided to RNs after handoff, reporting whether information on handoff tool was exchanged or not
  - RNs prompted, by student, to ask questions regarding immediate postoperative goals if information not addressed in handoff

(Powell et al., 2015)

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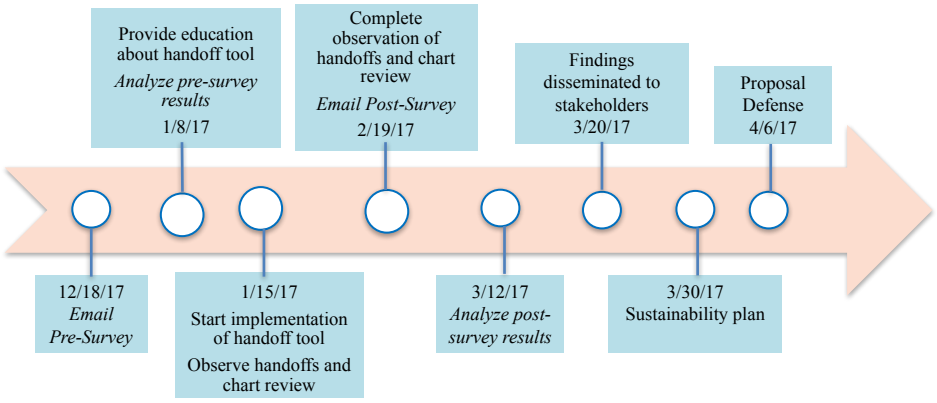
Timeline



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Measures

	Concept measured	How measured (tool, survey, variable)	When measured	Who measures
Implementation strategies	Provider/clinician satisfaction (MD/APPs)	Survey	Pre/post implementation	Student
	RN satisfaction	Survey	Pre/post implementation	Student
	Handoff duration	Observation of minutes	During handoff: Pre-/post-implementation	Project facilitator (Student/CNS)
	Handoff tool use	# observed	Start of handoff: Post-implementation	Project facilitators (Student/CNS)
	Prompted use of handoff tool (RN given tool)	# of times	Start of handoff: Post-implementation	Project facilitators (Student/CNS)
	Post-operative goals	Handoff tool/observation	During handoff: Post-implementation	Student
Patient outcomes	Complication: bleeding requiring re-operation	VPS report	Post-implementation	Student
	Complication: cardiorespiratory arrest	VPS report	Post-implementation	Student
	Complication: clotted/thrombosed	VPS report	Post-implementation	Student
	Complication: displaced/dislodged tube	VPS report	Post-implementation	Student
	Complication: hypoxia	VPS report	Post-implementation	Student
	Complication: mechanical assist device required	VPS report	Post-implementation	Student
	Complication: unplanned cardiac operation	VPS report	Post-implementation	Student
	Complication: venous thromboembolism	VPS report	Post-implementation	Student

Analysis Plan

- Descriptive statistics
- T-tests to determine if change was significant
  - Change in handoff duration from pre-implementation to post-implementation
  - Change in staff satisfaction surveys from pre-implementation to post-implementation
  - Change in patient complications from pre-implementation to post-implementation

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Results

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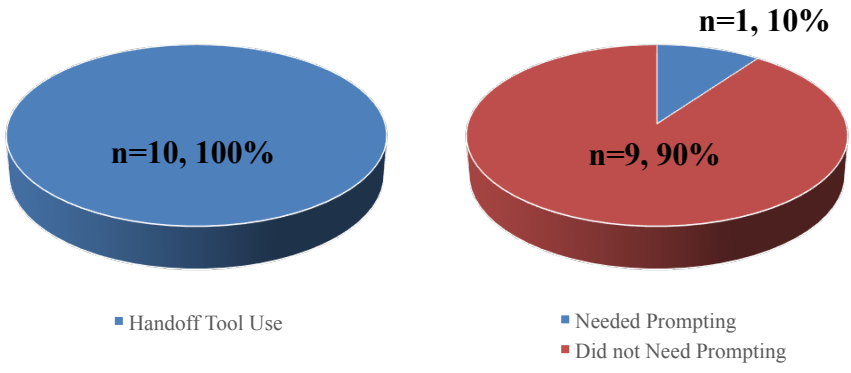
Results

- 13 cardiac handoffs from OR to PICU were observed over 7 weeks
  - 3 handoffs pre-implementation and
  - 10 handoffs post-implementation
- 110 pre-/post-surveys administered to PICU RNs (90 staff RNs, educators, the CNS and manager)
- 28 pre-/post-surveys administered to providers
- VPS report of cardiac cases
  - 89 cardiac cases retrieved pre-implementation
  - 10 cases post-implementation

Handoff Tool Use (N=10)



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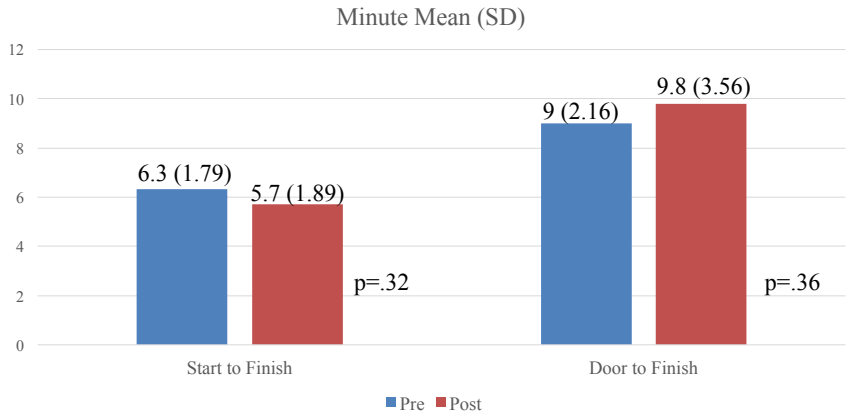
Pre- Post Handoff Duration



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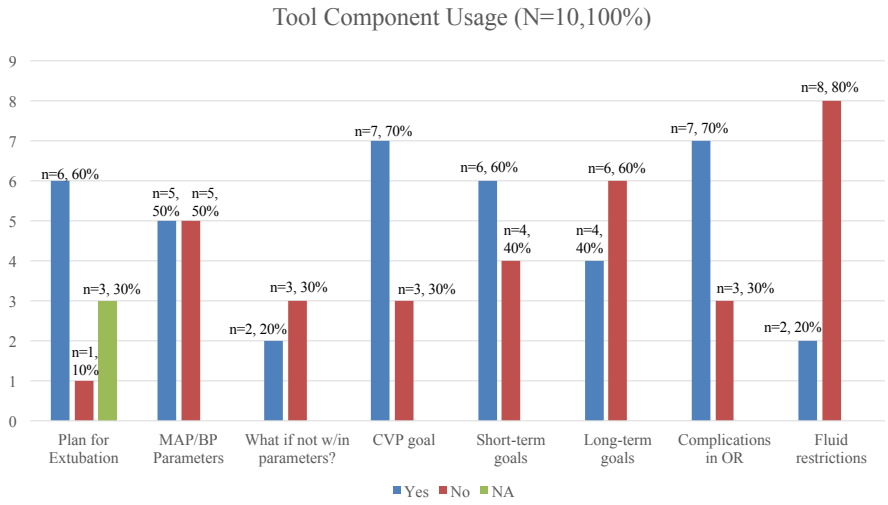
Postop Goals Addressed in Handoff



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Patient Complications

Complication	Pre (N=89)	Post (N=10)	% improved pre- to post-
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Unplanned cardiac reoperation	9% (8 of 89)	0% (0 of 10)	91.0%
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Venous thromboembolism	4.5% (4 of 89)	0% (0 of 10)	95.5%
Clotted/thrombosed	3.4% (3 of 89)	0% (0 of 10)	96.6%
Cardiorespiratory arrest	3.4% (3 of 89)	0% (0 of 10)	96.6%
Mechanical assist device required	3.4% (3 of 89)	0% (0 of 10)	96.6%
Hypoxia	1.1% (1 of 89)	0% (0 of 10)	98.9%
Total	5.8% (41 of 712)	0% (0 of 80)	94.2%

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RN Pre-/Post- Survey

Survey questions	Pre- mean (SD) range (N=38 of 110)	Post- mean (SD) range (N=17 of 110)	p-value
I receive all of the information I need to safely and effectively care for my patient during the patient handoff.	3.45	3.82	
I am provided anticipatory guidance regarding how long providers expect the patient will be intubated and a potential plan regarding when to extubate.	3.23	3.76	
I receive parameters related to mean arterial pressures and blood pressures and what to do if pressures are outside parameters (in terms of antihypertensive medications/fluids/inotropes).	3.36	3.53	
I am told the goals for CVP, RAP, or other intracardiac pressures, such as a Glen pressure.	3.34	3.47	
Short-term and long-term goals are expressed in the handoff. For example, in the next couple hours, I would like to see this... In 12 hours, I would like to see this…	2.79	3.23	
I am told what to anticipate regarding arrhythmias and a potential plan for arrhythmias.	2.63	3.06	
If the patient is actively being paced, I am told what the underlying rhythm is.	3.84	4.18	
I am told what complications the child had in the OR and what was done for the complication.	3.63	4	
If the patient has a fluid restriction, I am told specifically what that restriction may be. For example, 60 ml/kg/day, or 80 ml/kg/day.	3.97	4	
A summary of the handoff was provided with an opportunity for questions following handoff conclusion.	3.21	3.82	
Summed score	3.3 (0.4) 2.63-3.97	3.7 (0.3) 3.06-4.18	p=.03

Provider Pre-/Post- Survey

Survey questions	Pre- mean (SD) range (N= 9 of 28)	Post- mean (SD) range (N= 6 of 28)	p-value
The handoff of care is efficient and follows a standard written format when transitioning patients from one unit to another.	3	3.67	
Information that is exchanged in the handoff helps to improve postoperative patient care.	4.22	4.33	
The handoff process reduces the need for additional clarification from nursing staff, after the handoff, regarding postoperative patient management.	3.89	3.5	
Summed score	3.7 (.5) 3-4.22	3.8 (.35) 3.5-4.33	p=.39

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Discussion

- Improved use of handoff tool
  - From 0% to 100%
  - Decreased handoff duration
    - From 6.3 to 5.7 (0.63) minutes; clinically meaningful
- Improved knowledge of postoperative goals
  - From 0% to 20—80% review of the 8 goals
- Decreased number of patient complications
  - From 5.8% to 0% (94.2% improvement)
- Improved satisfaction of handoff
  - RN statistically (p=.03) and clinically meaningful
  - Provider clinically meaningful (p=.39)

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Limitations

- Education primarily through email
- Small sample size (number of handoffs observed)
- Relationship barriers between CV and PICU
- Unwillingness to change:
  - "This is how its always been done."

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Conclusions

- Standardized handoff tool proven to be effective
- Provides structure to the information exchanged
- This project revealed that a standardized handoff tool can improve:
  - RN knowledge of postoperative cardiac patients
  - Outcomes in children post-cardiac surgery
  - Staff satisfaction of the handoff information exchanged

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Implications for Practice

- Patient handoffs are vital times for children
  - Great potential for error and adverse outcomes
- A standardized handoff tool may improve:
  - the transition of care,
  - patient outcomes,
  - the amount of information lost,
  - handover duration, and
  - allow for questions to be answered regarding care of the pediatric postoperative patient.
- Further improvement projects should address whether the use of a standardized handoff tool is sustainable

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Sustainability

- Standardized handoff tool is available for staff in PICU
- Embedding tool into EHR
- Require staff to chart on handoff
  - May occur if management feels tool has been successful
- Tool has become part of standard of care for transferring patients
  - Similar tool is likely to be introduced between ED and PICU

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Dissemination

Dissemination

- Poster presentation: Michigan NAPNAP conference
- Poster presentation: GVSU Graduate Showcase
- Presentation to key stakeholders in organization
- Presentation to the PICU's SLC
- Presentation in meetings:
  - PICU charge nurses
  - Monthly PICU RN meeting
- Email results to CV and PICU providers
- Submit paper to Journal of Doctoral Nursing Practice for publication
- Submit to ScholarWorks

Reflection

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Reflection on DNP Essentials

- ***Essential I: Scientific Underpinnings for Practice***
  - Used theories and evidence to guide the intervention and implementation
  - Developed and evaluated new practice approaches
- ***Essential II: Organizational and Systems Leadership***
  - Meetings with organizational leaders
  - Designed plans to educate staff
- ***Essential III: Clinical Scholarship and Analytical Methods for Evidence-Based Practice***
  - Literature review of effective handoffs in order to implement an evidence-based intervention
  - Evaluating and analyzing project results

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Reflection on DNP Essentials

- ***Essential IV: Information Systems/Technology for the Improvement and Transformation of Health Care***
  - Navigating a new EHR
  - Generating reports from VPS of patient complications
- ***Essential V: Health Care Policy for Advocacy***
  - Advocated for the nursing profession
- ***Essential VI: Interprofessional Collaboration for Improving Patient and Population Health Outcomes***
  - Collaboration with nurses and physicians
  - Disseminate findings to key stakeholders

Reflection on DNP Essentials

- ***Essential VII: Clinical Prevention and Population Health for Improving the Nation's Health***
  - Evaluated the most current evidence
  - Analyzed patient outcome data
- ***Essential VIII: Advanced Nursing Practice***
  - Conducted a comprehensive and systematic assessment of an organization
  - Designed, implemented, and evaluated a new intervention
  - Developed and sustained therapeutic relationships within the organization

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