4-2020

Implementation of Early Mobility in the Pediatric Cardiac Intensive Care Unit

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Abstract

Patients admitted to pediatric intensive care units and pediatric cardiac intensive care units often experience prolonged periods of immobility due to critical illnesses and surgical interventions. Many pediatric intensive care unit survivors develop physical and developmental disabilities that have long-lasting impacts into childhood and adulthood. Early mobility may be one aspect to mitigate the risks associated with pediatric intensive care unit admissions. Early mobility protocols have shown to be a safe and feasible intervention to encourage mobility in pediatric patients. This quality improvement project developed and implemented an infant holding tool to promote the mobilization of infant patients admitted to a pediatric cardiac intensive care unit. While the data was not statistically significant for number of times held or for the number of patients held while intubated, this project provided a standardized process in infant holding and was widely accepted by stakeholders. No adverse events occurred during the mobilization of infant patients.

Keywords: Early mobility, holding, PICU, PCICU, infant, cardiac surgery

Implementation of Early Mobility in the Pediatric Cardiac Intensive Care Unit

Patients admitted to pediatric cardiac intensive care units (PCICUs) and pediatric intensive care units (PICUs) are hospitalized for a critical illness or recovering from an invasive surgery. These children often have equipment that is critical to recovery. Historically, patients were sedated and restrained to maintain the integrity of equipment leading to prolonged immobility (Kudchadkar et al., 2016). However, immobility may be detrimental to recovery and lead to long-term consequences, a longer hospital stays, and increased cost to healthcare system (Jolley et al., 2016).

Problem Description

Children discharged from PICU often experience physical and neurocognitive complications, such as delayed psychomotor development (Knoester et al., 2008). For children who undergo cardiac surgery, longer stays in the PCICU and hospital can lead to decline in cognitive function over time (Newburger et al., 2003). Immobility may play a role in the long-term effects in children who were hospitalized.

Mortality within the intensive care unit (ICU) is declining, yet many survivors experience significant morbidities and impairments in physical, cognitive, and mental health that persists long after hospitalization (Watson et al., 2018). These impairments have been described as post-intensive care syndrome (Watson et al., 2018). Research in pediatric post-intensive care syndrome is limited, however, morbidities in the adult literature may be similar in pediatric patients (Watson et al., 2018). Impairment due to hospitalization may cause a cascading effect to a child's growth and development; hindering familial relationships, school performance, and social interactions (Watson et al., 2018). The Post Intensive Care Syndrome in pediatrics (PICS-p) framework described by Manning et al. (2018) acknowledges the importance of the child's

baseline function; psychosocial development; and the interdependence of family, peers, and school (see Appendix A). These are integral aspects of social health, and trajectories of health recovery that can potentially impact a child's life for decades (Manning et al., 2018). Early mobility is one solution to mitigate the risk of morbidities associated with PICU and PCICU admissions.

Available Knowledge

A literature review examines evidence regarding a specific topic or phenomenon based on the clinical question (Moran et al., 2016). The purpose of this review was to determine the evidence on early mobilization in critically ill children admitted to a PICU to support an early mobility protocol implementation within a PCICU. The Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) method guided the literature review (Moher et al., 2009). A comprehensive electronic search was conducted in PubMed, CINAHL Complete, and Cochrane electronic databases. The search was limited to randomized controlled trials and systematic reviews in the English language during the period of 2015 to 2020. Keywords were early mobility, early mobilization, pediatric, intensive care, and critical care.

Included in the population were samples that involved critically ill pediatric patients admitted to a PICU or PCICU. Excluded were studies that included adult patients, a combination of adult and pediatric patients, and neonates. Samples that evaluated a mobilization intervention were included. Studies that were randomized controlled trials or higher-level evidence that used a comparison group of usual care were included. Included in this literature review were studies that described outcomes of timing of mobilization, duration of mobilization, safety and feasibility, rehabilitation services consults, and number of mobilization activities. Also included

were studies that reported patient outcomes such as length of ICU stay, length of hospital stay, and ventilator days.

The search yielded 135 results. Each review was screening using the inclusion and exclusion criteria according to PRISMA criteria (see Appendix B). Review of titles and abstracts resulted in removal of 87 articles that did not meet the inclusion criteria. 25 articles were excluded after in-depth examination of content, as they did not meet inclusion criteria. The remaining four articles were included in this review. Two articles were systematic reviews and two were randomized controlled trials.

While many of the studies cannot attest to improved patient outcomes such as length of hospital stay, length of ICU stays, and ventilator days; early mobility was shown to be safe and a feasible option for critically ill children (Choong et al., 2017; Cuello-Garcia et al., 2018; Fink et al., 2019; Piva et al., 2019). As more research on the topic of early mobility is disseminated, PICUs are moving towards earlier and more comprehensive mobility practices (Piva et al., 2019). Practice recommendations based on progressive levels guide the use of mobilization by objective criteria (Piva et al., 2019). Many studies involved utilization of multidisciplinary teams to implement early mobilization (Piva et al., 2019. Family involvement in early mobility should also be encouraged to provide vital support of the child's recovery process (Choong et al., 2018). Within the literature, there are a small number of published studies with small sample sizes as well as a lack of randomized controls trials (Piva et al., 2019) (see Appendix C).

Rationale

A theoretical framework guided understanding use of early mobilization within the PCICU. Lewin (1951) describes his Change Theory as a method of planned change using concepts of field and force. Field is explained as the entire system or organization where the

change will occur, and force encompasses the direction, focus, and strength of the change. There are driving forces in which encourages the goal and restraining forces in which block progress of the goal. Identifying these forces is important in planning for effective change. To plan for change, Lewin's (1951) three steps that must occur: unfreezing the status quo, moving to a new state, and refreezing the change.

Using the concepts of Lewin's Change Theory of driving forces and restraining forces allows for understanding of the organization's support of this change in mobilization (Lewin, 1951). Driving forces of the organization included the motivation of nurses for improved patient care and recovery, better relationships with families and children within the PCICU, and knowledge of the latest evidence-based research. Restraining forces among nurses were the perceived barriers of increased workflow with implementing mobilization practices. Addressing the driving and restraining forces in the unfreezing stage, change can occur more effectively.

The Kotter Model which uses eight steps to lead change guided the project (Kotter & Cohen, 2002). The eight-step process includes creating urgency, building a guiding coalition, developing a vision, communicating the vision, empowering action, generating wins, producing gains, and anchoring new approaches (Kotter & Cohen, 2002). These steps can drive the change in infant holding in the PCICU by encouraging communication, empowering employees, and capitalizing on success (see Appendix D).

Specific Aims

The purpose of the project was to create and implement an evidence-based standardized process for infant holding early mobility to reduce length of stay, length of invasive ventilation, and increase number of times held in the PCICU. Objectives were to develop a team of stakeholders to guide the project and to create a cognitive aid to standardize activity levels in

infants and the process of holding infants dependent on activity level. RNs were to be educated on the cognitive aid and standardized process. The use of the cognitive aid and concerns with the process of infant holding were to be evaluated and analyzed to develop and implement a sustainability plan to improve infant mobility. The goal was for nurses to use tools provided to assist in decision-making and communication so that infants were held at least once a day.

Methods

This was a quality improvement project. Quality improvement projects aim to use evidence-based practices to implement processes to improve health outcomes within an organization (Moran et al., 2016). The organization where the project occurred had a need for improved mobility in infants.

Context

The setting was a children's hospital within a large health care system in the Midwest. This project took place in the 6-bed PCICU dedicated for cardiac surgical patients who required intensive care. In 2019, there were 197 patients admitted to this unit.

Participants included infants who were 6 months of age or younger and registered nurses (RNs) who worked in the unit. PCICU used RNs who worked in the PICU, a 24-bed unit located in the same hospital that employed 87 RNs. Of these 87 RNs, 5 are primary staff in the PCICU, 33 RNs staffed both PICU and PCICU, and the remainder float to PCICU if needed.

Intervention and Implementation

The interventions used in the project were formulated within an early mobility protocol that was based on guidelines from the literature review (Lisanti et al., 2020; Wieczorek et al., 2016). Wieczorek et al. (2016) developed a tiered activity plan based on inclusion parameters to encourage appropriate activities. This included criteria to stop activities for changes in vital signs

or behavior (Wieczorek et al., 2016). Lisanti et al. (2020) developed holding and mobility guidelines for patients in a PCICU along with a list to prepare a patient to move with a transthoracic intracardiac line. Both articles provided evidence to develop guidelines for the early mobility protocol which included an infant holding tool for the organization.

Evidence-based implementation strategies are essential to building blocks to create successful change (Powell et al., 2015). Conducting a local needs assessment and understanding the barriers and facilitators within the organization establishes a baseline to prepare for change (Powell et al., 2015). Through surveys, time spent in the organization, and stakeholder meetings, barriers and facilitators to this quality improvement project were determined. Understanding the needs and readiness of the organization, a sense of urgency and a climate aimed towards change is created (Kotter & Cohen, 2002).

A guiding team was created by fostering relationship with stakeholders to implement a change (Powell et al., 2015). An Early Mobility team was developed to include the Clinical Nurse Specialist from PICU, a physician representative, a physical and occupational therapy representative, a cardiac advance practice provider, a respiratory therapist, and quality improvement specialists. The team was used to assist in the creation of an aid for mobility of infants allowing unique perspectives, guidance, and support from team members to develop a comprehensive aid. Utilizing these partnerships guides successful implementation efforts (Powell et al., 2015).

A cognitive aid was developed and implemented to standardize the process of infant holding (see Appendix E). This was a one-page document describing criteria in which it is safe to hold infant, requires discussion with the attending physician before holding, and hard stops for the patient to stay in bed. The aid provided support in nurse decision making and facilitation

of communication with multiple interdisciplinary teams for mobilization. The infant holding tool included a brief checklist to ensure proper procedure in mobilizing infants out of bed and signs of intolerance to mobilization.

Educational materials were developed and distributed to support implementation (Powell et al., 2015). A handout was created to explain the rationale behind the intervention, the criteria to hold, the appropriate procedure of infant holding, and key points to remember (see Appendix F). Distribution of educational materials occurred both in person and electronically (Powell et al., 2015). RNs employed by the PICU were emailed a copy of the aid to familiarize themselves with the intervention. Education was provided to the cardiac advanced practice providers via email due to COVID-19 restrictions and limitations on meeting time. Education was provided to the intensivists in a virtual meeting which included discussion on strategies, questions, and feedback. Intensivist that could not attend the meeting received the infant holding tool and educational handouts via email.

Thirty-seven RNs received in-person education, which included the opportunity to ask questions and provide feedback. Copies of the educational handout were placed in the breakroom and on the desks in the PICU. The infant holding tool was uploaded to the PICU website where frequently used education, policies, and procedures were housed for easy access. A simulation session was conducted in the PICU and six RNs participated in holding using various types of equipment. Use of education disseminates the vision and strategy created by the guiding team (Kotter & Cohen, 2002). Once education was completed, the aid was placed in each patient room and implemented into practice.

Evaluation and Measures

Quality monitoring tools specific to the innovation allows for the assurance of successful change (Powell et al., 2015). To examine improvement due to the project, implementation strategies, and patient and system outcomes were measured.

Patient outcomes measured included holding or other mobility activities documented; infant holding while intubated, length of stay (hospital and PCICU), presence and length of invasive ventilation, and adverse events during mobility. A chart audit tool was developed as shown in Appendix G. An observation tool was created to understand criteria for patients being held, contraindications to holding, use of the aid, as well as barriers and feedback used when conducting observation (see Appendix H).

System outcomes measured included physician and occupational therapy consults placed and length of stay using the chart audit tool.

Implementation strategies measured included stakeholder feedback to understand barriers to implementation of the cognitive aid, understanding of the aid, and the process of infant holding were collected using the observation tool.

Analysis

Descriptive statistics were used to analyze unplanned extubations and adverse events to understand any risks or limitations associated with the infant holding aid. A Mann Whitney U test was used to analyze the pre-/post-group times infants are held and total mobility activities in the PCICU based on length of stay. A Fischer's Exact Test was used to determine if there was a significant difference of infants held while intubated based on the data collected. Qualitative data were analyzed using thematic approach from data on the observation tool to determine facilitators and barriers to implementation and use of the protocol.

Procedures

The project site and site needs were identified in January 2020. Pre-implementation occurred activities including development of the advisory team, and completion of an organization assessment and literature review (February to July 2020). Data were collected on patients admitted to the PCICU from July, August, thru September 2020 to use as a comparison after implementation. Staff education and implementation occurred in January 2021. Post-implementation data were collected on patients admitted to the PCICU in February 2021.

Ethical Considerations

The organization internal review board was approved the project as quality improvement. The project was compliant with the Health Insurance Portability and Accountability Act of 1996 (HIPAA), excluding all protected patient health information and identifiers. Data collected were de-identified and stored in a password protected excel file.

Results

Patients included were ages 6 months and younger in the PICU. Prior to implementation, 19 patients met the inclusion criteria, 56.6% (n=10) female and 43.4% (n=9) male. After implementation, 10 patients met the inclusion criteria, 30% (n=3) female and 70% (n=7) male.

Patients had a cardiac surgical intervention 84.2% (16 of 19) of the time prior to implementation and 90% (9 of 10) after implementation (Fischer's Exact Test, $p>0.05$). Physical and occupational therapy were ordered 52.6% (10 of 19) times prior to implementation and 40% (4 of 10) of the time after implementation (Fischer's Exact Test, $p>0.05$).

Mean hospital length of stay prior to implementation were 21.9 (median 12) days and 14.9 (median 7) days after (Mann Whitney U, $p>0.05$; see Appendix I). Mean PCICU length of

stay prior to implementation were 10.3 (median 6) days; and post-implementation was 9.3 (median 2) days (Mann Whitney U, $p>0.05$; see Appendix J).

Invasive ventilation was present in 84.2% (16 of 19) patients prior to implementation and in 70% (7 of 10) after (Fischer's Exact Test, $p>0.05$). Mean length of invasive ventilation prior to implementation were 117.6 (median 46.4) hours and 68.5 (median 31.6) after (Mann Whitney U, $p>0.05$; see Appendix K). Of the 16 patients that had invasive ventilation present prior to implementation, 12.5% (n=2) were held while intubated and after implementation 7 had invasive ventilation and 14.2% (n=1) were held while intubated (Fischer's Exact Test, $p>0.05$).

Prior to implementation (N=19) "held" was documented a mean of 6.5 (median 4) times per PCICU admission and after "held" was documented a mean of 8.9 (median 2) times per admission (Fischer's Exact Test, $p>0.05$; see Appendix L). Prior to implementation total mobility activities including "held", "sitting in bed", "up to chair", and "other" was documented a mean of 7 (median 4) times per PCICU admission and after implementation no additional mobility activities were charted (Fischer's Exact Test, $p>0.05$; see Appendix M). The mean first post-operative day to first mobilization activity documented prior to implementation was 4.3 (median 2.5) days and after implementation 3.4 (median 2) days (Fischer's Exact Test, $p>0.05$; see Appendix N). There were no adverse events reported during mobilization during implementation.

During observation, RNs reported in the cases where holding did not occur, that the patient's clinical condition was not stable enough for holding to occur or that a parent was not present to hold the infant. RNs also reported use of the tool to determine if the patient was able to be held and use of the criteria to have a conversation about mobility with the attending physicians. RNs stated they liked the tool and felt it was accessible.

Discussion

There were no significant differences prior to and after implementation on patient or system outcomes. However, the project can be considered clinically meaningful. Clinical meaningfulness incorporates patient outcomes and a daily noticeable change that is valuable to the context (Weinfurt, 2019). Implementing the infant holding tool provided a standardized process for holding infant patients in PCICU. Many RNs did not know the proper steps in holding intubated patients and the tool provided a concise, standardized, and safe procedure that was accessible. RNs were able to use the tool daily to determine mobility and many patients were held at least once a day, when medically stable.

The infant holding tool was widely accepted by many of the stakeholders involved in this project. RNs provided positive feedback in having this tool available to determine if mobility is possible for certain equipment present. This tool was present on the unit and in appropriate patient rooms, it was also uploaded to the PICU website for easy access. Physician and APP feedback was overall positive, and many providers encouraged this tool to be implemented in the PICU. Some physicians had concerns regarding specific criteria discussed within the tool. However, many of these criteria fell in the “requires discussion with attending” category, allowing the attending physicians to ultimately decide appropriate mobility practices dependent on the patient. Respiratory therapy was also involved in education and had no concerns about being the airway guardian for intubated patients, as this was standard practice in the NICU. Implementing this tool seemed to lay the groundwork in providing education and developing buy-in for future mobility interventions.

Interpretation

Even though this project was not statistically significant, the infant holding tool was successful at mobilizing one intubated infant in post-implementation. No adverse safety events occurred with mobilization. RNs provided positive feedback in having a standardized tool to use in order to make decisions about mobility activities and having a process to move patients. Further quality improvement projects are needed to assess the safety and feasibility for use of the protocol in PCICU. This protocol could be used in the PICU once modified to include PICU-based diagnoses.

Limitations

There were significant limitations in this DNP project that may have impacted the results and success of the project including COVID-19. The PCICU has a dedicated space with 6 ICU beds for PCICU patients. Due to multiple barriers from COVID-19, PCICU patients were roomed on a different floor in the PICU. This may have led to inconsistencies in placing the infant holding tool into appropriate rooms instead of having the tool placed in the 6 rooms in the PCICU. COVID-19 also considerably impacted staff education and implementation strategies. Meetings for education in-person have been paused, limitations are in place for the number of people that can gather, and nurses are not able to come into the hospital aside from their scheduled shifts. Creative shifts in education had to be made in order to educate appropriate staff. Education was disseminated through email to nursing staff as well as some in-person education to discuss process and answer questions. Not all RNs were educated in-person due to the limitations discussed. Simulation occurred on a voluntary basis with a limited number of participants. Simulation was limited to three people at a time due to COVID-19.

Another limitation to this project was the culture of immobility. While some older and more experienced nurses felt very comfortable with mobility, some of the newer nurses do not feel as comfortable with mobility. When rounding on the unit, some nurses reported that holding while the patient was intubated was not important. Discussions of mobility practices are not always occurring during rounds and often get missed. Some physician providers also have differing views of mobility in the ICU which can be a barrier.

Documentation in the electronic health record (EHR) regarding mobility in infants continues to be a barrier in capturing accurate mobility activities. The EHR does not have easily accessible options to chart developmentally appropriate activities for infants. It allows for "held" to be charted however, many activities have to be charted by adding a comment. The EHR does not allow for time to be concisely charted. Options available are to add a comment or chart "held" and "back to bed" at the start and completion times of holding. However, this charting can be tedious for nurses and often does not occur. Use of the infant holding tool was charted via a comment with the "held" activity with the number of nurses and respiratory therapists used to mobilize an intubated infant, yet this thorough charting does not always occur with all nurses. Creating a more accessible mobility flowsheet in the EHR may lead to better capturing of mobility activities done, length of time, and use of resources for mobilization.

Conclusion

Immobility in critically ill pediatric patients can have detrimental effects on physical, cognitive, and mental health that may persist into adulthood (Watson et al., 2018). Implementing an early mobility protocol has shown to be safe and feasible in promoting mobilization in pediatric ICUs (Choong et al., 2017; Cuello-Garcia et al., 2018; Fink et al., 2019; Piva et al., 2019). This DNP quality improvement project aimed to improve mobilization activities for

infants admitted to the PCICU by developing and implementing an infant holding tool. While data was not statistically significant, this project can be considered clinically meaningful by promoting a safe, standardized process to infant holding.

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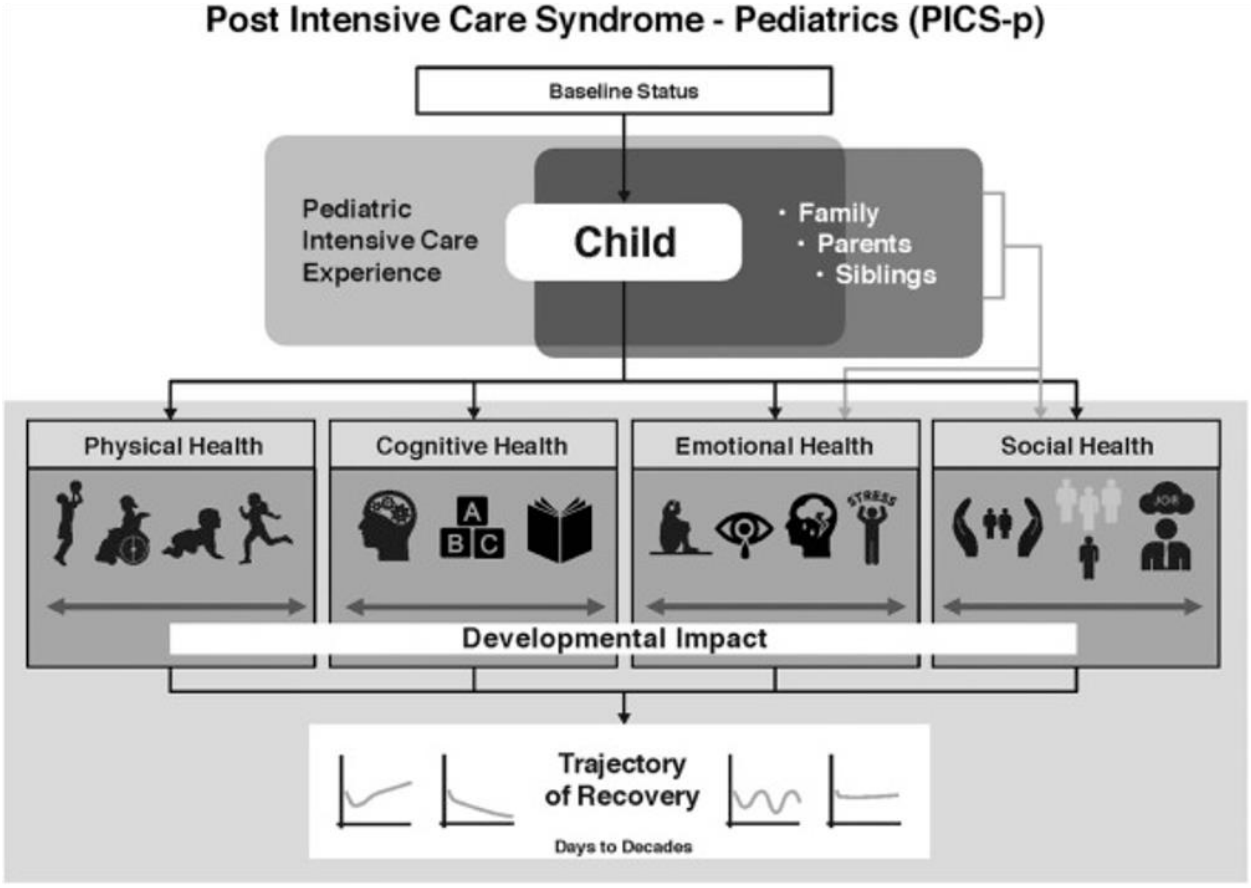
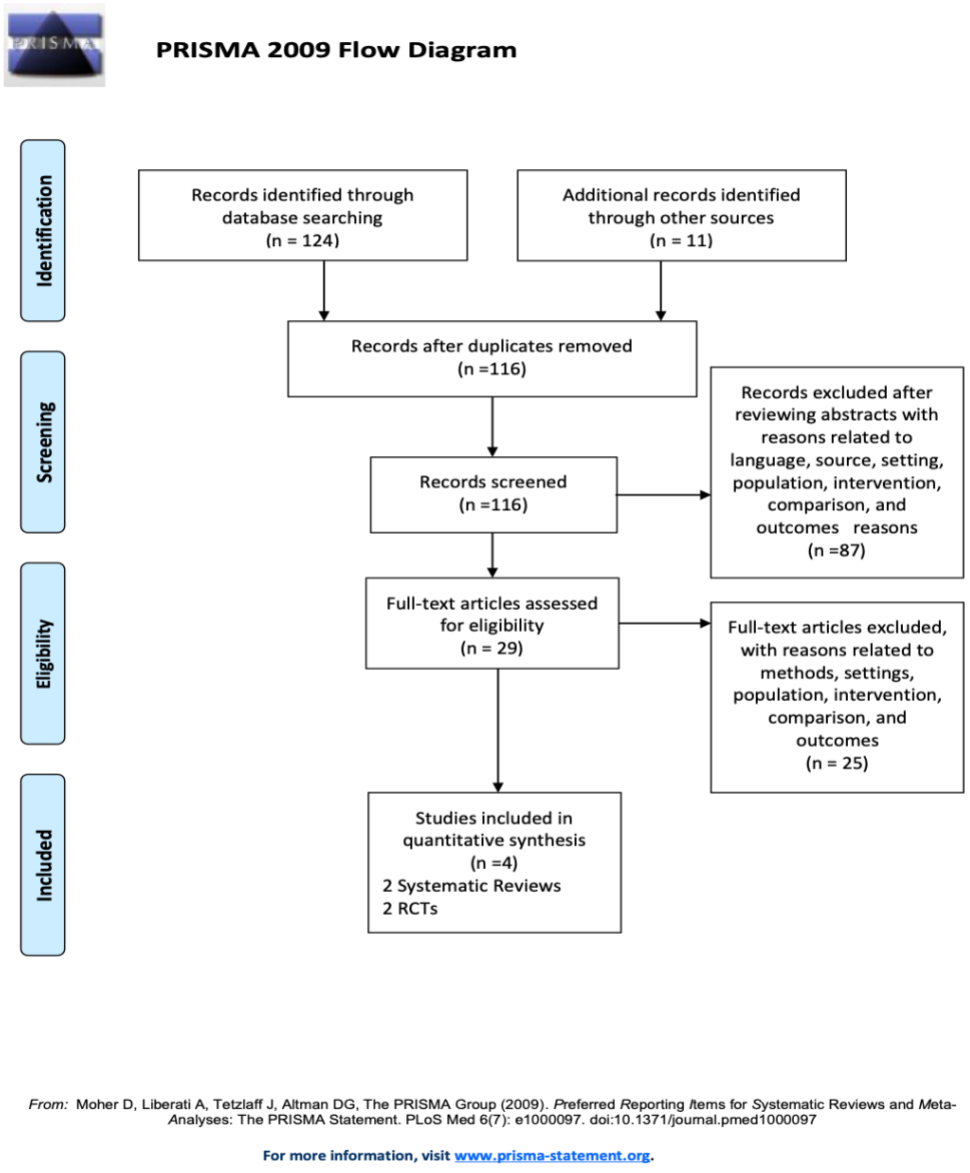
Appendix A



The Post Intensive Care Syndrome – Pediatrics (PICS-p) Framework. From "Conceptualizing post intensive care syndrome in children – The PICS-p framework" by J. Manning, N. Pinto, J. Renninck, G. Colville, and M. Curley, 2018, *Pediatric Critical Care Medicine*, *19*(4), https://doi.org/10.1097/PCC.0000000000001476. Copyright 2018 by the Society of Critical Care Medicine and the World Federation of Pediatric Intensive and Critical Care Societies.

Appendix B



PRISMA scheme detailing literature review process. 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 C

Summary of Evidence

Author (Year)	Purpose	Design (N)	Inclusion Criteria	Intervention vs Comparison	Results	Conclusion
Choong et al. (2017)	Determine the efficacy of early mobilization using in-bed cycling as an adjunct to physiotherapy on critically ill children	Pilot RCT (N=30)	Children 3 to 17 years old who were limited to bedrest with an expected PICU stay of at least 48 hours. Patients were excluded if they were at their baseline level of function, already mobilizing out of bed or expected to do so within 24 hours.	Patients were randomized in a 2:1 ratio to early mobilization using in-bed cycling in addition to usual care physiotherapy or usual care physiotherapy alone.	The median time from PICU admission to mobilization was 1.5 days in the cycling arm and 2.5 days in the control arm. Total duration of mobilization therapy was longer in the cycling arm (210 minutes) than the control arm (136 minutes).	Early mobilization is safe and feasible. In-bed cycling may facilitate greater duration and intensity of mobilization in critically ill children.
Cuello-Garcia et al. (2018)	Evaluate early mobilization in critically ill children.	Systematic review (N=12).1 clinical practice recommendation, 11 individual studies evaluating a total of 1178 children. Of 11 studies, there were 2 pilot randomized	RCTs or nonrandomized studies in critically ill children <18 years of age admitted to a PICU, (3) evaluated a mobilization intervention, and (4) full text, clinical trials, any language.	1. Retrospective study - no intervention, description of acute rehabilitation practices. 2. Interactive video game for minimum of twenty minutes	1. 15.1% of patients received early mobilization. 2. Upper limb activity was significantly greater during the intervention compared to the rest of the day	Early mobility is safe and feasible. The evidence suggests that the use of institutional early mobilization guidelines and the support of interdisciplinary

		controlled trials, 3 prospective single arm studies, 4 pre-post intervention studies, and 2 retrospective cohort studies		a day, twice a day. 3. No intervention, description of acute rehabilitation practices. 4. Passive and/or active mobilization for a minimum of 10 and a maximum of 20 minutes on day 1, and a minimum of 20 minutes on day 2. 5. Early mobilization framework implementation including staffing changes, rehabilitation guides, team approach, education and training, changing ordering systems of	(p=0.0049). Grip strength did not change. 3. Retrospective study – only 9.5% received early mobilization. 4. Interventions are safe and feasible. Lower limb activity was greater during in-bed cycling compared to highest 20 minutes of activity during nonintervention (p<0.001). 5. Significantly increased PT consults and proportions of patients who received PT after early mobilization compared with before early mobilization implementation	team education and resources increases the proportion of patients who receive acute rehabilitation consults and assessments, as well as the frequency of and the time to mobilization for these children.

				physical therapy, planning daily goals, and safety guidelines. 6. Implementation of a multicomponent, interdisciplinary, and tiered activity plan. 7. Early mobility with usual care or addition of in-bed cycling for 30 minutes/day, 5 days a week. 8. Early protocolized assessment and therapy compared to usual care. 9. Education and training on benefits and safety of early mobilization and techniques.	($p<0.001$). Length of intubation, PICU stay, and hospital stay were not significantly different. 6. Significant increase in OT ($p=0.034$) and PT consults (0.08) post implementation. Median number of mobilizations per patient by day 3 increased ($p<0.001$). 7. Intervention is feasible and acceptable, no adverse reactions occurred. Time mobilized was greater with cycling than with usual care. 8. More children in the Early Protocolized	

				10. ABCDEF bundle collaborative 11. In-bed cycling	group had consults and treatments occur in the ICU ($p<0.001$). 9. Intervention was feasible and safe. Increased percentage of patients mobilized. For patients who were not mechanically ventilated, PICU days decreased a mean of 1.1 days, but no difference for mechanically ventilated patients. 10. Fewer days on mechanical ventilation, length of stay in the ICU, and hospital length of stay in postinterventio n group.	

					11. In-bed cycling was safe and feasible.	
Fink et al. (2019)	Demonstrate feasibility and safety of ICU-based protocolized rehabilitation for pediatric neurocritical care patients	RCT (N=58)	Children between the ages of 3 and 17 years, admitted to the PICU with diagnoses of traumatic brain injury, cardiac arrest, stroke, brain mass, or central nervous system infection/inflammation . Children were enrolled prior to 72 hours of PICU admission, have English speaking parents or guardians, and an expected ICU stay greater than 2 days. Children with a do not resuscitate status or were not expected to survive > 24 hours were excluded.	The study intervention was timing of initiation of PT, OT, and speech and language therapy (SLT). The Early Protocolized group had orders place for PT, OT, and SLT placed within 72 hours of ICU admission. The control group received PT, OT, and SLT consultations per the treating team.	Increased PT consultations in the ICU ($p<0.001$), earlier PT consultations ($p<0.001$), and more PT sessions ($p<0.001$). The Early Protocolized group had more transfers ($p=0.006$), sitting outside of the bed ($p=0.001$), and less active assist range of motion interventions than children in the Usual Care group in the ICU ($p=0.026$). The Early Protocolized group had earlier OT consultations ($p<0.001$) and more OT sessions than the Usual Care group in the ICU ($p<0.001$).	Early, protocolized ICU-based rehabilitation therapies were feasible to deliver. More PT, OT, and SLT sessions were performed in the ICU in the Early Protocolized group. Therapies were delivered with relatively good safety profiles.

					SLT was consulted in the ICU more often in the Early Protocolized patients than Usual Care patients ($p<0.001$) with more SLT sessions in the ICU ($p<0.001$). No differences in hospital or ICU lengths of stay; outpatient PT, OT, or SLT prescription.	

Piva et al. (2019)	Described early mobilization protocol available for the pediatric population.	Systematic review (N=6) 2 prospective observational studies, 1 retrospective observational study, 2 quasi-experimental studies, and 1 RCT; totaled 394 patients.	Observational studies and RCT, nonrandomized or quasi-experimental clinical trials describing early mobilization protocols in the pediatric ICU for children and adolescents aged between 29 days and 18 years were included. Early mobilization was defined as any mobility exercise, whether passive or active, initiated as early as possible during the stay in the pediatric ICU and included passive, active-assisted or active exercises; bed mobility activities; transfers; orthostasis; stationary gait and/or ambulation; and mobilization with a cycle ergometer or virtual reality games.	Early Mobility protocols including 1. Interactive videogames 2 times a day for 10 minutes 2. Interactive videogames for cooperative and conscious patients. Cycle cyclometer passive exercise for lower limbs and noncooperative patients 3. Leveled early mobilization protocol 4. Standard treatment and cycle ergometer 30 minutes 5 times a week. 5. Daily planning on the level of mobilization for each patient 6. Active mobilization of patients under mechanical	1. Movement of upper limbs were increased ($p=0.0049$) but grip strength was unchanged ($p=0.20$). Limited number of patients due to lack of eligibility. 2. Passive mobilization with cycle ergometer increased activity of lower limbs ($p<0.001$). Safe when applied to noncooperative children. Interactive videogames are viable only in a minority of children and did not increase movement of upper limbs ($p>0.05$).	Early mobilization protocols are based on individualized interventions and are planned accordingly to the child's development. The use of a cycle ergometer may increase the movement of children and adolescents. There is limited feasibility of using interactive videogames in this patient population. The implementation of multidisciplinary protocols seems to be a viable tool for the promotion of early mobility.

				ventilation 10-60 minutes a day according to tolerance.	3. Increased number of physical and occupational therapy consultations. Mean number of mobilization activities per patient on 3rd day doubled ($p<0.001$). 4. Early mobilization is safe and viable, in-bed mobilization with a cycle ergometer can optimize the duration and intensity of mobilization in previously health children with pre-existing functional limitations. 5. Increased the proportion of patients who received	

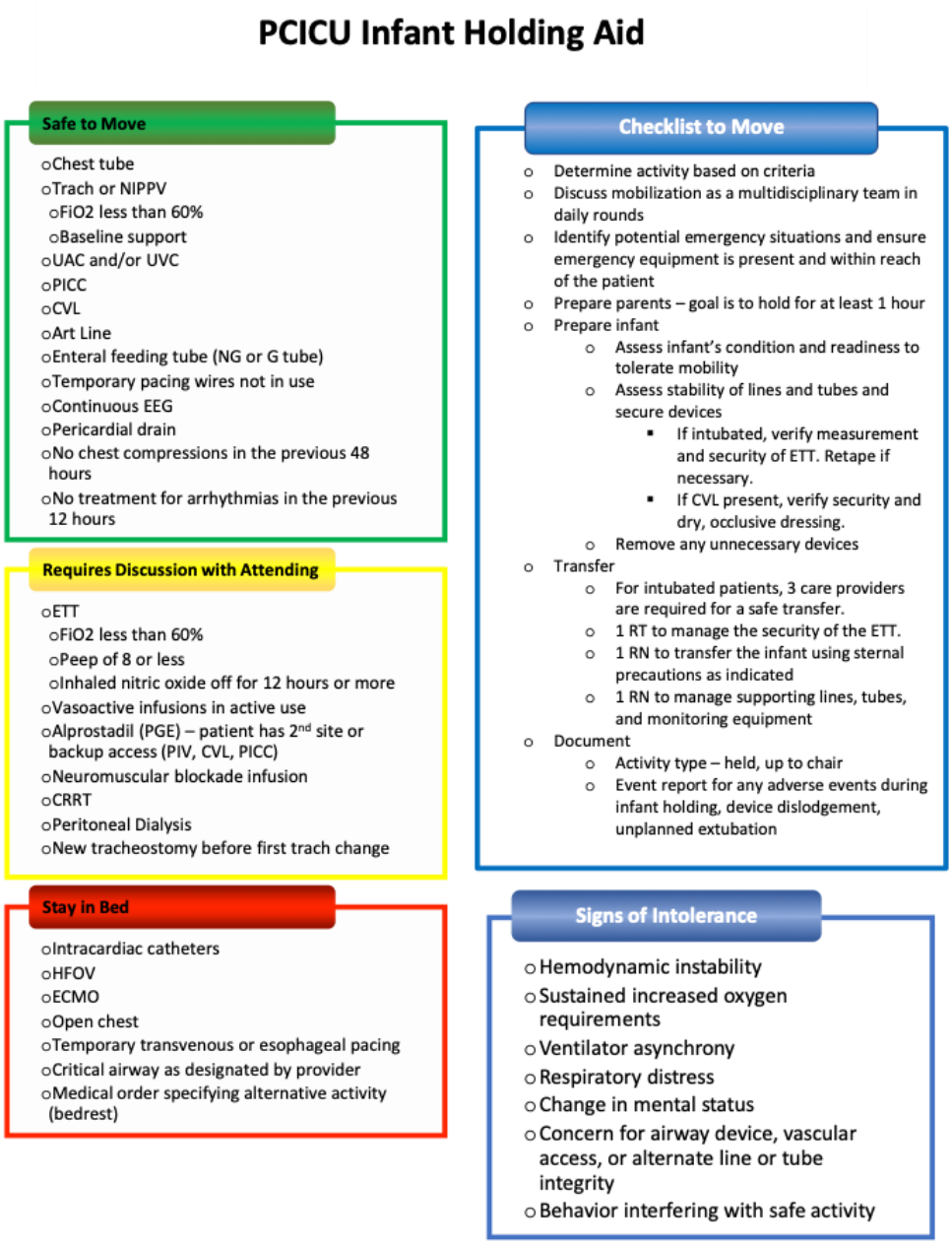
					physical therapy ($p<0.001$). No difference in length of intubation, length of stay in PICU or hospital. Mobilization was safe and well tolerated. 6. Increased number of consultations	

Appendix D

Kotter's 8-Step Model. Adapted from "The heart of change" by J. Kotter and D. Cohen, 2002, Harvard Business School Press. Copyright 2002 by John P. Kotter and Deloitte Consulting LLC.

Appendix E

Cognitive Aid



Appendix F

Educational Handout

NEW! Infant Holding Tool
Go-Live 1/27/2020

- Many patients in the PCICU are infants. With necessary cardiac surgery, some of these infants miss out on crucial bonding times with their parents. To encourage bonding, limit developmental disabilities, and improve parental stress, some infant patients may be held based on the criteria described in the PCICU Infant Holding Tool.
- This tool should be used with all PCICU patients 6 months and younger.
- There will be copies of the tool placed in the appropriate patient rooms and available on the unit.
- The goal is for all infant patients meeting criteria to be held once a day using the standardized process described in the **Checklist to Move** located on the tool.
- This tool categorizes patients into three categories: **Safe to Move**, **Requires Discussion with Attending**, and **Stay in Bed.**

Safe to Move: If FiO2 requirement is higher than 60% or escalating respiratory support, chest compressions within 48 hours, or arrythmias within 12 hours, move to next level.

Requires Discussion with Attending: All decisions should be discussed with attending intensivists during daily rounds. CV APP may make decision if patient status changes. Discussion should **ALWAYS** occur with at least the CV APP before moving a patient with an ETT out of bed.

- If FiO2 is above 60%, PEEP 8 or greater, or on iNO, patient may be mobilized out of bed dependent on an attending decision.
- If epi or norepi drip is higher than 0.02mcg/kg/min, patient may be mobilized out of bed dependent on an attending decision.

Stay in Bed: Patients with these criteria should **NOT** be mobilized out of bed **UNLESS** approved by an attending physician or surgeon or end of life care.

Key Points

- Daily discussion in rounds about mobility.
- Mobilizing any intubated infant out of bed requires a discussion with an attending physician.
- CV APP **must** be present on the floor and aware of mobilization during time of holding any intubated infant.
- RT **must** be airway guardian for an ETT.
- If intubated, RN **must** be present in room while parent is holding.
- Document activity type (held, up to chair, etc.) Comment use of tool or not.
- Event report for any adverse events

STOP Mobility if:

- Hemodynamic instability – outside of ordered parameters, longer than 5 minutes
- Sustained increased oxygen requirements >20% for more than 5 minutes
- Ventilator asynchrony
- Respiratory distress
- Change in mental status
- Concern for any airway device or line integrity
- Behavior interfering with safe activity

Appendix G

Chart Audit Tool

Chart Audit Tool

Patient MRN:	
Age:	
Sex:	Male / Female
Admission Date:	
Discharge Date:	
Length of Stay (Hospital) in days:	
Length of Stay (PCICU) in days:	
Times “held” charted:	
Times “sitting up in bed” charted:	
Times “up in chair” charted:	
Total number of mobility activities charted:	
Held while intubated:	Yes / No
Physical and Occupational Therapy Ordered:	Yes / No
“Early and Progressive Mobility” Order set placed:	Yes / No
Invasive Ventilation:	Yes / No
Unplanned extubation:	Yes / No
Event reports:	Yes / No
If “Yes: event reports, describe	
Infant held once per day of PCICU admission	Yes / No
Use of protocol charted in plan of care note or comment	Yes / No
Amount of time charted in plan of care note or comment	Yes / No
Amount of time held	

Appendix H

Observation Tool

Date: _____

RN Name: _____

Was the patient 6 months or younger? Yes/No

Criteria present (Circle):

Chest tube, trach/NIPPV, UAC/UVC, PICC, CVL, feeding tube, temporary pacing wires, EEG

ETT, vasoactive infusions – epi/norepi/PGE/other, neuromuscular blockade infusion, CRRT, PD,

intracardiac catheter, pericardial drain, new trach before 1st change

ECMO, open chest, temporary transvenous/esophageal pacing, critical airway, bedrest order

Other impacting mobility (describe): _____

Was mobility discussed in morning rounds? Yes/No

Was patient held? Yes/No

If yes, how many times (per shift)? _____ How long? _____

If no, why not?

___Criteria to stay in bed present

___ Clinical condition

___ Parent not present to hold

___Other (describe) _____

Any other mobility activities performed? Yes/No ___up to chair/swing __other (describe)

_____

Was tool used? Yes/No

Why/why not? _____

If intubated, was RT used as the airway guardian? Yes/No

If no, why not? _____

Were mobility activities charted? Yes/No

If no, why not? _____

Any adverse events? Yes/No _____

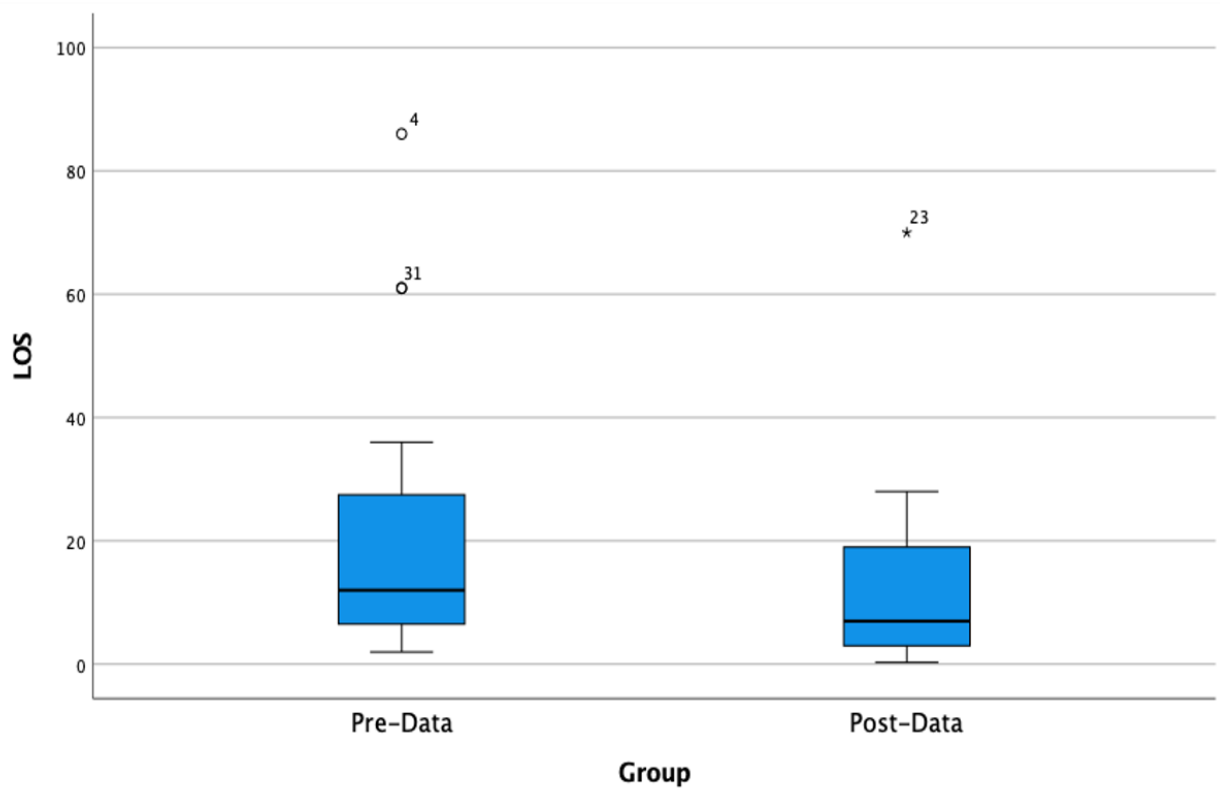
Questions/comments/feedback on protocol: _____

_____

_____

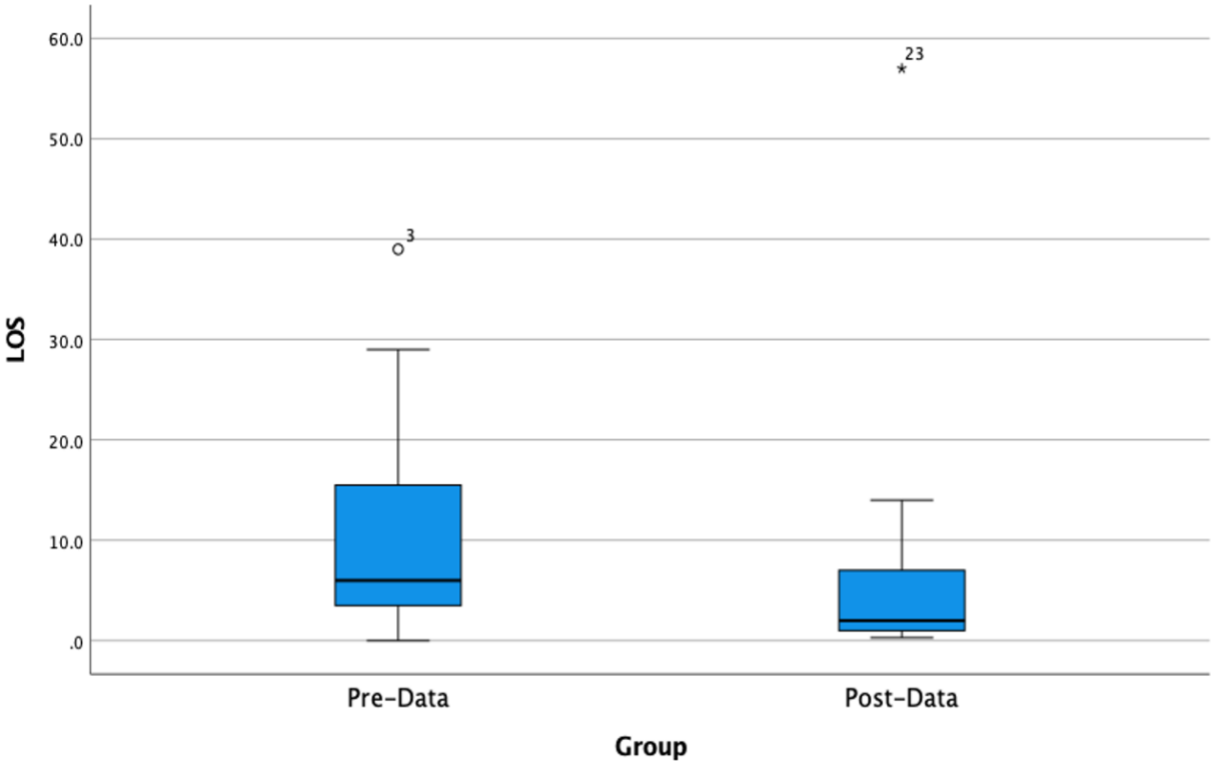
Appendix I

Results



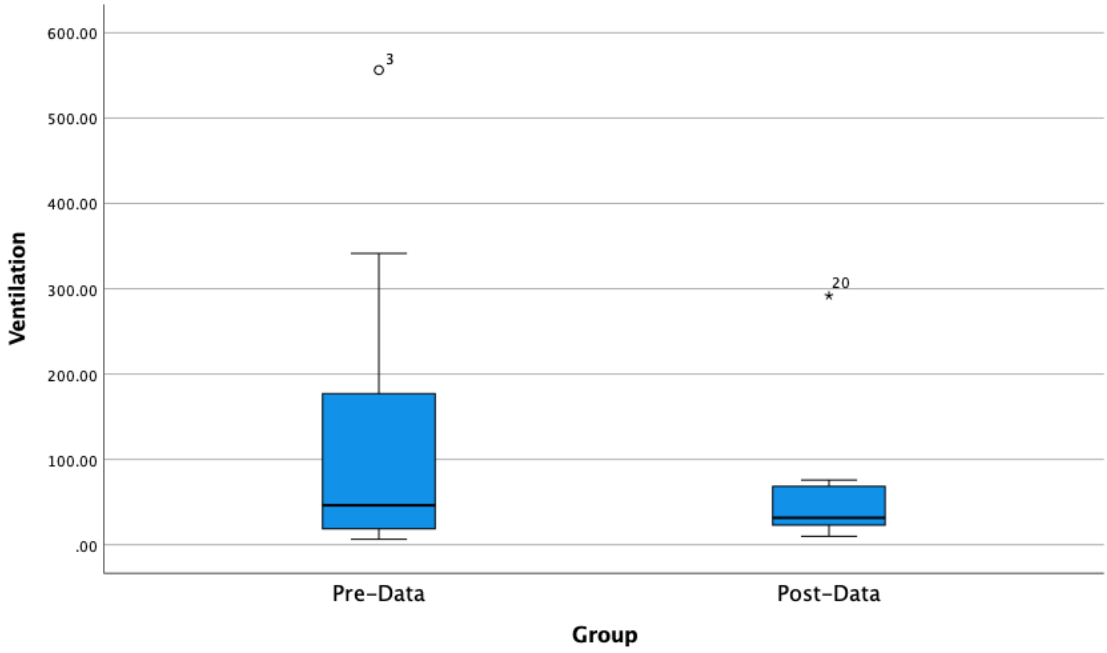
Graph displaying pre- and post-implementation data of hospital length of stay.

Appendix J



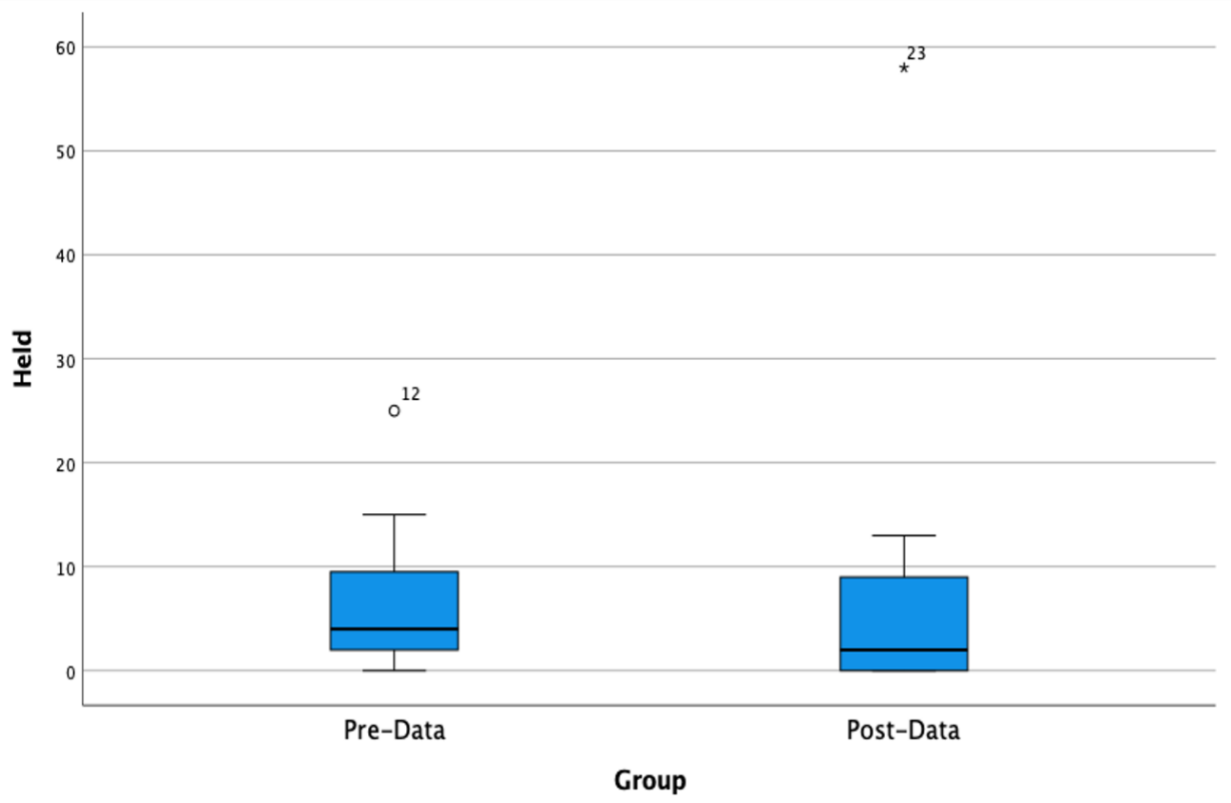
Graph displaying pre- and post-implementation of PCICU length of stay.

Appendix K



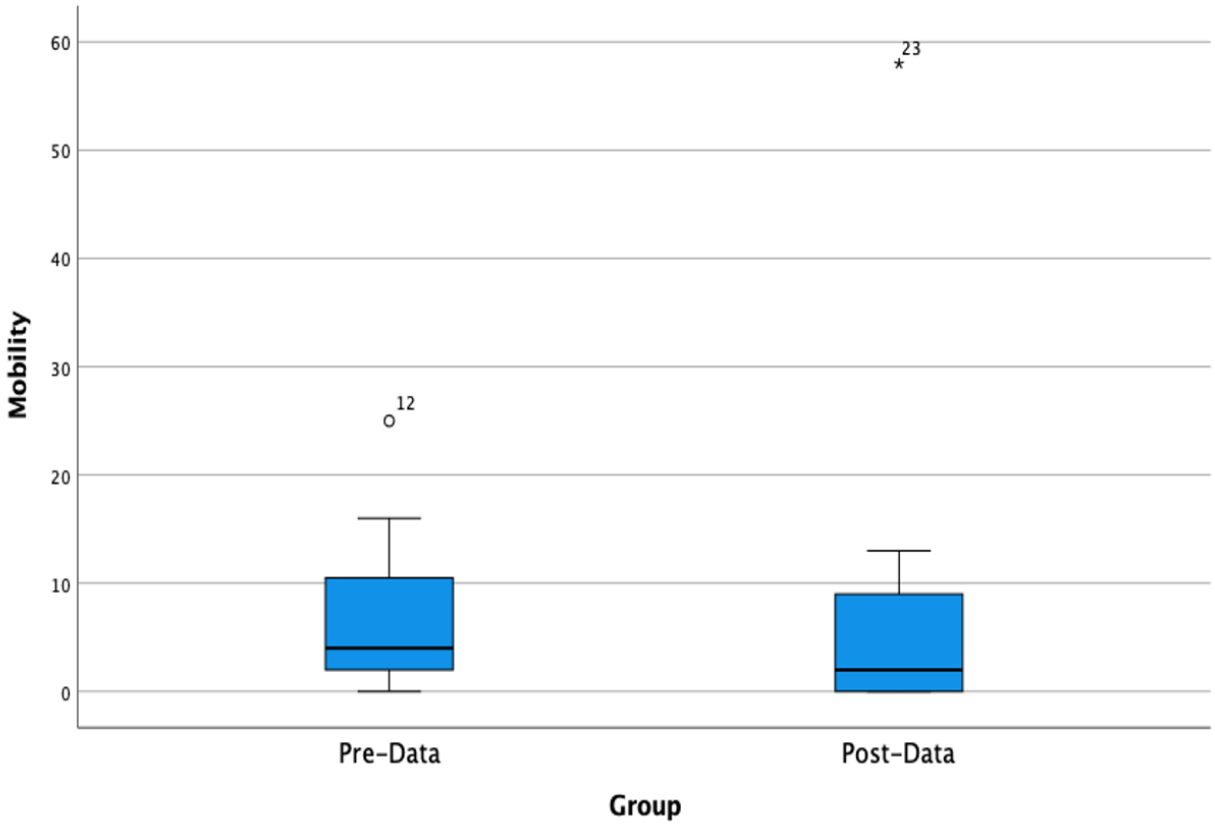
Graph displaying pre- and post-implementation length of ventilation in hours.

Appendix L



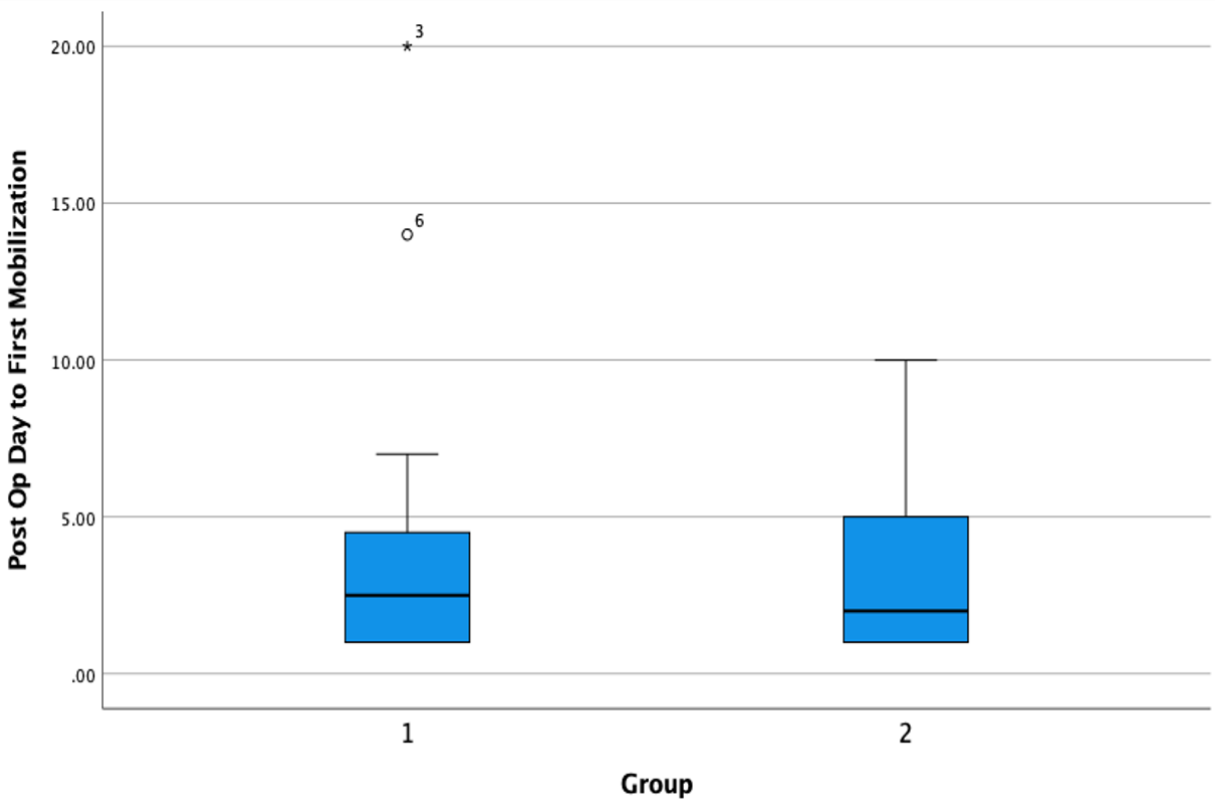
Graph displaying number of times held for pre- and post-implementation data groups.

Appendix M



Graph displaying total number of mobility activities charted in pre- and post-implementation data groups.

Appendix N



Graph displaying time in days to first mobility activity charted in pre- and post-implementation data groups.

Appendix O

DNP Defense PowerPoint

\

Implementation of Early Mobility in the Pediatric Cardiac Intensive Care Unit

Kelly Lubbers

DNP Project Defense

April 20, 2021

Grand Valley State University
Kirkhof College of Nursing

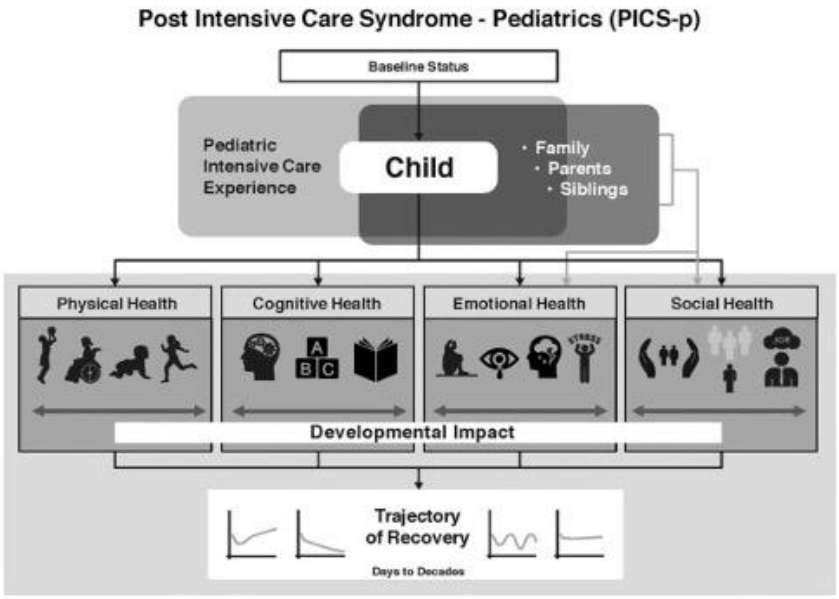
Acknowledgements

- Advisor:
  - Dr. Sandra Spoelstra, PhD, RN, FGSA, FAAN.
- Faculty Committee Member:
  - Dr. Christina Quick, DNP, APRN, CPNP-AC/PC.
- Site Mentor
  - Caryn Steenland, MSN, RN, CCRN, ACCNS-P.

Objectives for Presentation

1. Review the clinical problem and its contextual significance.
2. Review the organizational assessment and current literature regarding the clinical question.
3. Describe the project plan including design, implementation strategies, and evaluation.
4. Discuss results, implications for practice, and sustainability.
5. Discuss the application of the DNP Essentials to this DNP project.

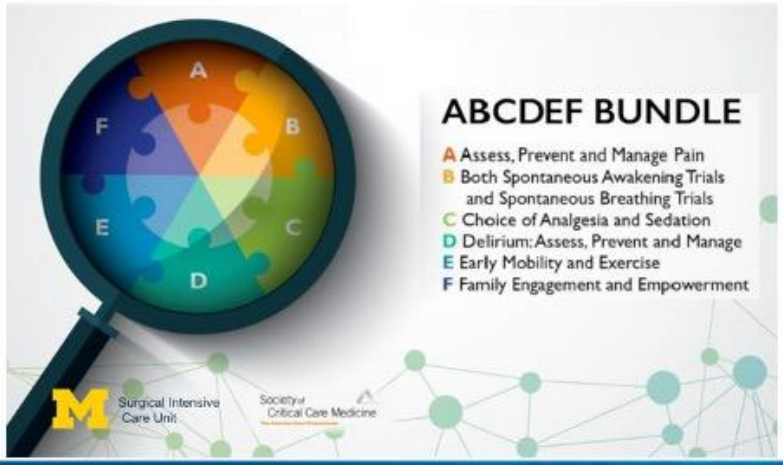
Introduction



Sourced from *Manning et al., (2018).*

Introduction

- ICU Liberation ABCDEF Bundle is an evidence-based guide to mitigate the adverse effects of critical illness used in adult and pediatric critical care patients (Marra et al., 2017).



Organizational Assessment

Organizational Context

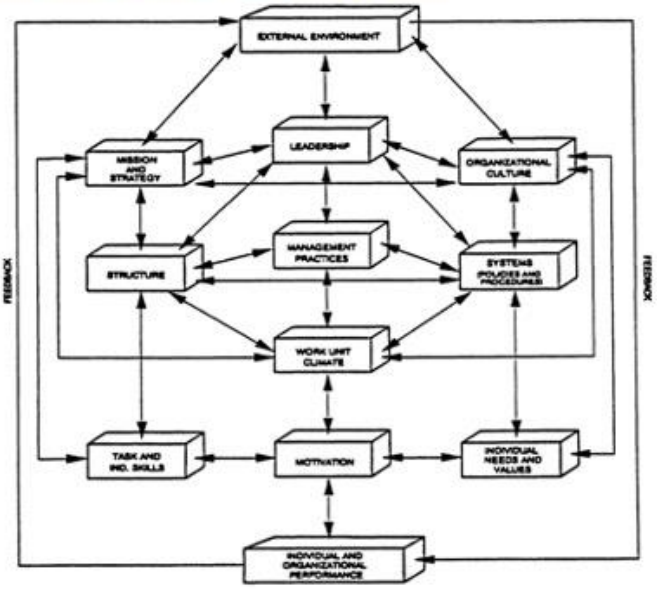


Image sourced from Burke & Litwin (1992).

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Organizational Assessment

- No standard process for early mobility.
  - Up to nursing judgement and comfort.
  - Respiratory therapy may be present to secure endotracheal tubes, but not always.
- Main barriers to early mobilization included lack of people, lack of time, and potential inadvertent extubation.
- Of 16 intubated infants, only 2 were held while intubated.

SWOT Analysis (Moran et al., 2016)

Strengths	Weaknesses
• **APP staffing.** • **Team of designated nurses to staff unit.** • Clinical Nurse Specialist and Shared Leadership Committee.	• Nurses pulled from other units. • Nursing turnover. • **No defined standard of care for early mobility, no documentation requirement.**
Opportunities	**Threats**
• Nationally ranked congenital heart center. • iHub center for innovation.	• Competition with other heart centers in the state. • Complexity of management of patients.

Clinical Practice Question

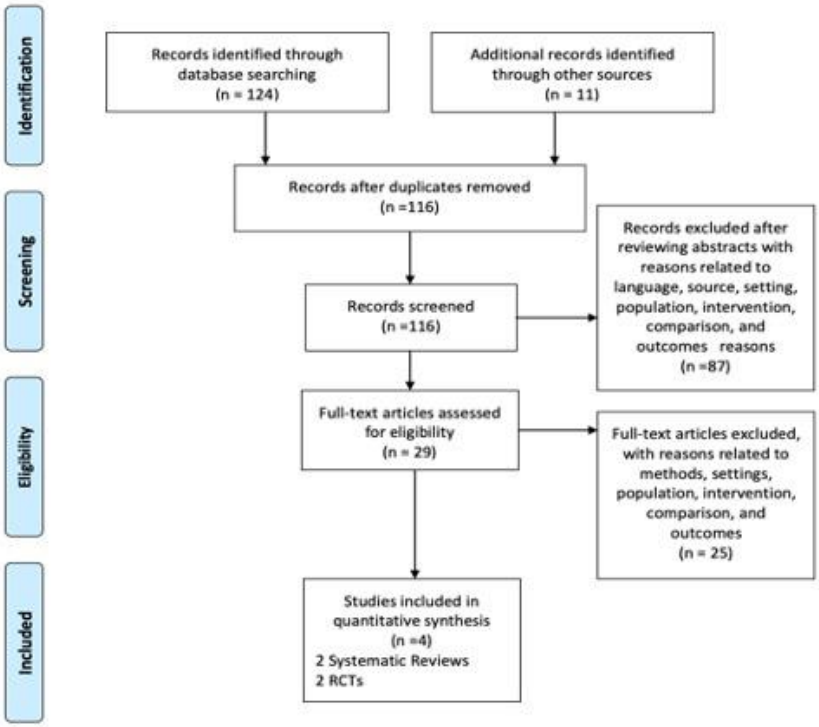
- In critically ill pediatric patients admitted to a PICU or PCICU, does an early mobilization protocol improve mobility activities performed compared to current practice?

Literature Review

Literature Review

- Focus:
  - Determine evidence on early mobilization in PICU patients.
  - Validate evidence to support an early mobility protocol.
- Method
  - Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) (Moher et al., 2009).
  - PubMed, CINAHL Complete, Cochrane.
- Keywords:
  - Early mobility, early mobilization, pediatric, intensive care, critical care.
- Inclusion/exclusion criteria:
  - Critically ill pediatric patients.
  - Mobilization interventions compared to usual care.
  - Description of outcomes.

PRISMA Figure



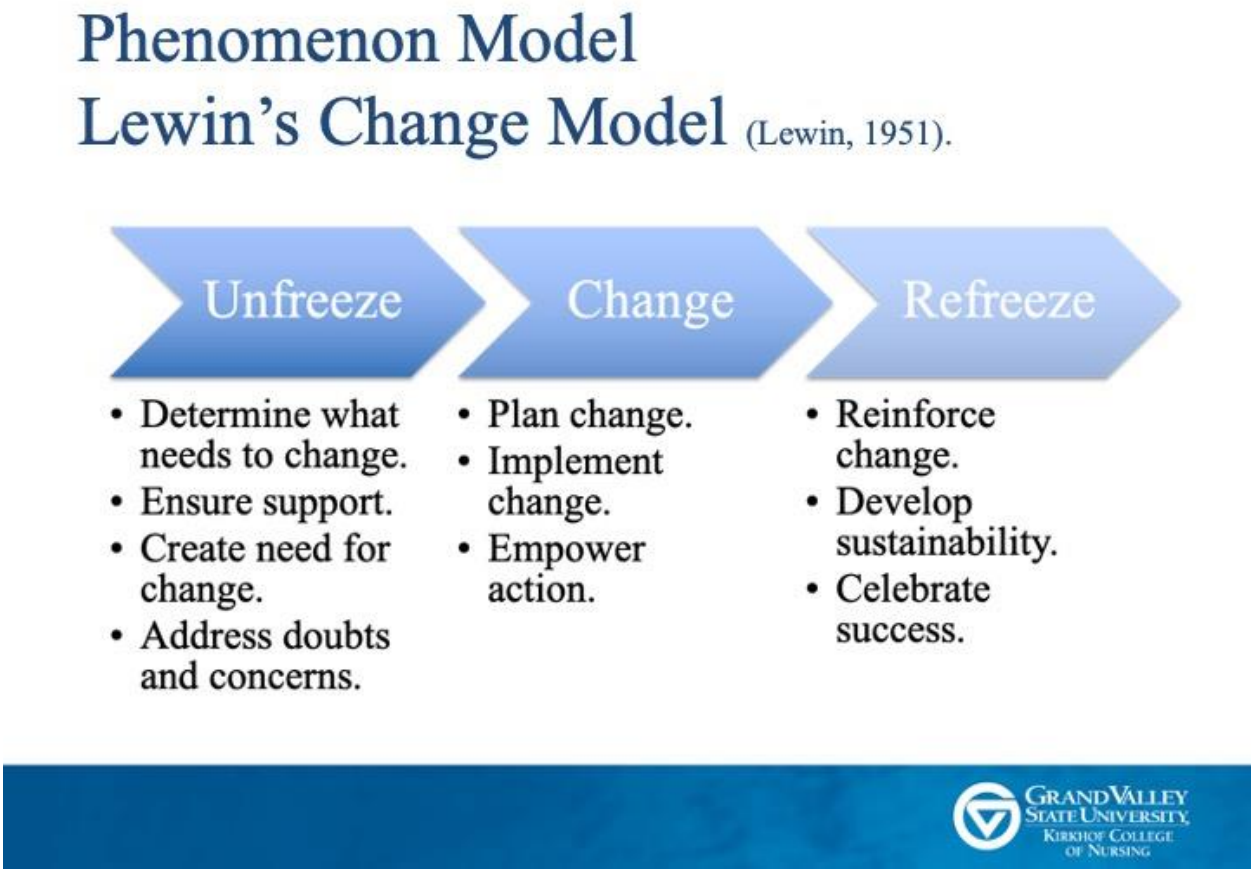
From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). *Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement.* PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

Author	Design	Results	Conclusion
Choong et al. (2017) evaluated the efficacy of early mobilization using in-bed cycling as an adjunct to physiotherapy in critically ill children	Pilot randomized controlled trial (N=30)	The median time from PICU admission to mobilization was 1.5 days in the cycling arm and 2.5 days in the control arm. Total duration of mobilization therapy was longer in the cycling arm (210 minutes) than the control arm (136 minutes).	Early mobilization is safe and feasible. In-bed cycling may facilitate greater duration and intensity of mobilization in critically ill children.
Cuello-Garcia et al. (2018) evaluated early mobility interventions in critically ill children	Systematic review of 12 studies evaluating a total of 1178 children.	Interactive video games, in-bed cycling, and early mobility protocols increased PT and OT consults and treatments	Early mobility is safe and feasible. The use of institutional early mobilization guidelines increases the proportion of patients who receive acute rehabilitation services and increases frequency of and time to mobilization.
Fink et al. (2019) evaluated feasibility and safety of ICU-based protocolized rehabilitation for pediatric neurocritical care patients	Randomized controlled trial (N=58)	Increased earlier PT, OT, and SLT consults in the ICU ($p<0.001$). No differences in hospital or ICU lengths of stay; outpatient PT, OT, or SLT prescription.	Early, protocolized ICU-based rehabilitation therapies were feasible to deliver. More PT, OT, and SLT sessions were performed in the ICU in the Early Protocolized group. Therapies were delivered with relatively good safety profiles.
Piva et al. (2019) evaluated interventions to describe an early mobility protocol for the pediatric population	Systematic review (N=6)	Early Mobility protocols increased the number of PT and OT consultations. A cycle ergometer increased movement of lower limbs ($p<0.001$) and was safe. Interactive videogames had limited feasibility in children admitted to a PICU and did not increase movement.	The implementation of multidisciplinary protocols seems to be a safe and viable tool for the promotion of early mobility.

Summary of Available Knowledge

- Early mobility protocols are a safe and feasible intervention to promote mobilization (Choong et al., 2017, Cuello-Garcia et al., 2018, Fink et al., 2019, Piva et al., 2019).
- Progressive mobility protocols should be utilized in PICUs to encourage mobilization (Piva et al., 2019).
- Multidisciplinary teams and families should be involved with daily mobility (Piva et al., 2019).
- Research is limited with small sample sizes and lack of randomized controlled trials (Piva et al., 2019).

Project Plan


Phenomenon Model
Lewin's Change Model (Lewin, 1951).
Unfreeze
Change
Refreeze
• Determine what needs to change.
• Ensure support.
• Create need for change.
• Address doubts and concerns.
• Plan change.
• Implement change.
• Empower action.
• Reinforce change.
• Develop sustainability.
• Celebrate success.
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Project Purpose and Objectives

The purpose of this project was to create and implement a standardized process for infant holding in the PCICU.

Objectives were to:

1. Develop a team of stakeholders to guide the project.
2. Create a cognitive aid to standardize activity levels in infants and the process to holding infants depended on activity level.
3. Educate RNs on the cognitive aid and standardized process.
4. Evaluate the use of the cognitive aid and address concerns with the process of infant holding.
5. Develop and implement a sustainability plan to improve infant mobility.

Project Type, Setting, & Participants

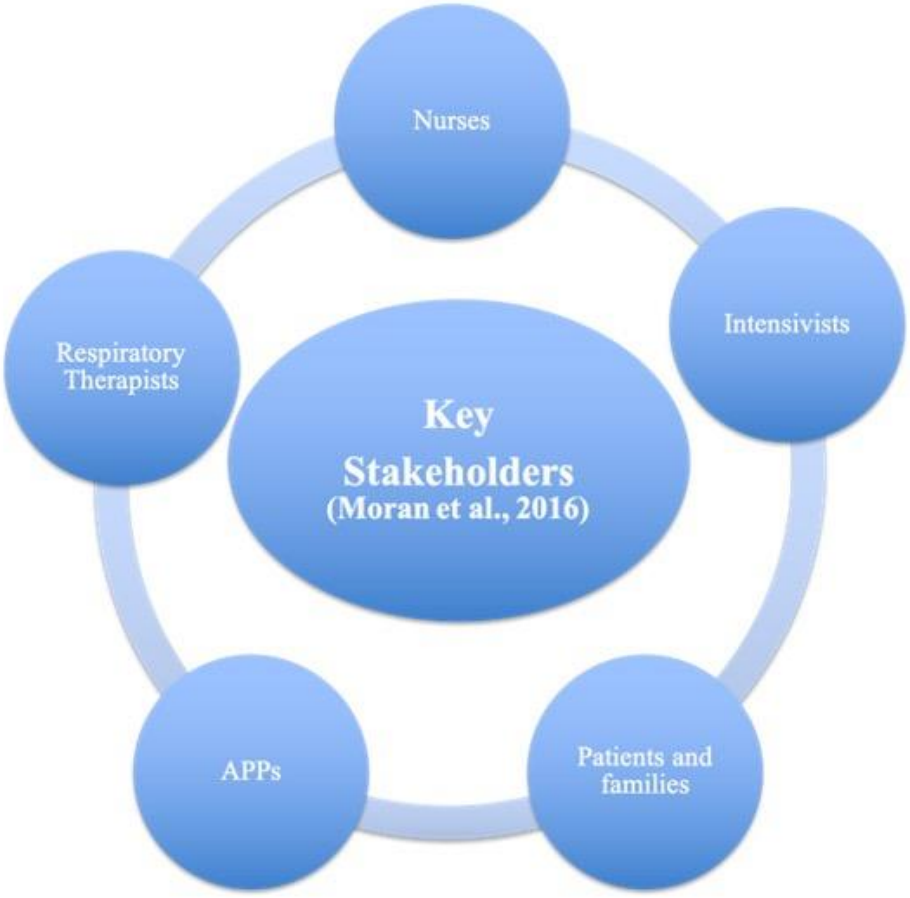
Type: Quality Improvement.

Setting: Children's Hospital in the Midwest with Magnet status and nationally ranked in cardiology and heart surgery (U.S. News and World Report, 2020).

- Pediatric Cardiac Intensive Care Unit (PCICU):
  - 6-bed unit.
  - 197 patients admitted in 2019.
  - Intensive care provided for patients with congenital heart defects and cardiac disease.

Participants:

- Infant patients 6 months or younger.
- PCICU and hybrid RNs – 38.
- APP team.


Nurses
Intensivists
Respiratory Therapists
Key Stakeholders
(Moran et al., 2016)
APPs
Patients and families

Implementation Framework: Kotter Model (Kotter & Cohen, 2002).

Implementation Strategies

Implementation Strategies

- Organizational Assessment
  1. Conduct a local needs assessment (Powell et al., 2015).
  2. Assess for change readiness and identify barriers and facilitators (Powell et al., 2015).
  3. Conduct local consensus discussions and engage stakeholders (Powell et al., 2015).

Implementation Strategies

- Team Development
  4. Build a coalition (Powell et al., 2015).
  5. Use an implementation advisor (Powell et al., 2015).


Implementation Strategies
• Cognitive Aid
6. Develop and distribute educational materials (Powell et al., 2015).
7. Develop and implement tools for quality monitoring (Powell et al., 2015).
8. Identify early adopters (Powell et al., 2015).
04 Enlist
Communicate the vision and strategy for change
05 Enable
Empower employees for taking action to incorporate changes
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Cognitive Aid

PCICU Infant Holding Aid

Safe to Move

- Chest tube
- Trach or NIPPV
  - FiO2 less than 60%
  - Baseline support
- UAC and/or UVC
- PICC
- CVL
- Art Line
- Enteral feeding tube (NG or G tube)
- Temporary pacing wires not in use
- Continuous EEG
- Pericardial drain
- No chest compressions in the previous 48 hours
- No treatment for arrhythmias in the previous 12 hours

Requires Discussion with Attending

- ETT
  - FiO2 less than 60%
  - Peep of 8 or less
  - Inhaled nitric oxide off for 12 hours or more
- Vasoactive infusions in active use
- Alprostadil (PGE) – patient has 2nd site or backup access (PIV, CVL, PICC)
- Neuromuscular blockade infusion
- CRRT
- Peritoneal Dialysis
- New tracheostomy before first trach change

Stay in Bed

- Intracardiac catheters
- HFOV
- ECMO
- Open chest
- Temporary transvenous or esophageal pacing
- Critical airway as designated by provider
- Medical order specifying alternative activity (bedrest)

Checklist to Move

- Determine activity based on criteria
- Discuss mobilization as a multidisciplinary team in daily rounds
- Identify potential emergency situations and ensure emergency equipment is present and within reach of the patient
- Prepare parents – goal is to hold for at least 1 hour
- Prepare infant
  - Assess infant's condition and readiness to tolerate mobility
  - Assess stability of lines and tubes and secure devices
    - If intubated, verify measurement and security of ETT. Retape if necessary.
    - If CVL present, verify security and dry, occlusive dressing.
  - Remove any unnecessary devices
- Transfer
  - For intubated patients, 3 care providers are required for a safe transfer.
  - 1 RT to manage the security of the ETT.
  - 1 RN to transfer the infant using sternal precautions as indicated
  - 1 RN to manage supporting lines, tubes, and monitoring equipment
- Document
  - Activity type – held, up to chair
  - Event report for any adverse events during infant holding, device dislodgement, unplanned extubation

Signs of Intolerance

- Hemodynamic instability
- Sustained increased oxygen requirements
- Ventilator asynchrony
- Respiratory distress
- Change in mental status
- Concern for airway device, vascular access, or alternate line or tube integrity
- Behavior interfering with safe activity

Educational Handout

NEW! Infant Holding Tool
Go-Live 1/27/2020

- Many patients in the PCICU are infants. With necessary cardiac surgery, some of these infants miss out on crucial bonding times with their parents. To encourage bonding, limit developmental disabilities, and improve parental stress, some infant patients may be held based on the criteria described in the PCICU Infant Holding Tool.
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Requires Discussion with Attending: All decisions should be discussed with attending intensivists during daily rounds. CV APP may make decision if patient status changes. Discussion should **ALWAYS** occur with at least the CV APP before moving a patient with an ETT out of bed.

- If FiO2 is above 60%, PEEP 8 or greater, or on iNO, patient may be mobilized out of bed dependent on an attending decision.
- If epi or norepi drip is higher than 0.02mcg/kg/min, patient may be mobilized out of bed dependent on an attending decision.

Stay in Bed: Patients with these criteria should **NOT** be mobilized out of bed **UNLESS** approved by an attending physician or surgeon or end of life care.

Key Points

- Daily discussion in rounds about mobility.
- Mobilizing any intubated infant out of bed requires a discussion with an attending physician.
- CV APP **must** be present on the floor and aware of mobilization during time of holding any intubated infant.
- RT **must** be airway guardian for an ETT.
- If intubated, RN **must** be present in room while parent is holding.
- Document activity type (held, up to chair, etc.) Comment use of tool or not.
- Event report for any adverse events

STOP Mobility if:

- Hemodynamic instability – outside of ordered parameters, longer than 5 minutes
- Sustained increased oxygen requirements >20% for more than 5 minutes
- Ventilator asynchrony
- Respiratory distress
- Change in mental status
- Concern for any airway device or line integrity
- Behavior interfering with safe activity

Chart Audit Tool

Chart Audit Tool

Patient MRN:	
Age:	
Sex:	Male / Female
Admission Date:	
Discharge Date:	
Length of Stay (Hospital) in days:	
Length of Stay (PCICU) in days:	
Times "held" charted:	
Times "sitting up in bed" charted:	
Times "up in chair" charted:	
Total number of mobility activities charted:	
Held while intubated:	Yes / No
Physical and Occupational Therapy Ordered:	Yes / No
"Early and Progressive Mobility" Order set placed:	Yes / No
Invasive Ventilation:	Yes / No
Unplanned extubation:	Yes / No
Event reports:	Yes / No
If "Yes: event reports, describe	
Infant held once per day of PCICU admission	Yes / No
Use of protocol charted in plan of care note or comment	Yes / No
Amount of time charted in plan of care note or comment	Yes / No
Amount of time held	

Observation Tool

Date: _____

RN Name: _____

Was the patient 6 months or younger? Yes/No

Criteria present (Circle):

Chest tube, trach/NIPPV, UAC/UVC, PICC, CVL, feeding tube, temporary pacing wires, EEG

ETT, vasoactive infusions – epi/norepi/PGE/other, neuromuscular blockade infusion, CRRT, PD,

intracardiac catheter, pericardial drain, new trach before 1st change

ECMO, open chest, temporary transvenous/esophageal pacing, critical airway, helmet order

Other impacting mobility (describe): _____

Was mobility discussed in morning rounds? Yes/No

Was patient held? Yes/No

If yes, how many times (per shift)? ____ How long? ____

If no, why not?

__Criteria to stay in bed present

___ Clinical condition

___ Parent not present to hold

___Other (describe) _____

Any other mobility activities performed? Yes/No ___up to chair/swing __other (describe)

_____

Was tool used? Yes/No

Why/why not? _____

If intubated, was RT used as the airway guardian? Yes/No

If no, why not? _____

Were mobility activities charted? Yes/No

If no, why not? _____

Any adverse events? Yes/No _____

Questions/comments/feedback on protocol: _____

_____

_____

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Implementation Strategies

- Facilitation and Feedback
  9. Facilitation (Powell et al., 2015).
  10. Audit and provide feedback (Powell et al., 2015).
  11. Conduct cyclical small tests of change (Powell et al., 2015).
  12. Tailor strategies (Powell et al., 2015).

Topic	Concept	How Measured	When Measured	Who Measures
Implementation Strategies	Assess for change readiness	Discussion, EHR Review, Observation	Pre-Implementation	Student and Site Mentor
	Conduct local consensus discussions and stakeholder engagement	Discussion	Pre-Implementation	Student
	Develop and distribute cognitive aid and educational materials	Attendance	Pre-Implementation	Student
	Feedback	Observation Tool	Post-Implementation	Student
Patient Outcomes	Number of mobilization activities during PCICU stay	EHR Audit	Pre-/Post-Implementation	Student
	Infant holding while intubated	EHR Audit, Observation Tool	Pre-/Post-Implementation	Student
	Length of stay, hospital and PCICU	EHR Audit	Pre-/Post-Implementation	Student
	Invasive ventilation, presence and length	EHR Audit	Pre-/Post-Implementation	Student
	Adverse events	EHR Audit, Event Reports, Observation Tool	Pre-/Post-Implementation	Student
System Outcomes	Use of aid	Observation Tool	Post-Implementation	Student
	Physical and Occupational Therapy Consults	EHR Audit	Pre-/Post-Implementation	Student
	Cardiac Surgery	EHR Audit	Pre-/Post-Implementation	Student

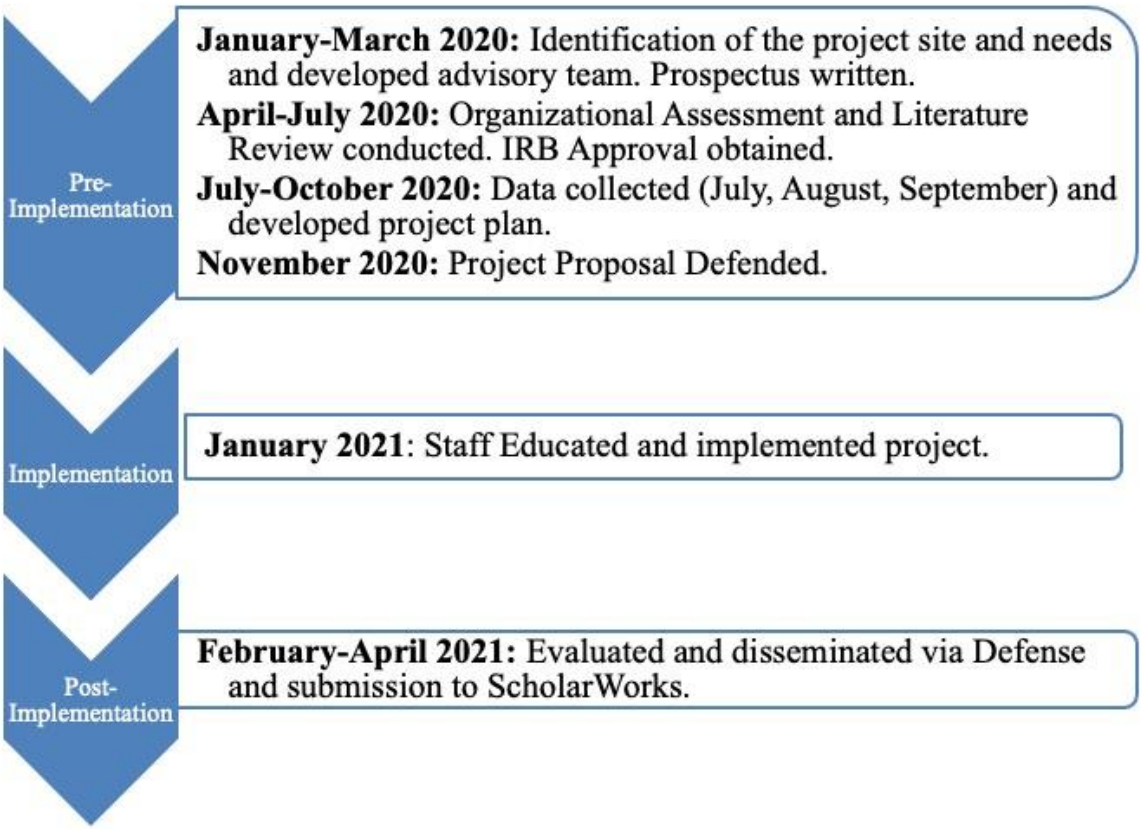
Analysis Plan

- Descriptive statistics.
- Mann Whitney U Test.
  - Nonparametric test to analyze numerical data.
- Fischer's Exact Test.
  - Analyze the relationship between categorical data.
- Qualitative data.

Ethical Considerations

- HIPAA Compliant with patient protected information.
- IRB Determination by organization on June 15, 2020 (available upon request).
- Data collection is de-identified and stored in a password protected excel file.

Timeline


Pre-Implementation
January-March 2020: Identification of the project site and needs and developed advisory team. Prospectus written.
April-July 2020: Organizational Assessment and Literature Review conducted. IRB Approval obtained.
July-October 2020: Data collected (July, August, September) and developed project plan.
November 2020: Project Proposal Defended.
Implementation
January 2021: Staff Educated and implemented project.
Post-Implementation
February-April 2021: Evaluated and disseminated via Defense and submission to ScholarWorks.

Results

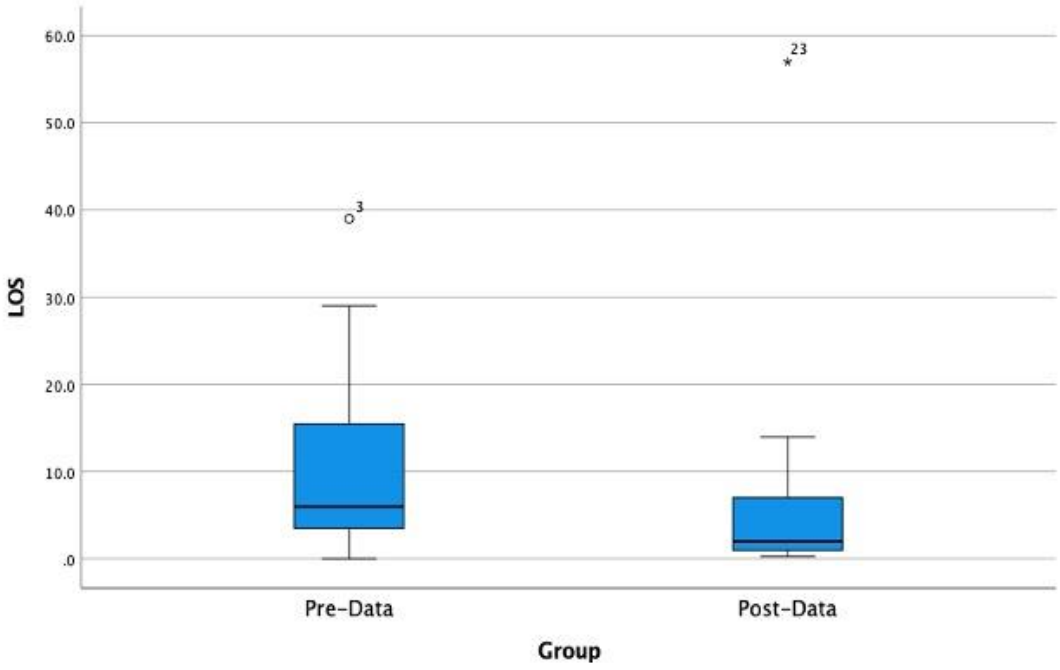
Results: Demographics & Characteristics

- Demographics:
  - Age: all were ≤6 months (pre-/post-implementation).
  - Gender (p-Value >.05):
    - Pre-implementation N=19: 56.6% (n=10) female; and 43.4% (n=9) male.
    - Post-implementation N=10: 30% (n=3) female; and 70% (n=7) male.
- Characteristics (p-Value >.05):
  - Cardiac Surgery:
    - Pre-implementation N=19: 84.2% (n=16) had surgery; and 15.8% (n=3) did not.
    - Post-implementation N=10: 90% (n=9) had surgery; and 10% (n=1) did not.
  - PT/OT Consults:
    - Pre-implementation N=19: 52.6% (n=10) consults; and 47.4% (n=9) did not.
    - Post-implementation N=10: 40% (n=4) had consults; and 60% (n=6) did not.

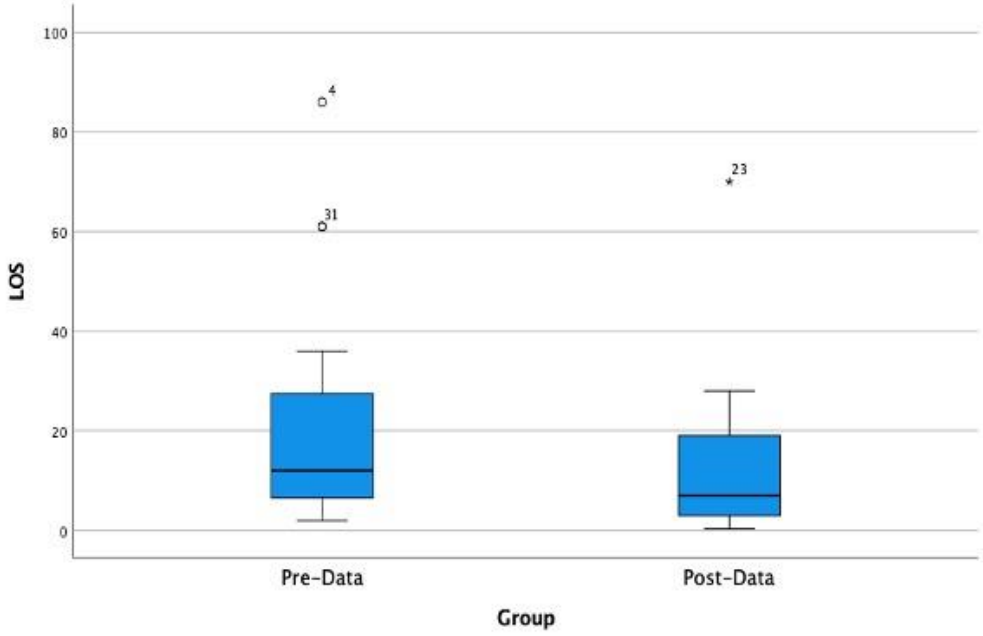
Results: LOS

- Average PCICU LOS (p-Value >.05):
  - Pre-implementation: 10.3 days (Median: 6 days).
  - Post-implementation: 9.3 days (Median: 2 days).
- Average Hospital LOS (p-Value >.05):
  - Pre-implementation: 21.9 days (Median: 12 days).
  - Post-implementation: 14.9 days (Median: 7 days).

Results: PCICU Length of Stay

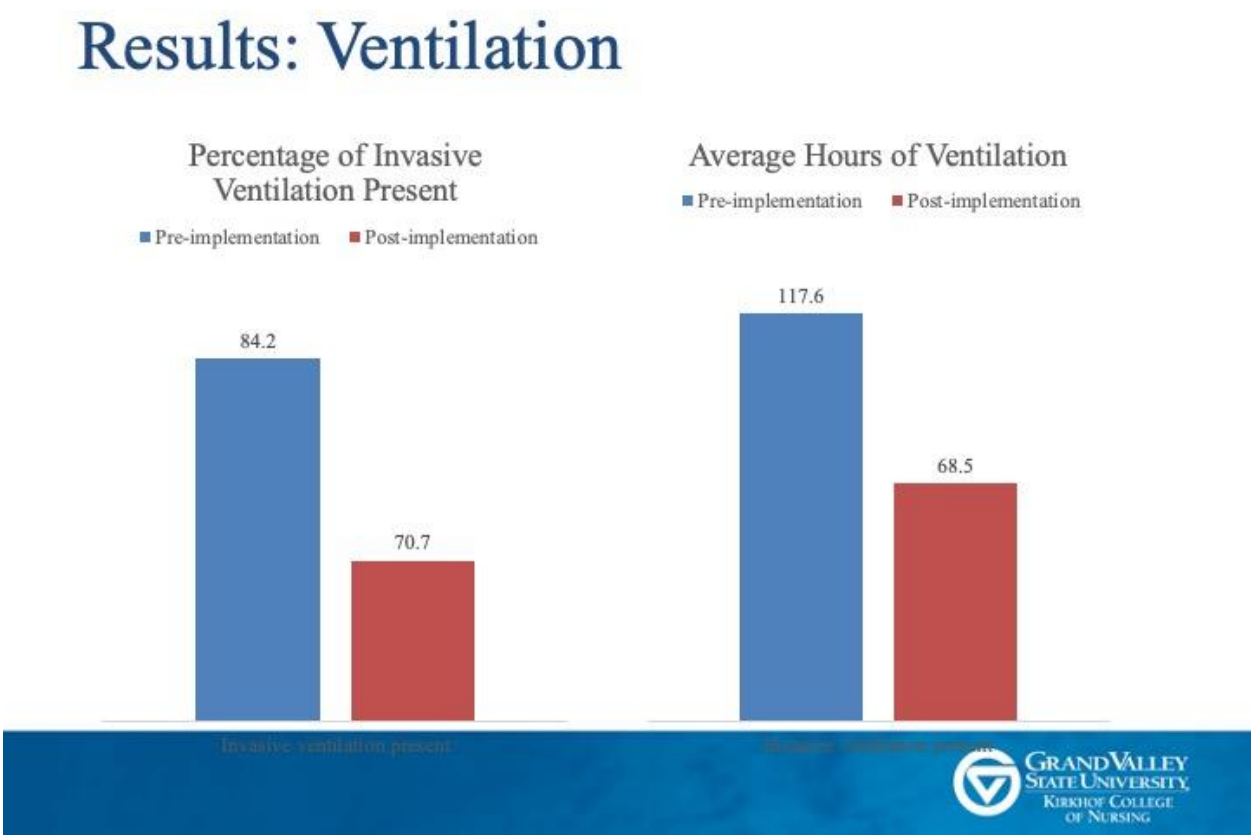


Results: Hospital Length of Stay



Results: Ventilation

- Invasive ventilation present (p-Value >.05):
  - Pre-implementation: 84.2% (16 of 19) patients.
  - Post-implementation: 70% (7 of 10) patients.
- Average length of ventilation (p-Value >.05):
  - Pre-implementation: 117.6 hours (Median: 46.4 hours).
  - Post-implementation: 68.5 hours (Median: 31.6 hours).


Results: Ventilation
Percentage of Invasive Ventilation Present
Pre-implementation
Post-implementation
84.2
70.7
Invasive ventilation present
Average Hours of Ventilation
Pre-implementation
Post-implementation
117.6
68.5
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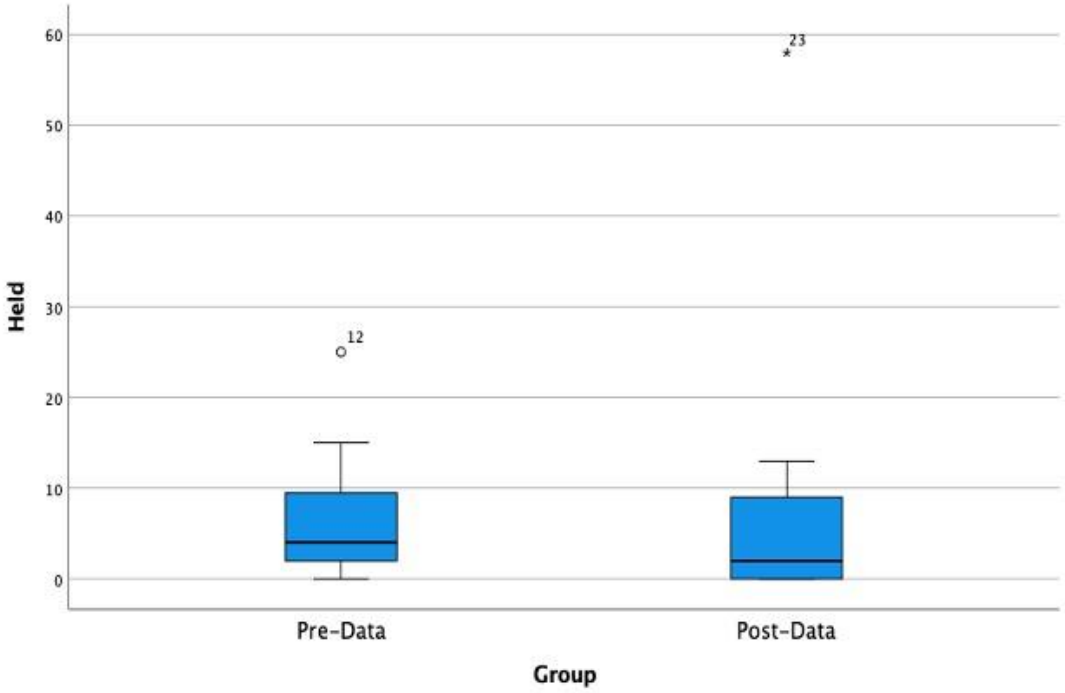
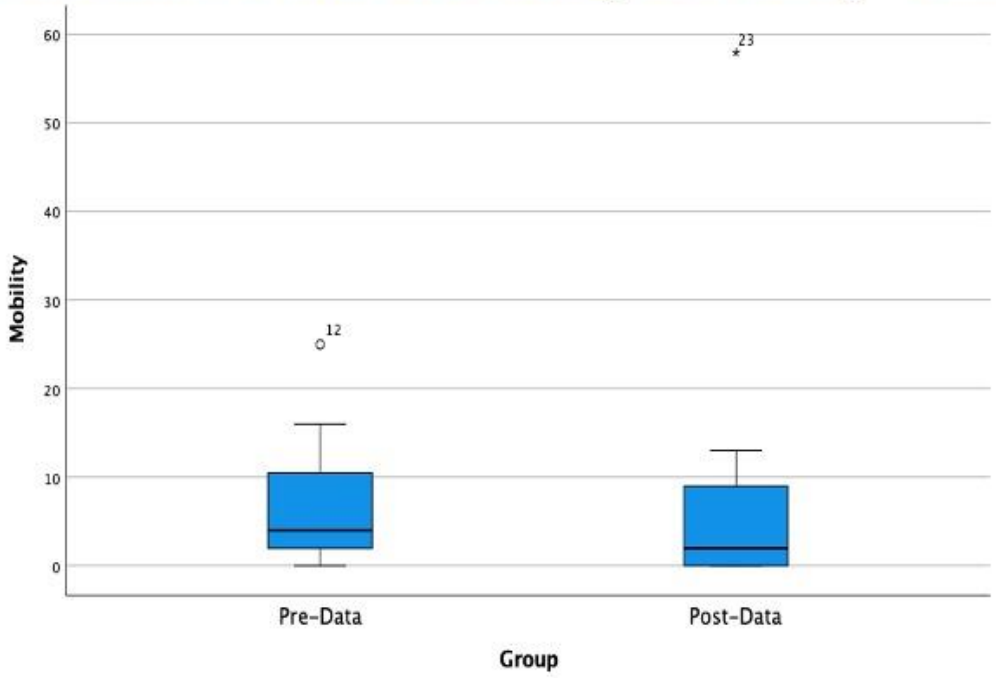
Results: Mobility

- "Held" charted (p-Value >.05):
  - Pre-implementation: 6.5 times (Median 4).
  - Post-implementation: "Held charted: 8.9 times (Median 2).
- Total mobility activities (p-Value >.05):
  - Pre-implementation: 7 times (Median 4).
  - Post-implementation: No other mobility activities charted
- Held while intubated (p-Value >.05):
  - Pre-implementation: 12.5% (2 of 16) held while intubated.
  - Post-implementation: 14.3% (1 of 7) held while intubated
- Average time to first mobility activity charted (p-Value >.05):
  - Pre-implementation: 4.3 days (Median 2.5).
  - Post-implementation: 3.4 days (Median 2).

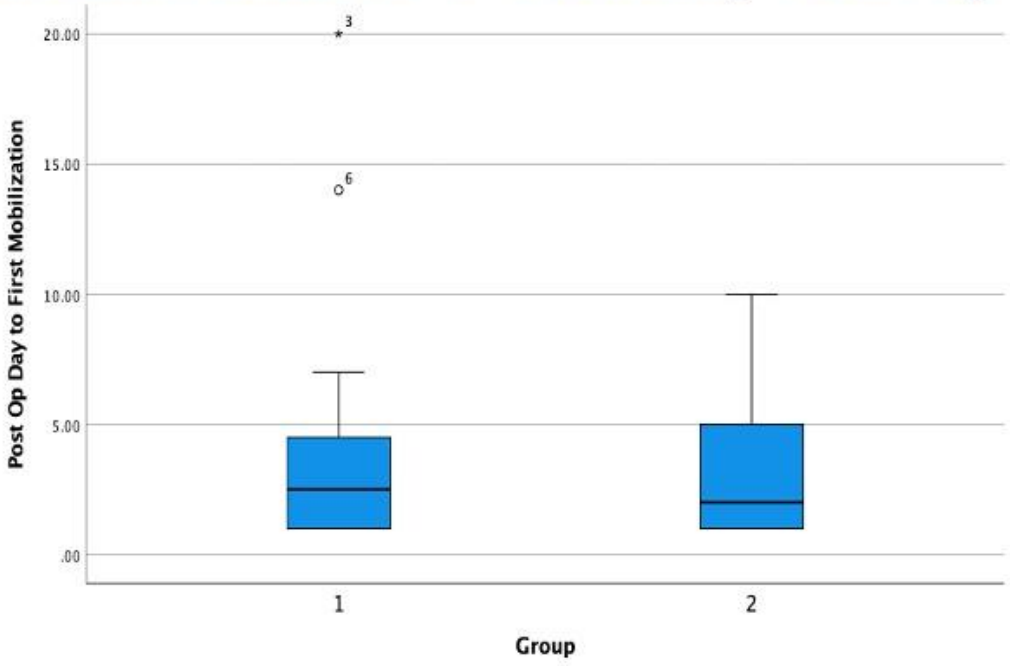
Results: Number of Times Held Charted



Results: Total Mobility Activity Charted



Results: Time to 1st Mobility Activity



Adverse Events

- Adverse Events:
  - ✓None reported during mobilization.

Qualitative Data

- RNs reported:
  1. Clinical condition not stable enough to hold.
  2. Parents not present to hold.
  3. No adverse events during mobilization.

Budget & Resources

Expenses for Implementation of Project	
Project Manager $55/hour, 300 hours	$16,500
Site mentor meetings $75/hour 20 hours	$1,100
Physician team member time $102/hour 2 hours	$204
Statistician Consultation	$100
Supplies	$700
Kangaroo Chair	$4500
Total Expenses	**$23,104**

Donated Resources	
Project Manager Time	$16,500
Statistician	$100
Supplies	$700
Kanagrro Chair	$4500
Total Donated Resources	**$21,800**

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Budget & Resources

Total Expenses	**$23,104**
Donated Resources	**$21,800**
Net Operating Cost	**$1,304**
Potential cost savings using a 20 percent reduction in length of ICU stay for an ICU with 200 admission a year (Lord et al., 2018).	$260,000
Total Cost Mitigation	**$257,392**

Discussion

- No statistically significant differences in measured variables between the pre- and post-groups.
- Standardized process in infant holding.
- Widely accepted by stakeholders.
- Project can be considered clinically meaningful as tool had a daily impact on mobility practices in infant patients.

Limitations

- COVID-19 had significant impacts on the PCICU and education strategies.
- Culture of immobility still exists in the PICU and PCICU.
- Documentation in EHR creates barriers in capturing mobility activities.

Implications for Practice

- Successful in mobilizing one intubated infant.
- No adverse events.
- Further studies and data collection are needed.

Sustainability Plan (Hailemariam et al., 2019)

- Organizational leadership.
- Stakeholder buy-in.
- Ongoing support.
- Collaboration.
- Shared decision-making.

Dissemination

- Early Mobility Team.
- Nursing Staff.
- Public DNP Project Defense.
- Submission to ScholarWorks and the Journal of Pediatric Nursing.

Conclusions

- Immobility in critically ill pediatric patients can have detrimental effects on physical, cognitive, and mental health that may be long-lasting into adulthood (Watson et al., 2018).
- Implementing an early mobility protocol has shown to be safe and feasible in promoting mobilization (Choong et al., 2017; Cuello-Garcia et al., 2018; Fink et al., 2019; Piva et al., 2019).
- This quality improvement project aimed to improve mobilization activities for infants admitted to the PCICU by implementing an infant holding tool.
- Data showed no statistically significant differences in the pre- and post-implementation groups.

DNP Essentials Reflection

DNP Essentials Reflection

- Essential I: Scientific Underpinnings for Practice
- Essential II: Organizational and Systems Leadership
- Essential III: Clinical Scholarship and Analytical Methods for Evidence-Based Practice
- Essential IV: Information Systems/Technology and Patient Care Technology for the Improvement and Transformation of Health Care

DNP Essentials Reflection

- Essential V: Health Care Policy for Advocacy in Health Care
- Essential VI: Interprofessional Collaboration for Improving Patient and Population Health Outcomes
- Essential VII: Clinical Prevention and Population Health for Improving the Nation's Health
- Essential VIII: Advanced Nursing Practice

Handouts

1. Literature Review Table of Evidence.
2. Cognitive Aid.
3. Chart Audit Tool.
4. Observation Tool.
5. Evaluations and Measures Table.
6. Education Materials.

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