2019

Using a Pediatric Early Warning Score Algorithm for Activating a Rapid Response Team

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This is to certify that the doctoral study by

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The Office of the Provost

Walden University
2019

Abstract

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MSN, Walden University, 2010

BSN, Seton Hall University, 1994

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Project Submitted in Fulfillment

of the Requirements for the Degree of

Doctor of Nursing Practice

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Abstract

The nursing culture of an inpatient pediatric unit was resistant to activating pediatric rapid response team (PRRT) alerts despite guidelines for activation. Nurses routinely assessed patients and assigned a pediatric early warning score (PEWS); however, the level of illness severity was not interpreted consistently among nurses and a PEWS action algorithm did not exist to guide nurses' minimal actions based on the PEWS score. Guided by 3 adult learning theories (Knowles, Kolb, and Bandura) and 1 evaluation model (Kirkpatrick), this staff education project sought to educate pediatric nurses on a PEWS action algorithm and determine whether this project improved nurses' knowledge, situational awareness, and attitude toward activating PRRT alerts. A convenience sample of 30 pediatric nurses completed a preeducation knowledge survey (EKS), attended an interactive PEWS education class, and completed a postEKS. After participating in the class, correct responses on the EKS increased from 43% to 82% and, using the Wilcoxon-signed rank test, a significant increase was noted in nurses' responses to questions related to self-efficacy, factual knowledge, and application. The overall increase in the nurses' self-efficacy and knowledge about the PEWS might enhance critical-thinking skills, foster identification of patients at risk for clinical deterioration, and empower nurses to follow the PEWS action algorithm including activation of PRRT alerts when indicated. This project has the potential to effect positive social change by supporting nurses' actions designed to improve pediatric patient outcomes.

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Dedication

I am truly blessed to have the love and support of my family and friends. To my mother, Vivian, I thank you for being the "wind beneath my wings". Although you are unaware of my recent accomplishment, I know that you would be proud of me and happy to celebrate my success. To my father, Wasil, I thank you for teaching me to work hard and the value of a strong work ethic and a formal education. You have been my guardian angel since I was 17 years old and I know that if you were here, you would be bursting with pride and flashing your big smile.

I thank all my family and friends for your encouragement and support throughout my journey. You had faith in my abilities when I doubted myself. You helped me to take things one day at a time and keep my eyes on the prize. Thank you for your patience and understanding of my absence from many social events. I look forward to reconnecting with you all.

To my greatest mentor, personal cheerleader, and dear friend, the late Dr. Richard Hader, I dedicate my DNP in your memory. You continue to influence my personal and professional life as your legacy is alive and well within me. You have touched the lives of so many people with your kindness and generosity of spirit that your legacy will always burn bright.

Acknowledgments

I am so grateful to all my professional educators and colleagues who invested their time and energy to support my educational and professional goals. To Dr. Eileen Fowles, my DNP Chair, thank you for your kindness, understanding, and patience for the many challenges of life that arouse during my DNP journey. You have been an invaluable resource for me. Thank you for sharing your time, knowledge, and insights. Most of all, thank you for your personal concern for me and commitment to my success. God bless you! I could not have done this without you.

To Dr. Christine Hader, my career mentor, your 34 years of commitment to my professional success is a priceless gift for which I am grateful. You pushed me to overcome my self-imposed barriers by challenging, mentoring, coaching, and encouraging me throughout my career.

I am grateful for the incredible team of nurses, nurse scientists, staff at the center for nursing research, librarians, and members of the nursing research and multidisciplinary and interdepartmental committees. Special thanks to Dr. Catherine Ballance, Ann Marie Conte, Dr. Kathryn Fleming, Linda Houseal, Dr. Matthew McCarrick, Kathleen McCarthy, Beth Ann McKeown, Mani Paliwal, Darlene Robertelli, Dr. Susan Weaver, Dr. Teri Wurmser, and Bonnie Zimmerman.

I have a very special appreciation for the key stakeholders in this project, the pediatric clinical nursing staff. Your voluntary participation in this project and commitment to learning and improving patient outcomes are priceless attributes. I could not have done this without you. Thank you!

Table of Contents

List of Tables

List of Figures

Section 1: Nature of the Proposal

Introduction

Researchers have demonstrated that pediatric patients outside of intensive care unit (ICU) areas who required resuscitation for cardiac and/or respiratory arrest had exhibited signs of deterioration in the hours preceding the arrest (Agulnik, Forbes, Stenquist, Rodriguez-Galindo, & Kleinman, 2016; Gold, Mihalov, & Cohen, 2014; Jankuloski, Shihab, O'Neil, Van Taak, & Abuhasna, 2011; Murray, Williams, Pignataro, & Volpe, 2015). As a result, the pediatric early warning system (PEWS) was developed to standardize language, assessment criteria, and the process for identifying early clinical deterioration in pediatric patients in non-ICU areas as well as guiding nursing actions for additional assessments and prompt immediate treatment (Agency for Healthcare Research and Quality (AHRQ), 2009; Murray et al., 2015). Various forms of the PEWS have since emerged and been implemented by several children's hospitals to identify pediatric patients in an early stage of clinical deterioration (Agulnik et al., 2016; AHRQ, 2009; Haines, Perrott, & Weir, 2006). The concept of the PEWS as an evidence-based practice (EBP) is relatively new which accounts for the lack of widespread adoption and use in U.S. children's hospitals (AHRQ, 2009; Haines et al., 2006; Jankuloski et al., 2011; Murray et al., 2015).

The PEWS of interest for this doctoral capstone project included two components: (a) revised PEWS scoring tool, and (b) new PEWS action algorithm (Agulnik et al., 2016; AHRQ, 2009; Bell et al., 2013; Demmel, Williams, & Flesch, 2010). The nurse assigns a PEWS score for the pediatric patient by using a table to assess specific criteria

within three physiologic systems: patient behavior (neurologic); cardiovascular; and respiratory (Agulnik et al., 2016; Demmel et al., 2010; Tucker, Brewer, Baker, Dermitt, & Vossmeyer, 2009). The revised PEWS scoring tool includes the three physiologic systems plus a section for scoring extra points based on blood pressure (BP) and respiratory status: (a) score 5 extra points for hypotension or the required use of a nonrebreather O_2 mask; and/or (b) score 2 extra points if a STAT Albuterol treatment is repeated twice in 1 hour or 1 hour of continuous Albuterol treatment is necessary. The PEWS action algorithm provides nurses with step-by-step workflows to follow based on the individual patient's PEWS score, including the activation of the pediatric rapid response team (PRRT) when necessary (Demmel et al., 2010).

Health care providers often miss observable warning signs exhibited by patients prior to a health crisis event (AHRQ, 2009; Douglas, Collado, & Keller, 2016; Murray et al., 2015; Tucker et al., 2009). Retrospective studies have shown that hospitalized patients displayed signs of physiologic deterioration within the 6- to 8-hour period preceding cardiopulmonary arrest (AHRQ, 2009; Douglas et al., 2016). Failure to identify signs of clinical deterioration and/or provide early interventions is known as *failure to rescue,* which has been associated with poor patient outcomes including death (AHRQ, 2009). Increasing regulations and expectations regarding quality have led to numerous initiatives for improving the quality and safety of care (AHRQ, 2009; Bellamo, 2012; Demmel et al., 2010; Douglas et al., 2016). Simple early warning scores (EWSs) have been successfully used in the hospitalized adult population to quickly assess a patient's condition and reliably predict the likelihood of deterioration (AHRQ, 2009;

Murray et al., 2015). These adult scores have been modified for use in children to reflect the anatomical and physiological factors unique to the pediatric population (infants to adolescents) which varies significantly from adults (Murray et al., 2015).

In 2004, the Institute of Health care Improvement (IHI) launched its 100,000 Lives Campaign with the goal of saving a minimum of 100,000 patient lives in U.S. hospitals (Demmel et al., 2010; Jankuloski et al., 2011). This major quality improvement project focused on six initiatives for improving safety and quality, one of which was the deployment of an emergency response team to the bedsides of deteriorating patients outside of critical care areas (Demmel et al., 2010). This emergency response team is called the rapid response team (RRT) and its purpose is to bring skilled, intensive care directly to the patient's bedside (Demmel et al., 2010). In 2006, Cincinnati Children's Hospital Medical Center (CCHMC) developed and implemented a PEWS that incorporated the activation of RRT alerts (AHRQ, 2009). CCHMC's PEWS included a simple scoring system called the PEWS scoring tool and a corresponding PEWS action algorithm (AHRQ, 2009). The CCHMC's PEWS scoring tool was found to be a reliable and effective tool for predicting patients who were likely to deteriorate after evaluating 40,000 scores for 3,000 patients (AHRQ, 2009). In 2007, the Child Health Corporation of America (CHCA) recommended for hospitals to implement the reliable and valid PEWS scoring tool to identify children at risk for clinical deterioration, manage deterioration by getting immediate help to the bedside and/or transferring the child to a higher level of care (Bell et al., 2013). Other organizations calling to improve early recognition and response to changing patients' conditions include the National Institute

for Health and Clinical Excellence (NICE) and The Joint Commission on Accreditation of Healthcare Organizations (TJC) (Bell et al., 2013; Demmel, Williams, & Flesch, 2010; Douglas, Collado, & Keller, 2016; Murray et al., 2015).

The positive social change that may be attributed to this doctoral project is the promotion of improved pediatric patient outcomes. Teaching the pediatric nursing team to understand the purpose and use of the comprehensive PEWS program (revised PEWS scoring tool and new PEWS action algorithm) should promote early recognition of children showing signs of clinical deterioration and empower nurses to act, ensuring timely and rapid intervention(s) (AHRQ, 2009; Demmel et al., 2010).

The PEWS has been shown to effectively identify patients at risk of clinical deterioration thereby; enhancing the timeliness of interventions (AHRQ, 2009; Demmel et al., 2010). The PEWS has been credited for decreasing the rates of many negative consequences associated with the failure to rescue such as adverse outcomes, rapid transfers to the pediatric intensive care unit (PICU), decreased lengths of stay (los) in the PICU, unexpected returns to the PICU, cardiac and/or respiratory arrests outside of the PICU, and preventable hospital deaths (AHRQ, 2009). The use of a PEWS has been reported to improve communication and teamwork between the interdisciplinary health care team and led to a sense of empowerment within the nursing team (AHRQ, 2009; Demmel et al., 2010). The implementation of the PEWS at CCHMC led to a decreased code rate outside of the PICU from five down to zero in a 30-month period (AHRQ, 2009). The 11% mortality rate for children transferred to the PICU decreased to 0%

within the first year of implementing the PEWS and the los in PICU was reduced by one day after the first year (AHRQ, 2009).

Problem Statement

The nursing culture of the inpatient pediatric unit was resistant to activating PRRT alerts despite clear guidelines for activation established in the hospital's PRRT policy. According to Williams et al. (2011), it is not unusual for nurses to decide against activating PRRT alerts even when a child exhibits clear signs of deterioration (Astroth, Woith, Stapleton, Degitz, & Jenkins, 2013; Jenkins, Astroth, & Woith, 2015). Rationales provided by the pediatric inpatient nurses for not activating PRRT alerts when appropriate included negative attitudes and comments expressed by the PRRT, belief that the pediatric resident's and/or attending physician's awareness of the situation was enough and/or insecurities related to their nursing competencies (Astroth et al., 2013; Jenkins et al., 2015).

The local children's hospital and health care practitioners are committed to providing safe, high quality, evidence-based care to the pediatric population they serve. As such, the hospital planned to incorporate a PEWS action algorithm into its existing PEWS program by the second quarter of 2019. Incorporating a PEWS action algorithm will provide a comprehensive evidence-based PEWS program. Nurses assign PEWS scores to patients using standardized assessment criteria (Agulnik et al., 2016; AHRQ, 2009; Demmel et al., 2010; Tucker et al., 2009). Based on the individual patient PEWS scores, nurses reference the PEWS action algorithm for guidance to perform additional patient assessments and/or interventions including the activation of PRRT alerts when

appropriate (AHRQ, 2009; Tucker et al., 2009). Utilizing a PEWS action algorithm not only provides nurses with guidance for action, it also empowers them to act, increases their critical thinking skills, increases self-efficacy, and improves their interdisciplinary communication and teamwork skills (AHRQ, 2009; Demmel et al., 2010).

Purpose

The children's hospital had an incomplete PEWS. The hospital previously adopted the CHCA's recommendation for implementing a PEWS scoring tool; however, the hospital did not implement a PEWS action algorithm to guide nurses' minimal actions based on the individual child's PEWS score (Bell et al., 2013; Tucker et al., 2009). The hospital planned to implement a PEWS action algorithm by the second quarter of 2019. The pediatric nursing team consistently assessed each patient every four hours using a preexisting PEWS scoring tool, then assigned and documented the PEWS scores. The PEWS scores were not routinely shared during hand-off of care or with other members of the health care team. In addition, the pediatric nurses and members of the interdisciplinary team did not have a shared mental model for the level of illness severity corresponding with the PEWS scores and color-coded system. My purpose in this project was to educate the pediatric nursing staff on a comprehensive PEWS program: (a) revised existing PEWS scoring tool; and (b) new PEWS action algorithm. My goals in this project were to increase the nurses' situational awareness of subtle changes in their patients' physiological status and empower nurses to activate PRRT alerts when necessary to improve patient outcomes.

The PICOT question for this doctoral project was as follows: In the pediatric nurses working within a children's hospital, how does the education of a PEWS action algorithm impact the knowledge, situational awareness and attitude of pediatric nurses in activating PRRT alerts as measured by post-education knowledge surveys (EKSs) when compared to the pre-EKSs prior to the education on the PEWS action algorithm?

I addressed the gap-in-practice by providing the health care team with a comprehensive PEWS that included both of the required components of an evidence-based PEWS: (a) reliable and valid PEWS scoring tool to identify children at risk for clinical deterioration; and (b) action algorithm to promptly manage clinical deterioration (Agulnik et al., 2016; AHRQ, 2009; Bell et al., 2013; Demmel et al., 2010). The nursing staff received education on the revised PEWS scoring tool and new PEWS action algorithm to accomplish the following goals: (a) increase their knowledge of the standardized language of the PEWS score, assessment criteria and the process for identifying early clinical deterioration in pediatric patients; (b) develop a shared mental model for the illness severity of a patient based on the PEWS score; (c) understand the process of the PEWS action algorithm to ensure a timely response from the medical team to diagnose the issue and order appropriate and timely interventions; (d) improve communication skills; (e) improve team building skills; (f) empower them to act; and (g) increase their self-efficacy to act (AHRQ, 2009; Murray et al., 2015).

Nature of the Doctoral Project

Early recognition of children at risk for deterioration has become a focus for improving outcomes for hospitalized children (Akre et al., 2010; Bell et al., 2013;

Bellamo, 2012; Demmell et al., 2010; Douglas et al., 2016; Duncan, Hutchison & Parshuram, 2006; Haines et al., 2006; Parshuram, Bayliss, Reimer, & Blanchard, 2011; Skaletzky, Raszynski, & Totapally, 2012; Tucker et al., 2009). PEWSs were developed to include objective clinical indicators and risk assessment tools to identify children at risk for deterioration and enable early recognition of changes in a child's physiologic condition (Akre et al., 2010; Duncan, Hutchison and Parshuram, 2006; Haines, Perrott, & Weir, 2006; Parshuram et al., 2011; Skaletzky et al., 2012; Tucker et al., 2009).

According to Shein et al. (1990), Franklin et al. (1994), and Buist et al. (1999), a substantial number of researchers highlight the fact that avoidable adverse clinical events are experienced by hospitalized patients (Jankuloski et al., 2011). Buist et al. (1999) argued that these adverse clinical events are "rarely sudden and unpredictable" as they are often preceded by one or more signs of physiologic and/or biochemical deterioration (Jankuloski et al., 2011). DeVita et al. (2006) identified flaws in the traditional health care model for responding to subtle signs of clinical deterioration and fault this model for substantial delays in response and initiation of treatment for patients exhibiting early signs of clinical deterioration (Jankuloski et al., 2011). DeVita et al. (2006) recommend for the traditional health care model to implement the following six steps to successfully identify and respond to early signs of clinical deterioration in patients:

- Timely response by all staff in a well-coordinated manner.
- Correct diagnosis of the problem.
- Communicating an accurate assessment of severity of the patient's condition.
- Take prompt and appropriate action.

- Document the actions taken.
- Document the patient response to the intervention(s) (Jankuloski et al., 2011).

The six steps described by DeVita et al. (2006) were easily applied to this education project. A comprehensive PEWS includes a PEWS scoring tool and PEWS action algorithm. Used in conjunction, these tools provide the health care team with a standardized language, assessment criteria and process for identifying early clinical deterioration in pediatric patients (AHRQ, 2009; Murray et al., 2015). The nurse performs patient assessments and assigns PEWS scores on every pediatric patient in his/her care every four hours. The PEWS score provides the health care team with an accurate assessment of the patient's illness severity. Based on the PEWS score, the PEWS action algorithm provides guidance for nursing actions to ensure a timely response for intervention in a well-coordinated manner. The action algorithm also includes a process for escalating communication with the health care team as well as additional assessments by the primary nurse and other members of the interdisciplinary team (AHRQ, 2009; Murray et al., 2015). The PEWS action algorithm also directs nurses to document actions taken by the nurse and interventions administered to the patient as well as the patient's response to the intervention. The sources for evidence to measure the success of this project were the EKSs that were administered and collected immediately prior to and after the PEWS education session (pre- and post-EKSs).

My purpose in this project was to educate the pediatric inpatient nursing staff on a comprehensive PEWS with an emphasis on learning how to use the new PEWS action algorithm. The goal of educating nurses on this comprehensive PEWS is to improve

patient outcomes by standardizing language, assessment criteria, and the process for identifying early clinical deterioration in pediatric patients, decreasing and/or eliminating barriers associated with escalation of care, and providing a tool to guide nursing actions for prompt immediate treatment (Agulnik et al., 2016; AHRQ, 2009; Bell et al., 2013; Demmel et al., 2010; Murray et al., 2015). In addition, I intended this project to empower the nursing team by increasing their self-efficacy and confidence in their skills of assessment, critical thinking, and communication to promote a cultural change from one that is resistant to activating PRRT alerts to one that proactively activates them when indicated. Other goals included the development of a shared mental model among nurses for a patient's illness severity and an understanding of the relationship between early identification of risk for deterioration, activation of PRRT alerts, timely interventions, and improved patient outcomes.

Significance

The setting for this project was a children's hospital within a Magnet designated suburban, not-for-profit, teaching university medical center in the mid-eastern United States. Although I focused this project on the inpatient pediatric unit, numerous stakeholders existed beyond the physical location of the unit. The senior nursing leadership team members were stakeholders in this project because they are responsible for leading initiatives focused on patient safety and quality as well as achieving the organization's goal of zero patient harm (A. Conte, personal communications, August 16, 2017). This leadership team had the power to provide resources to support the various phases of the project: education, implementation and evaluation. Members of the senior

nursing leadership team included the senior vice president of nursing and network chief nursing officer (CNO), vice president and hospital chief nurse executive (CNE), senior manager of patient care services, corporate director of nursing education and quality, Magnet program director, manager of corporate education, and director of center for nursing. Local nursing leader stakeholders in the children's hospital included the nurse managers and nurse manager assistants of the pediatric and PICU departments, the nurse manager of the nursing supervisor team, pediatric clinical nurse educator, and co-chairs of the unit-based professional practice committee. These local leaders supported the project leader on the unit level. The primary stakeholders for this project were the staff nurses working in the inpatient pediatric unit. Nurses providing direct patient care are responsible for accurately assessing pediatric patients' level of risk for deterioration by using the PEWS scoring tool and following the PEWS action algorithm to guide nursing actions based on the PEWS score. The success of this project was dependent on the knowledge and attitudes of staff nurses about the PEWS and their ability to use the PEWS tools properly. Buy-in consisted of more than nurses adopting the concept of PEWS, it required active learning to use the PEWS tools and understand the processes of the PEWS. The nursing staff was part of the interdisciplinary team therefore; members of the medical team were included as key stakeholders as they are responsible for responding to the nurse's call for action. The medical team included the chairman of the pediatric department, director of women's and children's services, PICU intensivists, pediatric hospitalists and pediatric resident physicians. Interdisciplinary education and

collaboration should foster improvements in communication and teamwork, putting the patient at the center of care.

The potential contribution of this doctoral project to nursing practice is the improvement of patient outcomes by educating nurses about an evidence-based PEWS inclusive of a PEWS action algorithm. This project demonstrated that a well-planned education project had a positive impact on pediatric nurses' confidence to activate PRRT alerts. The education program increased the nurses' knowledge and self-efficacy, which should empower them to act in the future. This project has the potential to be transferable to inpatient pediatric units in other children's hospitals by demonstrating the effectiveness of an EBP that addresses similar interests among children's hospitals which may strongly influence the transferability of information (Burchett, Mayhew, Lavis, & Dobrow, 2012). The use of the PEWS scoring tool may also be transferable to pediatric emergency departments (EDs) to determine the level of patient care assigned for a pediatric patient and PICUs to determine a patient's readiness to be transferred to a lower level of care (Gold et al., 2014). The potential for positive social change is improved outcomes for the pediatric patient population. Providing education on a comprehensive, evidence-based PEWS should provide the staff nursing team with a process for identifying early clinical deterioration in their pediatric patients and guide their nursing actions for additional assessments and prompt immediate treatment (AHRQ, 2009; Murray et al., 2015).

Summary

A growing body of evidence reveals that health care providers often miss observable signs of clinical deterioration exhibited by pediatric patients outside of ICU areas in the hours preceding a cardiac and/or respiratory arrest (Gold et al., 2014; Jankuloski et al., 2011; Murray et al., 2015). Research also demonstrates there are delays in implementation of interventions and nurses are often reluctant to activate PRRT alerts even when a child exhibits clear signs of deterioration secondary to personal and/or system barriers (Astroth et al., 2013; Jenkins et al., 2015). Failure to rescue patients has been associated with poor patient outcomes (AHRQ, 2009). A PEWS is an EBP that provides tools for tracking PEWS scores and triggering actions guided by the PEWS action algorithm. The goal of a PEWS is to improve patient outcomes for hospitalized children in non-ICU areas by using a reliable and valid PEWS scoring tool to identify children at risk for clinical deterioration in combination with a PEWS action algorithm to guide nursing actions to get prompt, immediate help to the bedside (Agulnik et al., 2016; Bell et al., 2013; Demmel et al., 2010).

Section 2: Background and Context

Introduction

Despite clear hospital guidelines for activating the PRRT when a child demonstrates signs and symptoms of clinical deterioration, the nursing culture of the inpatient pediatric unit was resistant to activating the PRRT. This culture was consistent with studies that identified a variety of barriers preventing nurses from activating PRRTs even when a child exhibits clear signs of deterioration (Astroth et al., 2013; Carter, 2015; Jankuloski et al., 2011; Jenkins et al., 2015; McLellan, & Connor, 2013). Nurses reported a variety of reasons for not activating the PRRT when appropriate including negative attitudes, remarks, and comments conveyed by the PRRT, belief that the pediatric resident's and/or attending physician's awareness of the situation was enough, and/or lack of self-efficacy in their nursing competencies (Astroth et al., 2013; Jenkins et al., 2015).

The PICOT question for this doctoral project was as follows: In the pediatric nurses working within a children's hospital, how does the education of a PEWS action algorithm impact the knowledge, situational awareness and attitude of pediatric nurses in activating PRRT alerts as measured by post-EKSs when compared to the pre-EKSs prior to the education on the PEWS action algorithm?

The purpose of this project was to educate the pediatric nursing staff on a comprehensive PEWS program: (a) revised existing PEWS scoring tool; and (b) new PEWS action algorithm. My goals in this project were to increase the nurses' situational

awareness of subtle changes in their patients' physiological status and empower them to activate PRRT alerts when necessary to improve patient outcomes.

Concepts, Models, and Theories

My focus in this doctoral project was education. An abundance of literature is available on the principles of adult learning however; one single theory is not fully supported over another due to the diverse manners in which adults learn (Curran, 2014). As such, I blended key components of three complementary education theories to provide the theoretical underpinnings for this education project: (a) *Knowles's adult learning theory*; (b) *Kolb's model of experiential learning*; and (b) *Bandura's social cognitive theory* (SCT) (Curran, 2014). I used *Kirkpatrick's four level evaluation model* to guide my doctoral project and evaluation of the outcome.

Knowles' adult learning theory is learner-focused and collaborative in nature (Curran, 2014; Mitchell & Courtney, 2005). Knowles describes the andragogical model as the art and science of helping adults to learn (Curran, 2014; Mitchell & Courtney, 2005). Knowles's theory is rooted in the humanistic philosophies of Maslow and Carl Rogers (Mitchell & Courtney, 2005). According to Worley (2001), Merriam, and Caffarella, Knowles's humanistic approach to learning influences the thought processes, behaviors, and emotions of the learner (Mitchell & Courtney, 2005). Adult learners, according to Knowles, are less interested in the content of education than they are in the learning process and its relevance to their life circumstances (Curran, 2014). The foundation of Knowles's theory is based on six key assumptions about adult learners:

- Need to know why they should learn something.

- Need for autonomy and self-direction.
- Life experience serves as a resource for learning.
- Readiness and/or applicability of the information to the learner's life situation.
- Motivation to learn.
- Problem-solving or task-focused orientation to learning (Curran, 2014; Mitchell & Courtney, 2005).

All the key assumptions of Knowles's adult learning theory applied to this project. The participants were recruited by providing them with information about the project, purpose and goals which satisfied the adult learner's need to know why they should learn about the PEWS. It also provided the nurses with a motivation to learn. The voluntary nature of participation satisfied the learner's need for autonomy and self-direction as well as the readiness to learn information relevant to the learner's professional knowledge base, skills and responsibilities. The clinical scenarios (case studies) provided in the PEWS class engaged learners in problem-solving and/or task-focused learning events and provided opportunities for learners to share life experiences which may have served as additional resources for learning (Curran, 2014; Mitchell & Courtney, 2005). Knowles's adult learning theory is illustrated in Figure 1.

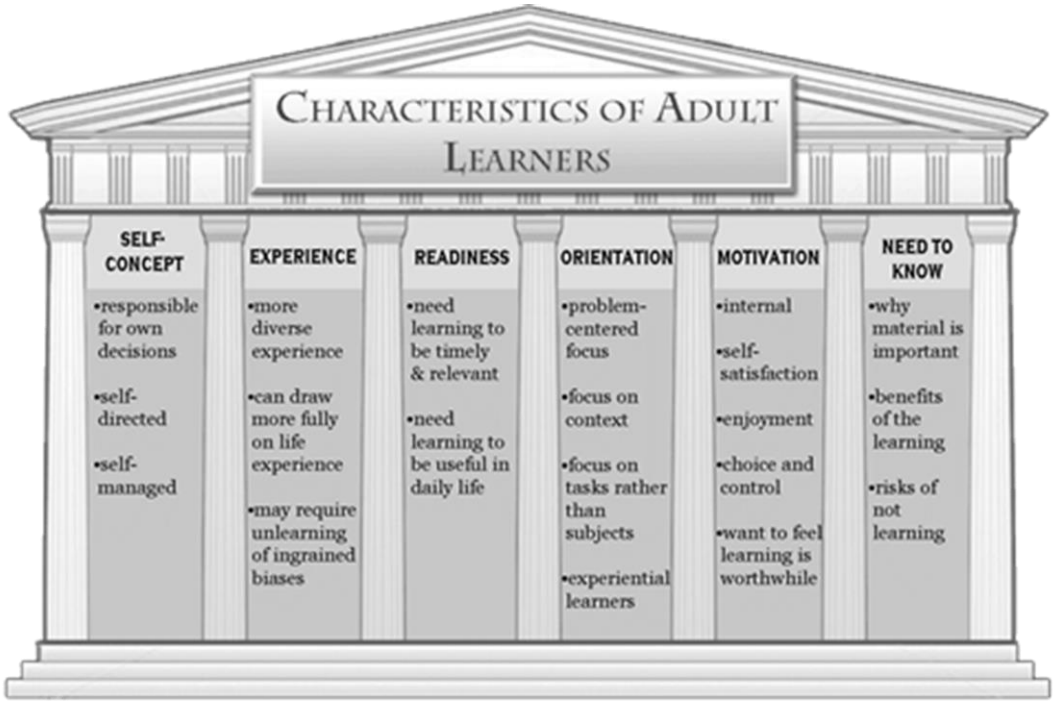

Figure 1. Knowles's adult learning theory. Reprinted from *Educational and Instructional Technology* by Andragogy: The adult learning theory of Malcolm Knowles, 2014, http://edtechtutorials.blogspot.com/2014/09/adragogy.html. Copyright 2014 by Andragogy. The adult learning theory of Malcolm Knowles.

Kolb's model of experiential learning is a middle-range learning theory based on Kolb's belief that learning occurs by the "grasping" (understanding) of experience (Fowler, 2008; Lisko & O'Dell, 2010; Manolis, Burns, Assudani, & Chinta, 2013). Kolb's model facilitates learning through the following actions:

- By doing.
- While experiencing.
- With hands on practice.
- With reflection (Hill, 2017).

Kolb (1984, p. 38) described learning as the 'process whereby knowledge is created through the transformation of experience' (McLeod, 2013, p. e1). Kolb's theory includes a four-stage cycle of learning and four distinct learning styles (Hill, 2017; McLeod, 2013). The four stages of the experiential learning cycle include:

- Concrete experience (CE).
- Reflective observation (RO).
- Abstract conceptualization (AC).
- Active experimentation (AE) (Hill, 2017; Manolis et al., 2013; McLeod, 2013).

The four learning styles include:

- Accommodating (CE/AE).
- Converging (AC/AE).
- Diverging (CE/RO).
- Assimilating (AC/RO) (Manolis et al., 2013; McLeod, 2013).

Learners may enter the cycle of learning at any stage however; for learning to be effective, they must progress through each stage of the learning cycle in sequence (Lisko & O'Dell, 2010; McLeod, 2013). An individual's preferred learning style is the product of two pairs of variables along the process and perception continuums, develop over time and influenced by factors such as the individual's cognitive structure, social environmental and educational experiences (Lisko & O'Dell, 2010; Manolis et al., 2013; McLeod, 2013). Kolb illustrated the continuums by using lines of an axis, each of which has conflicting learning styles at either end: (a) the east-west axis represents the process

continuum (AE/RO); and the north-south axis represents the perception continuum (CE/AC) (Manolis et al., 2013; McLeod, 2103). The model can also be seen viewed as a two-by-two matrix which represents a combination of two preferred styles (McLeod, 2013).

The interactive nature of the PEWS class supported Kolb's description of learning as the 'process whereby knowledge is created through the transformation of experience' (McLeod, 2013, p. e1). The PEWS class provided didactic information that was reinforced by the learner's experience by doing, while experiencing, with hands on practice, and with reflection (Hill, 2017). Clinical scenarios (case studies) provided opportunities for learners to calculate PEWS scores and use the PEWS action algorithm to guide actions based on the PEWS score. The learners shared past experiences and reflected on how the new information and PEWS tools may have affected outcomes in the past. Kolb's Model of Experiential Learning is illustrated in Figure 2.

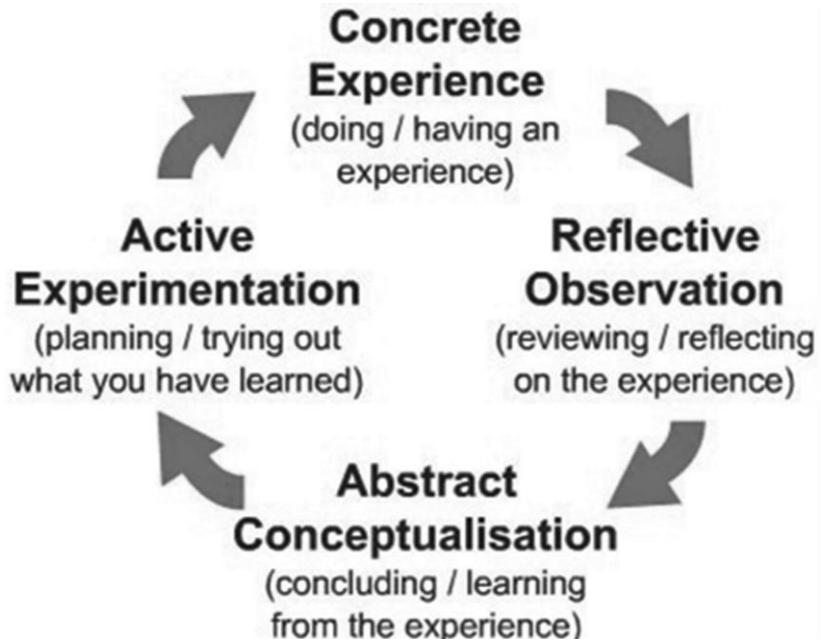

Figure 2. Kolb's model of experiential learning. Reprinted from *Simply Psychology* by McLeod, 2017, https://www.simplypsychology.org/learning-kolb.html. Copyright 2017 by McLeod.

Bandura's SCT is a middle-range behavior and learning theory that postulates that people learn from one another by means of observation, imitation, and modeling (Garcia, 2016; McEwen & Mills, 2014). SCT differs from other behavioral change and social learning theories in that its foundation is based on the concept of *reciprocal determinism* in which Bandura (1986) affirms that human behavior is influenced by continuous, bidirectional interplay of three key elements: personal factors (cognition, affect, and biological events), environmental influences, and resulting behavior (Garcia, 2016; Hodges & Videto, 2011). SCT emphasizes that cognition plays a critical role in peoples' ability to alter their environment, self-regulate, translate information, and execute behaviors (Weld, Padden, Ramsey, & Bibb, 2008). SCT is rooted in the concept of

human agency in which people are individual agents who proactively participate in their self-development and can create outcomes based on their own actions (Hodges & Videto, 2011). The three core constructs of SCT are *self-efficacy*, *self-control*, and *expectations* (Elmore & Sharma, 2013; Hodges & Videto, 2011; Sosa, 2012). According to Bandura (1986), a crucial element for the human agency is self-efficacy (Grossklaus & Marvicsin, 2104, p. 72; Hodges & Videto, 2011). Other constructs of SCT include environment, behavioral capacity, observational learning, and reinforcements (Knol et al., 2016).

The concept of reciprocal determinism is applicable to this project because nurses were reluctant to activate PRRTs secondary to barriers such as their lack of knowledge, guidance for action, and self-efficacy in their nursing competencies (AHRQ, 2009; Astroth et al., 2013; Jenkins et al., 2015). My purpose in this project was to educate the pediatric nursing staff on a comprehensive PEWS program with goals of increasing the nurses' situational awareness of subtle changes in their patients' physiological status and providing them with an action algorithm to empower them to activate PRRT alerts when necessary to improve patient outcomes. Bandura's SCT is illustrated in Figure 3.

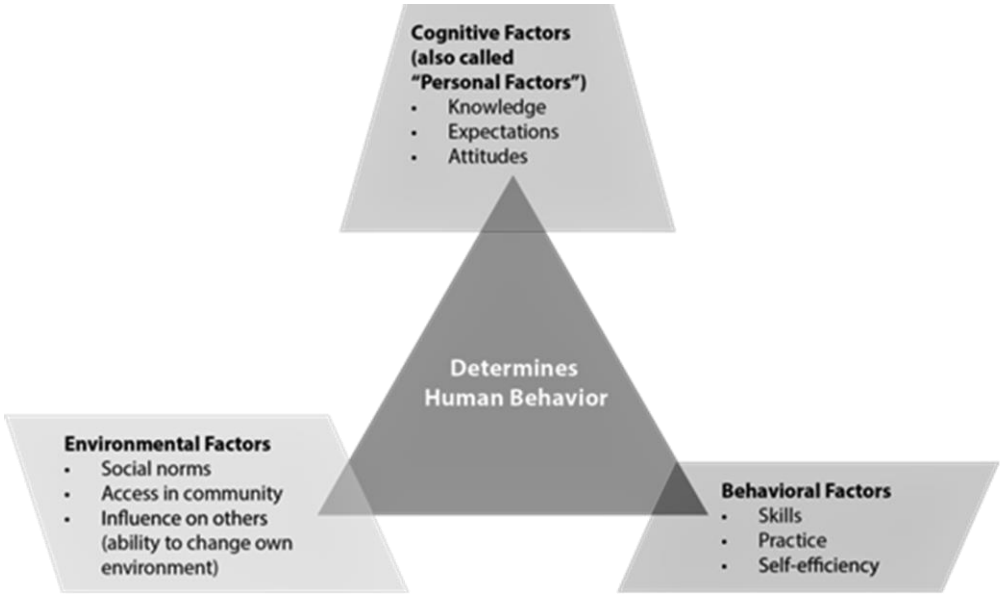

Figure 3. Bandura's social cognitive theory. Reprinted from *SBCC for Emergency Preparedness* by Johns Hopkins University, 2016, http://www.euromonitor.com/. Copyright 2016 by Johns Hopkins University.

Promoting and facilitating the integration of evidence into nursing practice improves and enhances nursing practice-related outcomes (Curran, 2014). Successful integration of EBP requires education methods that promote learning by actively engaging the learners in the process, transfer of learning into nursing practice. and organizational knowledge and excellence (Curran, 2014). The various learning styles of adult learners requires educators to be creative in their teaching methods (Curran, 2014; Lisko & O'Dell, 2010). The three for mentioned adult learning theories capture key elements associated with adult learning and in some cases, share overlapping concepts. Infusing the elements of three different learning theories helped ensure learning transfer by incorporating learning styles that best matched the preferred learning style of each

nurse (McLeod, 2013). The validity and reliability of these learning theories promoted their application in the health care arena for nursing and patient education, and they have been successfully applied to motivate behavioral changes in learners (Curran, 2014; Lisko & O'Dell, 2010). The application of these three learning theories contributed to meeting my goals in this capstone project which were to increase situational awareness of the pediatric nurses and empower them to activate PRRT alerts when necessary to improve patient outcomes. Learning the level of illness severity associated with individual PEWS scores and following the corresponding PEWS action algorithm were relevant to the pediatric nurses' clinical practice therefore; should promote critical thinking, autonomy to act, and self-efficacy (Curran, 2014; Lisko & O'Dell, 2010).

Kirkpatrick's four level evaluation model was used to guide the development of my education project and evaluate the outcome. Kirkpatrick's four level approach was developed in the 1950s by Donald Kirkpatrick as a model for evaluating learner outcomes for the training program industry (Frye & Hemmer, 2012; Kirkpatrick & Kirkpatrick, 2007). According to Bates (2004), Kirkpatrick's model has been used as the primary organizing plan for evaluating training programs for by a variety of institutions and organizations such as education, business, and research (Abdulghani, Shaik, & Khamis, 2014; Frye & Hemmer, 2012). Kirkpatrick's evaluation model provides an action-oriented design and useful tools for developing results driven education programs (Kirkpatrick & Kirkpatrick, 2007). This model also provides a logical and systematic approach for gathering data useful for evaluation (Abdulghani et al., 2014). Kirkpatrick's model focuses on program outcomes in relation to the program's objectives, goals, and

mission not simply learner satisfaction (Frye & Hemmer, 2012). This model is composed of four hierarchal levels for evaluating program outcomes, with each level impacting the next level:

1. *Level 1, Reaction* – learner satisfaction or how the participant feels about the program.
2. *Level II, Learning* – evaluates acquisition of knowledge and skills.
3. *Level III, Behaviors* – evaluates the application of learning into practice.
4. *Level IV, Results* – evaluates the programs impact on outcomes in the context of the program's overall mission and impact on society such as patient outcomes and/or improved health care team performance) (Abdulghani et al., 2014; Frye & Hemmer, 2012; Mann, Sargeant, & Hill, 2009).

Given the purpose of this DNP project and the time constraints for teaching the PEWS class, Levels I and II of Kirkpatrick's model were evaluated, reaction and learning respectively. An accurate evaluation of levels III and IV require a longer timeframe for nurses to apply learning into practice and even longer for practice changes to affect outcomes (Kirkpatrick & Kirkpatrick, 2007). Kirkpatrick's four level evaluation model is illustrated in Figure 4.

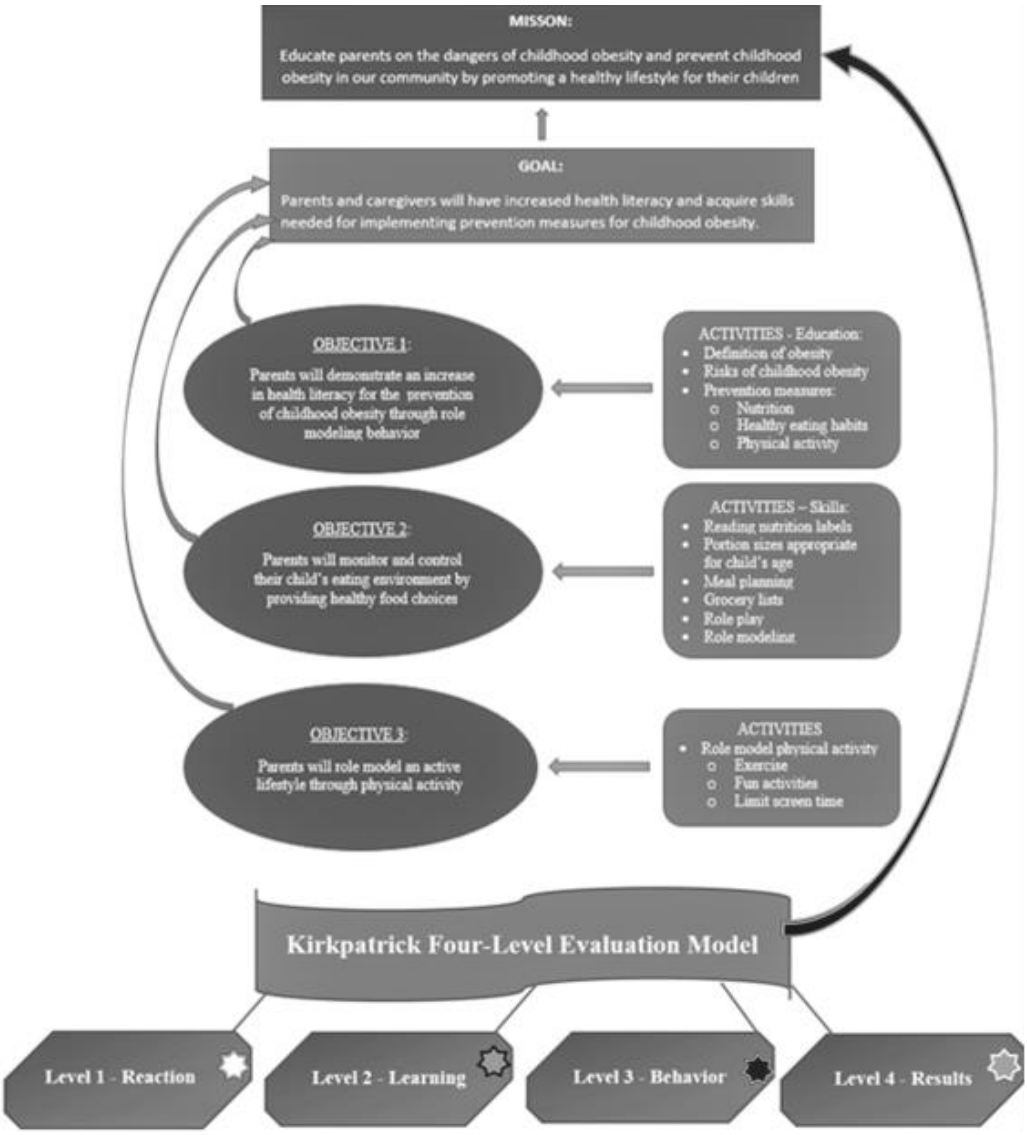

Figure 4. Kirkpatrick's four level evaluation model. Adapted from Adapted from *Implementing the four levels: A practical guide for effective evaluation of training programs* by Kirkpatrick & Kirkpatrick, 2007. Copyright 2007 by Berrett-Koehler Publishers, Inc.

Definition of Terms

Abstract conceptualization: concluding and/or learning from experience by using logic and ideas to understand the situation or problem (Lisko & O'Dell, 2010; McLeod, 2013).

Accommodation: "learn through apprehension and active, hand-on experimentation" (Lisko & O'Dell, 2010, p. 107).

Active experimentation: tests theory by planning and/or trying out what was learned through an experience (Lisko & O'Dell, 2010; McLeod, 2013).

Apprehension: understanding occurs through participation in the concrete experience (Lisko & O'Dell, 2010).

Assimilation: learn by comprehension and internalize the learning (Lisko & O'Dell, 2010, p. 107).

Comprehension: understanding occurs outside the concrete experience through abstract conceptualization (Lisko & O'Dell, 2010).

Concrete experiences: the source of learning comes from the learner doing or having an experience (Lisko & O'Dell, 2010; McLeod, 2013).

Converging: "learn by comprehension, considering abstract ideas separate from the actual experience" (Lisko & O'Dell, 2010, p. 107).

Diverging: learn through apprehension and internalize via reflection (Lisko & O'Dell, 2010).

Expectations: belief that specific behaviors will result in positive outcomes (Elmore & Sharma, 2013; Hodges & Videto, 2011; Pajares, 2002, electronic; Sosa, 2012).

Perception continuum: an individual's emotional responses, or how one thinks or feels about something (McLeod, 2013)

Processing continuum: how individual approaches a task (McLeod, 2013).

Reciprocal determinism: "dynamic interaction of a person, his or her behavior, and the environment in which the behavior is performed" (Garcia, 2016, p. 172).

Reflective observation: to make sense of, and organize the concrete experience (Fowler, 2008; Lisko & O'Dell, 2010; McLeod, 2013).

Self-control: ability to adjust behavior to achieve self-rewards and goals (Elmore & Sharma, 2013; Hodges & Videto, 2011; Sosa, 2012).

Self-efficacy: one's self-confidence and belief that he/she can control his/her thoughts, feelings, and behaviors to actively engage in specific, recommended actions to achieve desired outcomes (Elmore & Sharma, 2013; Garcia, 2016; Hodges & Videto, 2011; Sosa, 2012).

Self-regulate: controlling oneself (Garcia, 2016).

Relevance to Nursing Practice

Hospitalized patients frequently suffer from avoidable adverse clinical events (Jankuloski et al., 2011). According to Buist et al. (1999), adverse clinical events are seldom sudden and unpredictable as they are typically preceded by one or more signs of physiologic and/or biochemical deterioration (Jankuloski et al., 2011). Unfortunately,

health care professionals frequently miss recognizable warning signs of clinical deterioration shown by patients well in advance of a health crisis event (AHRQ, 2009; Douglas et al., 2016; Murray et al., 2015; Tucker et al., 2009). This failure to rescue patients has been associated with poor patient outcomes including death (AHRQ, 2009). According to DeVita et al. (2006), our flawed health care model inhibits clinicians' recognition of, and response to subtle signs of clinical deterioration thereby causing substantial delays in response and initiation of treatment for patients exhibiting early signs of clinical deterioration (Jankuloski et al., 2011). The six recommended steps outlined by DeVita et al. (2006) are designed to successfully identify and respond to early signs of clinical deterioration in patients:

- Timely response by all staff in a well-coordinated manner.
- Correct diagnosis of the problem.
- Communicating an accurate assessment of severity of the patient's condition.
- Take prompt and appropriate action.
- Document the actions taken.
- Document the patient response to the intervention(s) (Jankuloski et al., 2011).

I used this doctoral project to fill the identified gap-in-practice by educating the pediatric nurses on a comprehensive PEWS. The revised PEWS scoring tool enabled nurses to identify children at risk for clinical deterioration and the PEWS action algorithm should empower them take timely action to get immediate help to the bedside

by activating PRRT alerts (Bell et al., 2013). The education project was designed to address the six steps previously outlined by DeVita et al. (2006) (Jankuloski et al., 2011).

The past practice for this pediatric unit was to assess pediatric patients every four hours and assign a PEWS score using an outdated PEWS scoring tool. PEWS scores were not shared with the health care team and the frequency of patient assessments did not increase with higher scores. In addition, the previous scoring tool was insufficient for identifying increased risk because there were no extra points assigned for specific physiologic disturbances. There was no trending of the PEWS scores to identify patients who were exhibiting increased risk for deterioration. The nursing team and pediatric interdisciplinary team did not have a shared mental model for illness severity or standardized responses. These inconsistencies likely contributed to the resistant culture for activating PRRT alerts and delaying necessary interventions. This was evidenced by the lack of PRRT alerts over a two-year period despite transfers from the pediatric unit to the PICU.

Local Background and Context

My clinical observations and conversations with the nursing and physician staff in the pediatric unit indicated that the current nursing culture was resistant to activating PRRT alerts despite clear guidelines for activation established in the hospital's PRRT policy. The average number of PRRT activations in the inpatient pediatric unit is two per year (P. Chapple, April 4, 2018). In 2017, one PRRT was activated in the inpatient pediatric unit even though 40 children were transferred from the inpatient unit to the PICU for clinical deterioration (P. Chapple, personal communications, April 4, 2018).

Many nurses, including members of the management team state, “we almost had a rapid response today”. When questioned about what happened, it was clear the patient was exhibiting signs of deterioration but rather than activate the PRRT, the nurses talked amongst each other, made multiple phone calls to the resident physician, and/or waited between 3-6 hours before receiving orders for interventions.

On one occasion, a practitioner entered a patient’s room to assist an experienced nurse and noted that the infant was having periods of apnea related to seizure activity. The practitioner informed the nurse that she was going to activate the PRRT and was stunned when the nurse replied, “please don’t call a rapid”. When the nurse was asked why not, she responded that she didn’t want to “make a big deal of it” and didn’t want “all the doctors mad” at her. She stated that she had notified the pediatric resident who came to evaluate the infant and had since been in touch with the attending physician and pediatric intensivist. She had been waiting over an hour for follow-up orders. The practitioner respectfully declined her request not to activate the PRRT and activated it. The team arrived immediately. The patient was transferred to the PICU within 5 minutes of the PRRTs arrival. The infant was subsequently intubated in the PICU.

One of the most troubling events occurred on the night shift when a 14-year-old, narcotic naïve patient was received from a sister hospital. Upon arrival, the transport nurse reported that he gave 15 mg of IV morphine to the patient in transit in addition to the 2 mg she received in the sending ED (total dose of 17 mg of IV morphine within the period of one hour). Shortly after her arrival, the child became obtunded and had significant respiratory depression with frequent episodes of apnea. The nurse called the

pediatric resident and requested for the patient to be transferred to PICU. The resident evaluated the patient at different times and told the nurse the patient was breathing fine when he examined her. The nurse documented that she informed the resident that she would "call the PRRT if he did not return to the bedside immediately." All three nurses working on the unit at the time actively advocated for the patient to be transferred to PICU but none of them escalated their concerns by activating the PRRT alert, calling the attending physician or nursing supervisor. The patient remained on the pediatric inpatient unit even though she received hourly doses of IV Narcan (totaling five doses) to reverse the respiratory effects of her acute narcotic overdose. Thankfully the patient recovered and was discharged without harm. This incident highlighted nurses' confusion about activating the PRRT and lack of knowledge and/or confidence for escalating patient care despite an existing policy for activating the PRRT and a PEWS scoring program. It is important to note that the PEWS score for this patient did not represent the clinical presentation of the patient.

The existing PEWS used in the hospital consisted of a PEWS scoring tool only. Nurses routinely assigned PEWS scores to patients every four hours using standardized assessment criteria (Agulnik et al., 2016; AHRQ, 2009; Demmel et al., 2010; Tucker et al., 2009). The PEWS scores were not routinely assessed for trends or shared with members of the health care team to promote situational awareness of a child's level of risk for deterioration. Although PEWS scores were assigned, the nurses did not process the significance of the PEWS score or escalate care based on the PEWS score equivalently. Providing the pediatric inpatient nurses with education about the purpose

and use of a PEWS action algorithm provided guidance for additional assessments and/or actions based on a child's PEWS score. The PEWS score and correlating escalation of care recommendations within the PEWS action algorithm should help to increase the nurses' critical thinking skills and self-efficacy. In turn, nurses should improve their interdisciplinary communication and teamwork skills, all of which should empower them to act (AHRQ, 2009). The inclusion of a PEWS action algorithm with the revised PEWS scoring tool provides the hospital with a comprehensive evidence-based PEWS (AHRQ, 2009).

The setting for this education project was a Magnet designated suburban, not-for-profit, teaching university medical center in the mid-eastern United States. It has a trauma department, pediatric emergency department, pediatric inpatient unit, pediatric same day stay, PICU, NICU, and maternal child health department. The medical center provides services a diverse population encompassing two counties with a population of nearly 1.8 million. The unit was an inpatient pediatric unit housed in a children's hospital within a hospital and is part of the area's state designated children's hospital. This children's hospital is also part of the region's only level II trauma center. The pediatric inpatient unit occupies two floors in the hospital and is licensed for 44 beds. The average volume of annual admissions is approximately 2,900 (not including observation patients), average daily census (ADC) was 19.5, and the average length of stay (ALOS) was 1.9 days. The pediatric nursing leadership team included the senior manager of patient care services for the children's hospital, one nurse manager for the pediatric department, and four nurse manager assistants for the inpatient pediatric unit.

There were 34 permanent registered nurse (RN) team members and 14 float RNs who are supported by an ancillary team of eight patient care technicians (PCTs) and five nursing unit assistants. All patient assessments were performed by RNs. Direct patient care was performed by RNs with some care responsibilities appropriately delegated to the PCT team members. The physician team was board certified. There were three pediatric intensivists, five pediatric hospitalists, 18 pediatric resident physicians, one nurse practitioner (NP), and four child life specialists (CLSs). The children's hospital also had board certified pediatric surgeons, urologists, orthopedists, neurosurgeons, gastroenterologists, endocrinologists, pulmonologists and neonatologists. The top five admitting diagnoses year-to-date (YTD) were seizure, asthma, bronchiolitis and RSV infections, general surgery and gastrointestinal disorders.

The landmark report by the Institute of Medicine (IOM) in 1999, *To Err is Human: Building a Safer Health System,* captured the attention of the health care legislators and the health care industry worldwide, serving as the catalyst to create a safer health care environment (Demmel et al., 2010). The U.S. Congress responded by adopting The Patient Safety and Quality Act in 2005, requiring U.S. hospitals to develop a culture of safety (Demmel et al., 2010). Many health care quality groups have advocated for hospitals to improve the safety and quality of care delivery through quality initiatives such as RRT programs and EWSs (Bell et al., 2013; Bellamo, 2012; Demmel et al., 2010; Douglas et al., 2016; Edwards, Powell, Mason, & Oliver, 2009; Ennis, 2014). These and other quality initiatives were endorsed by health care and professional organizations including the American Nurses Association (ANA), Centers for Medicare

and Medicaid Services, American Medical Association (AMA), TJC, and Association of American Medical Collages (AAMC) (Bellamo, 2012).

NICE recommended for hospitals to implement EWSs for the adult population that uses "multiparameter and aggregate-weighted scoring systems" to identify patients at risk for deterioration (Edwards et al., 2009, p. 604). NICE (2007) and Pearson (2008) reported that international and local recommendations were made for hospitals caring for children to incorporate EWSs into the routine care of hospitalized children (Ennis, 2014). According to the CHCA, early recognition of subtle signs of clinical deterioration in children with prompt intervention is essential for preventing cardiopulmonary arrest in hospitalized children (Bell et al., 2013). As such, the CHCA recommends for children's hospitals to implement reliable and validated PEWS tools to identify children at risk for clinical deterioration, noting that higher PEWS scores are associated with poorer outcomes (Bell et al., 2013). Improving health care providers' recognition and responses to changes in a patient's condition were initially advocated by the IHI, NICE, and TJC (et al., 2016) prior to TJC including it as a National Patient Safety Goals (NPSG) for hospitals in 2009 (Demmel et al., 2010).

Role of the DNP Student

I performed this project in the pediatric inpatient unit where I was employed as the pediatric clinical nurse educator. As the clinical nurse educator for the pediatric department, I was responsible for all the education and orientation of RNs and PCTs, development and maintenance of policies and procedures, guideline development, performance improvement projects, and other projects as assigned. I had developed

positive, collaborative working relationships with the nursing leadership team, nursing staff, ancillary staff and members of the interdisciplinary team.

I was the primary educator for this project. I used Kirkpatrick's four level evaluation model to guide the development of my education program and evaluate the outcome of my DNP project. I incorporated key elements from three complimentary adult education theories to guide my teaching methods: Knowles's adult learning theory, Kolb's model of experiential learning and Bandura's SCT. I worked with an interdisciplinary team to revise the existing PEWS scoring tool and create a PEWS action algorithm. The nursing leadership supported the education plan by relieving nurses to attend formal classes. I elicited help from the hospital's center for nursing research to analyze the project data.

The motivation for this project came from my firm commitment to providing safe, quality, evidence-based nursing care. Nurses shared their confusion regarding the appropriate circumstances and time for activating a PRRT alert. Nurses often reported that they didn't call a PRRT because the doctor was aware of the situation and following up with the patient. As the DNP student, it was my responsibility to provide the nursing team with education and training for providing excellent nursing care, including their ability to identify and respond to early signs of clinical deterioration in hospitalized children. As a staunch patient and nurse advocate, I believe I have a duty to empower the nursing team to act, increases their critical thinking skills, increases self-efficacy, and improve their interdisciplinary communication and teamwork skills. The inclusion and education of a PEWS action algorithm with the hospital's revised PEWS scoring tool

provides the hospital with a comprehensive evidence-based PEWS (AHRQ, 2009). Providing nurses with EBP PEWS action algorithm should promote a cultural change within the pediatric inpatient unit, fostering nurses and members of the interdisciplinary team to embrace the PEWS and realize the patient benefits of activating PRRT alerts.

There was a potential for bias with this project because I worked at the project site and had personal relationships with many of the pediatric nurses. To limit or eliminate bias, I had objective members of the nursing research committee review the content of the education PPT, data collection tools, and pre- and post-EKSs to ensure objectivity. I had an attendant from each class assess my presentation and verify that it was presented free of bias by signing a declaration statement at the end of the presentation. Anonymity was ensured amongst the nursing team members when forms were collected by having each participant seal her data collection forms in a plain, unmarked envelope which was collected by a volunteer from the class and placed randomly in the collection file box.

Summary

A growing body of evidence reveals that health care clinicians frequently miss observable signs of clinical deterioration exhibited by pediatric patients outside of ICU areas in the hours preceding a critical clinical event (Gold et al., 2014; Jankuloski et al., 2011; Murray et al., 2015). Research demonstrates nurses are often reluctant to activate PRRT alerts even when a child exhibits clear signs of deterioration (Astroth et al., 2013; Jenkins et al., 2015). Frequent delays in implementation of interventions and follow-up assessments may lead to situations of failure to rescue (AHRQ, 2009; Astroth et al., 2013; Jenkins et al., 2015). A comprehensive PEWS is an EBP that provides tools for

tracking PEWS scores and triggering actions guided by the PEWS action algorithm (Agulnik et al., 2016; Bell et al., 2013; Demmel et al., 2010). My focus for this doctoral project was education about a comprehensive PEWS inclusive of a PEWS action algorithm to enable nurses to recognize children at risk for clinical deterioration and guide their actions to get prompt, immediate help to the bedside. I used Kirkpatrick's four level evaluation model to guide the development of my education program and evaluate the outcome of my DNP project. The key elements of the three complimentary adult education theories were incorporated in my plan to guide my teaching methods:

- Knowles' adult learning theory:
    - Need to know why they should learn something.
    - Need for autonomy and self-direction.
    - Life experience serves as a resource for learning.
    - Readiness and/or applicability of the information to the learner's life situation.
    - Motivation to learn.
    - Problem-solving or task-focused orientation to learning (Curran, 2014; Mitchell & Courtney, 2005).
- Kolb's model of experiential learning:
    - Learner's experience by doing.
    - While experiencing.
    - With hands on practice.
    - With reflection (Hill, 2017).

- Bandura's SCT:
    - Self-efficacy.
    - Self-control.
    - Expectations (Elmore & Sharma, 2013; Hodges & Videto, 2011; Sosa, 2012).

Reviewing the evidence related to comprehensive PEWSs helped me to plan my education project, design my education PowerPoint (PPT), and develop evaluation tools.

Section 3: Collection and Analysis of Evidence

Introduction

Despite clear hospital guidelines for activating the PRRT, the nursing culture of the inpatient pediatric unit was resistant to activating PRRT alerts. This culture was consistent with studies that found it is not unusual for nurses to decide against activating PRRTs even when a child exhibits clear signs of deterioration (Astroth et al., 2013; Jenkins et al., 2015). Nurses reported a variety of reasons for not activating PRRT alerts when appropriate including negative attitudes and remarks conveyed by the PRRT, belief that the pediatric resident's and/or attending physician's awareness of the situation was enough, and/or lack of self-efficacy in their nursing competencies (Astroth et al., 2013; Jenkins et al., 2015). The purpose of this project was to educate the pediatric nursing staff on a comprehensive PEWS program inclusive of a PEWS action algorithm.

Practice-Focused Question

The nursing culture in the pediatric inpatient nursing unit was resistant to activating PRRT alerts despite clear guidelines for activation established in the hospital's PRRT policy. As the pediatric clinical nurse educator, I received beeper and email messages when a PRRT alert was activated. The annual average activation of PRRT alerts was two or less even though there were numerous PICU transfers related to clinical deterioration. Nurses shared information with me about patient situations that upset them because they believed that the physicians should have intervened sooner or transferred the patient to PICU. Several nurses have retrospectively reported that they should have activated PRRT alerts for specific patient care situations. I witnessed situations that

required the activation of a PRRT alert according to the PRRT policy, but the primary nurse was reluctant to activate the team for fear of negative repercussions. There have been many instances when PRRT alerts should have been activated according to the patient's clinical presentation but the lack of knowledge, guidance for action, self-efficacy, and standardized language created barriers for the nursing team (AHRQ, 2009). The preexisting PEWS used in the hospital consisted of the PEWS scoring tool only. Nurses routinely assigned PEWS scores to patients every 4 hours using standardized assessment criteria however; they did not routinely share their patients' PEWS scores with other members of the health care team, assess trends in their patients' PEWS scores, increase the frequency of patient assessments and PEWS scoring, promote situational awareness of a child's level of risk for deterioration, and/or use the PEWS score to guide their actions.

My project question originated from the clinical practice problem and gap-in-practice. The narrative PICOT question for this doctoral project was as follows: In the pediatric nurses working within a children's hospital, how does the education of a PEWS action algorithm impact the knowledge, situational awareness and attitude of pediatric nurses in activating PRRT alerts as measured by post-EKSs when compared to the pre-EKSs prior to the education on the PEWS action algorithm?

The PICOT format for the clinical practice question was:

- **P:** Pediatric nurses working within a children's hospital.
- **I:** Education of a PEWS action algorithm.
- **C:** Post-EKSs compared to the pre-EKSs.

- **O:** Impact the knowledge, situational awareness and attitude of pediatric nurses in activating PRRT alerts.

My literature search about RRTs and failure to rescue led to my chosen EBP solution. The hospital had a preexisting PEWS scoring program but did not have a PEWS action. My purpose in this project was to educate the pediatric nursing staff on a comprehensive PEWS program: (a) revised pre-existing PEWS scoring tool, and (b) new PEWS action algorithm. The goals of this project were to increase the nurses' situational awareness of subtle changes in their patients' physiological status and empower nurses to activate PRRT alerts when necessary to improve patient outcomes.

Sources of Evidence

This project took place at a Magnet designated suburban, not-for-profit, teaching university medical center in the mid-eastern United States. The site was an inpatient pediatric unit housed in a children's hospital within a hospital and part of the region's state designated children's hospital. This children's hospital was also part of the region's only level II trauma center. The pediatric inpatient unit was licensed for 44 beds and had an average daily census (ADC) of 19.5, and the average LOS was 1.9 days. The pediatric department nursing leadership team included one senior manager of patient care services for the children's hospital, one nurse manager and four nurse manager assistants. There were 34 permanent RN team members and 14 float RNs. The children's hospital had board certified pediatric surgeons, urologists, orthopedists, neurosurgeons, gastroenterologists, endocrinologists, pulmonologists, and neonatologists. The top five

admitting diagnoses year-to-date (YTD) were seizure, asthma, bronchiolitis and RSV infections, general surgery and gastrointestinal disorders.

The sources of evidence for measuring the impact of this education project were the results of the EKSs administered before and after the PEWS education (pre- and post-EKSs respectively). The scores for these EKSs were compared to evaluate whether learning occurred and if the education impacted the knowledge and attitude of pediatric nurses to activate PRRT alerts.

My purpose in this project was to educate the pediatric nursing staff on a comprehensive PEWS inclusive of a PEWS action algorithm to increase the nurses' situational awareness of increased risk of patient deterioration and empower them to activate PRRT alerts when necessary to improve patient outcomes. The pediatric nurses were provided education on the PEWS using an interactive PPT presentation that provided rationales, information, and practice scenarios to inform their nursing assessments and clinical decisions as well as empowering them to act. The success of this education project was determined by comparing the pre- and post-EKS scores. If the post-EKS scores following the education were greater than the pre-EKS scores, the evidence would demonstrate that learning occurred.

Providing education on a comprehensive PEWS for the pediatric inpatient nursing team improved their knowledge and understanding of the two PEWS components: (a) scoring tool, and (b) action algorithm (Agulnik et al., 2016; AHRQ, 2009; Bell et al., 2013; Demmel et al., 2010). The nurses learned the following aspects of the standardized process for identifying early clinical deterioration in pediatric patients: (a) assessment

criteria for assigning PEWS scores; (b) illness severity based on the PEWS score; and (c) PEWS action algorithm to ensure a timely response and interventions (AHRQ, 2009; Murray et al., 2015). Understanding illness severity and how to apply the escalation of care recommendations for specific PEWS scores should improve outcomes by enabling pediatric nurses to identify children at increased risk for clinical deterioration, empowering them to act, improving communication and team building skills, and increasing their self-efficacy to act (Agulnik et al., 2016; AHRQ, 2009; Bell et al., 2013; Demmel et al., 2010).

I conducted an electronic literature search exploring the following databases: Cochrane Database of Systematic Reviews, Cumulative Index to Nursing & Allied Health Literature (CINAHL) Plus with Full Text, MEDLINE with Full Text, and ProQuest Nursing and Allied Health Source. Limitations applied to the article search included full text, peer-reviewed scholarly journals, and English language. Because PEWSs are relatively new, I expanded publication dates to include articles between 2005 and 2019 (AHRQ, 2009; Haines et al., 2006; Jankuloski et al., 2011; Murray et al., 2015). Search words and phrases included *pediatric early warning system, pediatric early warning system score, pediatric early warning score, pediatric early warning system algorithm, pediatric early warning system action algorithm, pediatric early warning score algorithm, pediatric early warning system score action algorithm, pediatric early warning system decision-tree, pediatric early warning score decision-tree, pediatric early warning system research, pediatric early warning score research, pediatric early warning system tools, pediatric early warning score tools, PEWS, PEWS score, PEW*

score, PEWS action algorithm, PEWS score action algorithm, PEW score action algorithm, PEWS algorithm, PEWS score algorithm, PEW score algorithm, PEWS and outcomes, PEWS score and outcomes, PEW score and outcomes, PEWS research, PEWS score research, PEW score research, PEWS system, PEWS score system, PEW score system, PEWS tools, PEWS score tools, PEW score tools, early warning scores, EWS, early warning scores and outcomes, EWS and outcomes, rapid response team, RRT, rapid response team and outcomes, RRT and outcomes, medical emergency team, MET, medical emergency team and outcomes, MET and outcomes, PRRT, pediatric RRT, rapid response system, failure to rescue, adult learning theory, learning theory, Knowles's adult learning theory, Knowles's theory, Kolb's model of experiential learning, Kolb's model, Kolb's theory, Bandura's social cognitive theory, Bandura's SCT, Bandura, Kirkpatrick's four level evaluation model, and Kirkpatrick's model and Kirkpatrick.

My literature search located over 60 journal articles that were read for relevance to the DNP project. There were 53 journal articles related to the generic topics of pediatric and adult early warning scores and systems, RRTs or METs and failure to rescue. Six of these articles were published prior to 2010. Seven journal articles were related to adult learning theory and four of which were published prior to 2010. In addition to searching databases, textbooks were used as references as well as a few online resources.

Synthesis of Evidence

It is known that children who are currently admitted to hospitals have higher acuity levels and comorbidities than in previous years (Akre et al., 2010; Bell et al., 2013;

Bellamo, 2012; Robson et al., 2013). While the incidence of cardiopulmonary arrest in pediatric patients remains low (PICU = 2-6%; general pediatric unit = 0.7-2%), the low survival to discharge rates for these children range between 16-45% (Agulnik et al., 2016; Bell et al., 2016; Kaul et al., 2014; Lambert, Matthews, MacDonell, & Fitzsimons, 2014; McLellan & Connor, 2013; Murray et al., 2015; Naddy, 2012; Robson et al., 2013). Hospitalized children are known to deteriorate quickly which may result in sudden respiratory and/or cardiac arrest (Akre et al., 2010; Bell et al., 2013; Bellamo, 2012; Carter, 2015; Demmel et al., 2010; Douglas et al., 2016; Duncan et al., 2006; Fenix, Gillespie, Levin, & Dean, 2015; Haines et al., 2006; Lambert et al., 2014; Mandell et al., 2015). As such, it is imperative for children's hospitals to have a strategy for early recognition of children at risk for deterioration and a process to expedite appropriate and timely interventions (Agulnik et al., 2016; AHRQ, 2009; Akre et al., 2010; Bell et al., 2013; Bellamo. 2012; Demmel et al., 2010; Douglas et al., 2016; Fenix et al., 2015; Forbes et al., 2016; Fuijkschot, Vernhout, Lemson, Draaisma, & Loeffen, 2015; Gold et al., 2014; Jankuloski et al., 2011; Kaul et al., 2014; Lambert et al., 2017; Murray et al., 2015).

Research demonstrates that hospitalized children who suddenly deteriorated and/or arrest (cardiac and/or respiratory) outside of critical care areas showed signs of clinical deterioration within the 24-hour period preceding the arrest (Agulnik et al., 2016; Gold et al., 2014; Jankuloski et al., 2011; Lambert et al., 2017; Murray et al., 2015). Studies indicate that observable physiological and behavioral signs of clinical deterioration have gone unrecognized and/or the implementation of appropriate

interventions were not provided in a timely manner (Akre et al., 2010; Bell et al., 2013; Bellamo, 2012; Gawronski et al., 2016; Lambert et al., 2017; McCabe, 2009; Pansesar et al., 2014). This lack of recognition and inaction to a patient's deteriorating clinical status is known as a *failure to rescue,* which is associated with preventable adverse events and poor patient outcomes (Akre et al., 2010; Bell et al., 2013; Bellamo, 2012; Edwards et al., 2009; Fenix et al., 2015; Gawronski et al., 2016; Lambert et al., 2017; McCabe, 2009; Naddy, 2012; Pansesar et al., 2014; Parshuram et al., 2011; Skaletzky et al., 2012). Failure to rescue is related to multiple reasons that fall into four broad themes: (a) engagement of parents/caretakers in child's care; (b) knowledge and training of health care professionals; (c) lack of response to signs of physiological deterioration; and (d) failure of systems and processes within a health care organization (Carter,2015; Edwards et al., 2009). Numerous national and international health care quality groups, health care committees and regulatory bodies have collaborated to intensify efforts to develop health care safety and quality initiatives, standards of care, and clinical practice guidelines to create a safer health care environment, improve quality of care, and improve patient outcomes (Bell et al., 2013; Bellamo, 2012; Demmel et al., 2010; Douglas et al., 2016; Edwards et al., 2009; Ennis, 2014; Fenix et al., 2015; Jankuloski et al., 2011; McLellan & Connor, 2013; Murray et al., 2015; Naddy, 2012; Robson et al., 2013).

Early recognition of clinical deterioration in children is a critical component of a PEWS. The health care industry has successfully implemented a simple EWS tool for use in hospitals to quickly assess an adult patient's condition and reliably predict the probability of deterioration (Agulnik et al., 2016; AHRQ, 2009; Bell et al., 2013;

Bellamo, 2012; Forbes et al., 2016; Fuijkschot et al., 2015; Gold et al., 2014; Jankuloski et al., 2011; Murray et al., 2015). Taking the lessons learned from the success of the adult EWS, pediatric hospitals have adopted the concept of EWS and modified it for use in children (AHRQ, 2009; Bell et al., 2013; Bellamo, 2012; Demmel et al., 2010; Fuijkschot et al., 2015; Haines et al., 2006; McCabe, 2009; Murray et al., 2015). The anatomical and physiological factors unique to the pediatric population were incorporated into the EWS program including age-specific criteria such as vital signs (AHRQ, 2009; Bell et al., 2013; Bellamo, 2012; Demmel et al., 2010; Edwards et al., 2009; Fuijkschot et al., 2015; Haines et al., 2006; McCabe, 2009; Murray et al., 2015). The modified EWS for use in children is often referred to as the PEWS although there are a variety of names and components associated with several acronyms:

- PEWS – pediatric early warning system (may include a scoring tool or a combination of a scoring tool and action algorithm/ decision-tree).
- PEWS – pediatric early warning system score (scoring tool only).
- PEWS – pediatric early warning score (scoring tool only).
- PEWS score – pediatric early warning system score (scoring tool only.
- PEW score – pediatric early warning score (scoring tool only).
- PAWS – pediatric advanced warning score (scoring tool and action algorithm/ decision-tree) (Agulnik et al., 2016; AHRQ, 2009; Bell et al., 2013; Bellamo, 2012; Fuijkschot et al., 2015; Gold et al., 2014; Jankuloski et al., 2011; Murray et al., 2015).

The PEWS was developed to standardize language, assessment criteria, the process for identifying early clinical deterioration in pediatric patients outside of critical care areas and provide a guide for nursing actions including additional assessments, prompt immediate treatment, and escalation of care which may include the activation of the PRRT (AHRQ, 2009; Murray et al., 2015). A comprehensive PEWS includes a PEWS scoring tool and PEWS action algorithm (Agulnik et al., 2016; AHRQ, 2009; Bell et al., 2013; Demmel et al., 2010). Both components are necessary for an effective PEWS based on the assertion that early identification of children at risk for clinical deterioration will ultimately improve patient outcomes through timely interventions (Agulnik et al., 2016; AHRQ, 2009; Bell et al., 2013; Demmel et al., 2010, p. 231). The PEWS scoring tools all use simple physiological parameters suitable for quick bedside application (behavior/neuro status, cardiovascular status, and respiratory status) and some may score extra points for specific criteria such as hypotension, use of nonrebreather, and/or high frequency use of albuterol (Agulnik et al., 2016; Akre et al., 2010; Bell et al., 2013; Douglas et al., 2016; Edwards et al., 2009; Fuijkschot et al., 2015; Jankuloski et al., 2011; Kaul et al., 2014; Lambert et al., 2017; Skaletzky et al., 2012; Tucker et al., 2009; Zhai et al., 2014). Many modified PEWS scoring tools use colors to correspond with the score and risk hierarchy (green = lowest risk; yellow = moderate risk; orange = med-high risk; and red = high risk) (Akre et al., 2010).

PEWS action algorithms were developed to provide guidance for nurses to act based on a corresponding PEWS score (AHRQ, 2009; Akre et al., 2010; Bell et al., 2013; Bellamo, 2012; Lambert et al., 2017; Murray et al., 2015; Pansesar et al., 2014;

Parshuram et al., 2011; Skaletzky et al., 2012; Tucker et al., 2009). Nursing actions may include one or more interventions such as increasing the frequency of patient assessments, application of additional monitoring equipment, implementation of immediate interventions, communication with other members of the health care team, escalation of care, the activation of PRRT alerts, and/or PICU transfers (AHRQ, 2009; Murray et al., 2015; Pansesar et al., 2014; Parshuram et al., 2011; Skaletzky et al., 2012; Tucker et al., 2009).

A large body of evidence supports the reliability and validity of PEWS scoring tools to identify children at risk for clinical deterioration (Agulnik et al., 2016; Akre et al., 2010; Astroth et al., 2013; Bell et al., 2013; Bellamo, 2012; Fuijkschot et al., 2015; McLellan, Gauvreau, & Connor, 2017; Skaletzky et al., 2012; Tucker et al., 2009). According to some studies, the lack of a standardized PEWS scoring tool for use in all pediatric hospitals has led to conflicting results for its validity (Bellamo, 2012; Roland, 2012). The sensitivity and specificity for the PEWS scoring tools also vary because of variations among the available tools and patient illnesses (Akre et al., 2010; Astroth et al., 2013; Bell et al., 2013). PEWS score ≥ 4 had a sensitivity of 84.2% accuracy for identifying children who required intervention (Akre et al., 2010). PEWS scores of ≥ 5 had a sensitivity of 80% accuracy for PRRT activations (Bell et al., 2013). One study reported a threshold score of five had a sensitivity of 78% and specificity of 95% (Astroth et al., 2013).

Despite some conflicting reports related to the reliability, validity, sensitivity and specificity of various PEWS scoring tools, health care safety and quality groups strongly

recommend for children's hospitals to implement objective, systematic PEWS scoring tools to identify children at risk for clinical deterioration (Akre et al., 2010; Carter, 2015; Demmel et al., 2010; Edwards et al., 2009; Jankuloski et al., 2011; Jenkins et al., 2015; Kaul et al., 2014; Lambert et al., 2017). The benefit of implementing PEWS scoring tool is that it creates a *shared mental model* amongst the health care team for patients' illness severity, increases situational awareness, promotes critical thinking, and prevents delays in implementing interventions (Carter, 2015; Demmel et al., 2010; Gawronski et al., 2016; Jankuloski et al., 2011; Lambert et al., 2017). The implementation of a PEWS action algorithm benefits patients and the health care team. When members of health care team share the same mental model of the patient's illness severity, they develop predictable responses according to the PEWS action algorithm that are linked to the specific PEWS score (Demmel et al., 2010; Gawronski et al., 2016; Jankuloski et al., 2011; Lambert et al., 2017). The PEWS action algorithm is triggered by the patient's PEWS score. The key benefit of using a PEWS action algorithm is that it provides a predetermined escalation and response pathway for immediate implementation of required interventions to improve patient outcomes (Demmel et al., 2010; Gawronski et al., 2016; Jankuloski et al., 2011; Lambert et al., 2017; Naddy, 2012). The action algorithm removes barriers for nurses by empowering them to make independent clinical decisions which increases their confidence and self-efficacy over time (Demmel et al., 2010; Gawronski et al., 2016; Jankuloski et al., 2011; Lambert et al., 2017; Murray et al., 2015). Other benefits include improved communication and collaboration between members of the multidisciplinary health care team (Demmel et al., 2010; Gawronski et

al., 2016; Jankuloski et al., 2011; Lambert et al., 2017; Murray et al., 2015; Naddy, 2012).

Knowing that hospitalized children are admitted to hospitals with higher acuity levels and comorbidities than in the past and they are known to deteriorate quickly, it is imperative for children's hospitals to have a strategy for early recognition of children at risk for deterioration and a process to expedite appropriate and timely interventions (Akre et al., 2010; Bell et al., 2013; Bellamo, 2012; Carter, 2015; Demmel et al., 2010; Douglas et al., 2016; Duncan et al., 2006; Fenix et al., 2015; Haines et al., 2006; Lambert et al., 2014; Mandell et al., 2015; Robson et al., 2013). While PEWSs are in their infancy, they have been shown to be effective systems for early identification of hospitalized children at risk for clinical deterioration in non-critical care areas and triggering an escalation and clinical-decision tree for immediate intervention (Akre et al., 2010; Carter, 2015; Demmel et al., 2010; Edwards et al., 2009; Jankuloski et al., 2011; Jenkins et al., 2015; Kaul et al., 2014; Lambert et al., 2017).

Evidence Generated for the Doctoral Project

I used a convenience sample for this education project. The permanent RN staff of the inpatient pediatric unit and pediatric float RNs were invited to participate in the PEWS project. The maximum population was 48 if all nurses agree to participate. I met with nurses individually to invite them to participate in the project, explain the purpose of the project, discuss the consent to participate, and give them a packet that included a description of the project (purpose, mission, goals, target audience, and learning

objectives), and participant expectations (consent, pre-EKS, attend class, post-EKS, demographic data sheet, and class evaluation).

Once I obtained IRB approval from the project site and Walden University, I commenced with my education project. The tools and procedure for collecting the evidence started with each participant completing and submitting a pre-EKS prior to the start of the PEWS class. Next, the PEWS education was presented using an interactive PPT presentation inclusive of practice scenarios for scoring and managing deteriorating patients. Upon completion of the PEWS education, each participant completed and submitted a post-EKS (same as pre-EKS), demographic data sheet, and class evaluation form.

Protections

Multimodal strategies were employed for recruiting volunteer participants for the PEWS education project: flyers, emails, mail, and face-to-face meetings. I invited the pediatric in-patient RNs to participate in this project by providing each nurse with an invitation packet that included the name and voluntary nature of the project, purpose of the project, participation expectations (attend class and complete pre- and post-EKS, demographic data sheet, and class evaluation form), anticipated timeline for the project, class schedule, informed consent, and DNP student contact information. The informed consent for voluntary participation was reviewed with each participant as well as the option to withdraw from the project. The informed consent was reviewed again on the day the participant attended the PEWS class. The informed consent was collected prior to administering the pre-EKS and placed in the consent storage bin separate from the data

collection tools. Participants were provided with an unmarked envelope containing a pre- and post-EKS to complete as directed. Participant privacy was maintained by assigning corresponding numbers and letters for each EKS to differentiate the pre-EKS from post-EKS for each participant. For example, the pre-EKS labeled 1A corresponded with the post-EKS labeled 1B for the same participant. The unmarked envelopes containing the data collection tools were randomly selected by each participant to prevent the possibility of identifying participants according to the date they attended the class. RNs who attended the PEWS class were compensated for their time by the healthcare organization (pay based on individual rates of pay). No further incentives were provided.

Analysis and Synthesis of Project Data

The system for analysis and synthesis of the evidence was to score the self-efficacy questions and correct responses for the pre-EKSs and post-EKSs. The pre- and post-EKS scores were compared per participant (EKS 1A compared to EKS 1B) and as a group (EKSs A compared to all EKSs B). An increased percentage of correct responses for the post-EKS demonstrated that learning occurred. The Likert-like rating for the self-efficacy questions of the pre- and post-EKS were compared per participant and as a group. Increased Likert-like scores for the self-efficacy questions demonstrated that participants increased their self-efficacy for activating PRRT alerts. The DNP student and biostatistician reviewed the EKSs and demographic data sheets for completeness and compared individual and group scores for accuracy to ensure objectivity.

Summary

Consistent with many studies, the nursing culture of the inpatient pediatric unit was resistant to activating PRRT alerts even when a child exhibits clear signs of deterioration (Astroth, et al., 2013; Jenkins et al., 2015). Nurses decided against activating PRRT alerts when appropriate due to numerous barriers such as their lack of knowledge, guidance for action, self-efficacy in their nursing competencies, and standardized language as well as the fear of criticism from the PRRT members (AHRQ, 2009; Astroth et al., 2013; Jenkins et al., 2015). Research on the clinical practice problem and gap-in-practice revealed EBPs for early identification of clinical deterioration in children by utilizing a two-component PEWS (scoring tool and action algorithm) to provide early clinical management for these patients. The narrative PICOT question was as follows: In the pediatric nurses working within a children's hospital, how does the education of a PEWS action algorithm impact the knowledge, situational awareness and attitude of pediatric nurses in activating PRRT alerts as measured by post-EKSs when compared to the pre-EKSs prior to the education on the PEWS action algorithm? The PICOT format for the clinical practice question was:

- **P:** Pediatric nurses working within a children's hospital.
- **I:** Education of a PEWS action algorithm.
- **C:** Post-EKSs compared to the pre-EKSs.
- **O:** Impact the knowledge, situational awareness and attitude of pediatric nurses in activating PRRT alerts.

The purpose of this project was to educate the pediatric nursing staff on a comprehensive PEWS program with goals of increasing the nurses' situational awareness of subtle changes in their patients' physiological status and empowering nurses to activate PRRT alerts when necessary to improve patient outcomes. The sources of evidence for measuring the impact of this education intervention were the results of the EKSs (pre- and post-EKSs). The comparison scores between the pre-EKSs and post-EKSs demonstrated whether learning occurred and the impact of the class on the attitude of pediatric nurses to activate PRRT alerts.

Section 4: Findings and Recommendations

Introduction

Retrospective studies highlight the fact that avoidable adverse clinical events are experienced by hospitalized patients and according to Buist et al. (1999), they are rarely sudden and unpredictable (Jankuloski et al., 2011). Members of the health care team often miss observable warning signs of physiologic and/or biochemical deterioration exhibited by patients in the hours preceding a health crisis event (AHRQ, 2009; Douglas et al., 2016; Murray et al., 2015; Tucker et al., 2009). This failure to rescue patients has been associated with poor patient outcomes including death (AHRQ, 2009). As such, early recognition of children at risk for clinical deterioration and prompt initiation of treatment have become a focus for improving outcomes for hospitalized children (Akre et al., 2010; Bell et al., 2013; Bellamo, 2012; Demmell et al., 2010; Douglas et al., 2016; Duncan et al., 2006; Haines et al., 2006; Parshuram et al., 2011; Skaletzky et al., 2012; Tucker et al., 2009).

PEWS is an evidence-based initiative designed to improve the quality and safety of care for hospitalized children (AHRQ, 2009; Bellamo, 2012; Demmel et al., 2010; Douglas et al., 2016). PEWS was developed to standardize language, assessment criteria, and the process for identifying early clinical deterioration in pediatric patients in non-ICU areas, and guide nursing actions for additional assessments and prompt immediate treatment including the activation of PRRT alerts (AHRQ, 2009; Murray et al., 2015). PEWS has been credited for decreasing the rates of negative consequences associated with the failure to rescue (AHRQ, 2009).

The practice problem I addressed with this project was a pediatric nursing culture that was resistant to activating PRRT alerts even when a child exhibited clear signs of deterioration. The gap-in-practice I addressed with this DNP project was the incomplete PEWS at the project site. The preexisting PEWS included an early version of a PEWS scoring tool but did not have a PEWS action algorithm to guide nurses' actions based on the individual patient PEWS scores. The PEWS action algorithm provides nurses with guidance for additional assessments and/or actions including the activation of PRRT alerts when appropriate (AHRQ, 2009; Tucker et al., 2009). Utilizing a PEWS action algorithm not only provides nurses with guidance for action, it should also empower them to act, increase their critical thinking skills, increase self-efficacy, and improve their interdisciplinary communication and teamwork skills (AHRQ, 2009; Demmel et al., 2010).

The practice question for this doctoral project was as follows: In the pediatric nurses working within a children's hospital, how does the education of a PEWS action algorithm impact the knowledge, situational awareness, and attitude of pediatric nurses in activating PRRT alerts as measured by post-EKSs when compared to the pre-EKSs prior to the education on the PEWS action algorithm? My purpose in this project was to educate the pediatric nursing staff on a comprehensive PEWS program: (a) revised PEWS scoring tool, and (b) new PEWS action algorithm. My goals in this project were to increase the nurses' situational awareness of subtle changes in their patients' physiological status and empower nurses to activate PRRT alerts when necessary to improve patient outcomes.

Once IRB approval was obtained from the project site (201817182J) and Walden University (11-01-18-0128959), I employed multimodal strategies to recruit volunteers from a convenience sample of nurses working in a pediatric unit to participate in the PEWS education project. These strategies included face-to-face meetings, emails, and flyers (see Appendix A and B respectively). Twelve classes were given within a 6-week period. The average class length was 60 minutes.

Prior to starting the PEWS class, I distributed informed consents to each participant and reviewed the consent. Signed consents were collected from participants and placed in a file box specific for consents, separate from the project data collection tools. After a brief introduction about the PEWS education, each participant randomly selected a plain white, unmarked envelope containing the data collection tools. Each participant completed the pre-EKS (see Appendix C) and placed it back in the unmarked envelope. The PEWS education was presented next, using an interactive PPT presentation (see Appendix D) that included case scenarios (studies) for nurses to practice assigning PEWS scores, develop a shared vision for the illness severity of each PEWS score and follow the corresponding PEWS action algorithm. Time was allowed for questions. Upon completion of the PEWS education, each participant completed and placed the post-EKS (see Appendix E), demographic data sheet (see Appendix F) and class evaluation (Appendix G) into the unmarked envelope and sealed it. A volunteer participant from each class collected the sealed envelopes and randomly placed them in the designated file box for completed data packets. The pre- and post-EKSs,

demographic data sheets and class evaluation forms were free of identification markers to protect the privacy and anonymity of participants.

I summarized the demographic data. The non-parametric test Wilcoxon-signed ranks was used to analyze the matched pair data, $n = 30$. This statistical procedure was appropriate to use because I was comparing two sets of scores from the same participants from one point in time to another (pre-education and post-education) (Laerd Statistics, 2018). My data passed all three assumptions required to obtain valid results using Wilcoxon signed-rank test: (a) Assumption 1 – The dependent variable (EKS) was measured at the ordinal and continuous levels; (b) Assumption 2 – The independent variable (participants) consisted of matched pairs in which each participant was measured on two occasions on the same dependent variable; and (c) Assumption 3 – The distribution of the difference between the matched pairs is symmetrical in shape (Laerd Statistics, 2018).

Findings

Demographic Data

Thirty nurses from a maximum population of 48 (63%) participated in the project. The participants were registered nurses (RNs) from all shifts who provide direct patient care in the inpatient pediatric unit. The demographic survey included eight variables/categories: (a) gender; (b) age; (c) year graduated as RN; (d) years of pediatric nursing; (e) work status; (f) highest degree; (g) CARE (clinical recognition program); and (i) national certification (see Table 1).

Table 1

Summary of Demographic Data (n = 30)

Variable/categories	Responses	Frequency	Percentage
Gender	Females	30	100
Age category in years	20-25	5	16.70
	26-30	6	20
	31-35	5	16.70
	36-40	3	10
	41-45	2	6.70
	46-50	2	6.70
	51-55	1	3.30
	56-60	3	10
	> 60 yrs.	3	10
Year graduated as RN:	1972-1975	1	3.30
	1976-1980	0	0
	1981-1985	5	16.70
	1986-1990	1	3.30
	1991-1995	1	3.30
	1996-2000	1	3.30
	2001-2005	3	10
	2006-2010	6	20
	2011-2015	6	20
	2016-2019	6	20
Years in pedi:	0-5	9	30
	6-10	6	20
	11-15	4	13.30
	16-20	2	6.70
	21-25	2	6.70
	26-30	0	0
	31-35	4	13.30
	36-40	2	6.70
	> 41 yrs.	1	3.30
Work status:	Full time- Status I	22	73.30
	Part time- Status II	5	16.70
	Part time- Status III	2	3.30
	Per diem- Status IV	1	6.70

(table continues)

Variable/categories	Responses	Frequency	Percentage
Highest degree:	Diploma	3	10
	Associates	3	10
	BSN / BA	22	73.30
	Masters	2	6.70
CARE level:	I clinician	13	43.30
	II fellow	3	10
	III resource	4	13.30
	IV scholar	6	20
	N/A	4	13.30
National certification:	Yes	26	86.70
	No	4	13.30

The gender of the population was 100% female. Age was divided into 5-year groupings beginning with 20 years and ending with more than 60 years. Participants more than 60 years old were grouped as one. More than 50% of the RNs were between the ages of 20 and 36 years of age and the highest percentage of RNs was from the 26-30 years grouping.

The year graduated as an RN was divided into three- and four-year groupings starting with the year of 1972 and ending with 2019. The RN experience ranges between < 1 and 47 years. More than 60% of the nurses graduated in the 13-year period between 2006 and 2019. The number of years of pediatric nursing experience were divided into five-year groupings beginning with 0 years and ending with ≥ 40 years. Participants with ≥ 40 years of pediatric experience were grouped as one. RNs with ten or less years of pediatric experience comprised 50% of the population.

The work status of employment was divided into four categories. Nearly 75% of the participants were full time employees. The highest degree held by nearly three-

quarters of the participants was a BSN/BA. Most RN participants were on the first level of the CARE program (I – Nurse Clinician) and held a national certification.

Knowledge Surveys

The content for the interactive PPT presentation used in the PEWS class was developed from a review of the literature and consultation with other children's hospitals who had comprehensive PEWS policies. A variety of PEWS scoring tools and PEWS action algorithms were reviewed and compared with the literature. The revisions to the pre-existing PEWS scoring tool and the development of the new PEWS action algorithm were done in consultation with the pediatric physician PEWS champions and nursing leadership. Both tools were presented to and approved by the site's pediatric quality council, PICU interdisciplinary committee, and perinatal child health council.

I created identical pre- and post-EKSs that consisted of 14 questions which addressed concepts consistent with Bandura's SCT of knowledge, self-efficacy and application. Five adult care nursing colleagues agreed to review the PEWS PPT and complete the pre- and post-EKSs as directed. All five participants reported that the PPT content and EKS questions were clear and easy to understand.

There were four Likert-type scale self-efficacy questions, followed by eight multiple choice factual knowledge questions (#1-8) and two multiple choice applicability questions (# 9-10). Scores on the pre- and post-EKSs were compared to determine if learning occurred and if the education project improved pediatric nurses' knowledge and attitude (self-efficacy) toward activating PRRT alerts. I compared the overall test scores as well as the individual test questions. The overall number and

percentage of correct responses were higher for the post-session knowledge surveys compared to the post-session knowledge surveys. The aggregate percentage of correct responses for all 10 questions on the post-EKS was 81.7% compared to 43% for the pre-EKS.

Self-Efficacy

The average total score for the post-EKS was higher compared to the pre-EKS (see Figure 5). The descriptive statistics and Wilcoxon Signed ranks tests for the four Self-Efficacy questions are shown in Table 2. The Wilcoxon Signed ranks tests was statistically significant for all the four self-efficacy questions, p-value < 0.05.

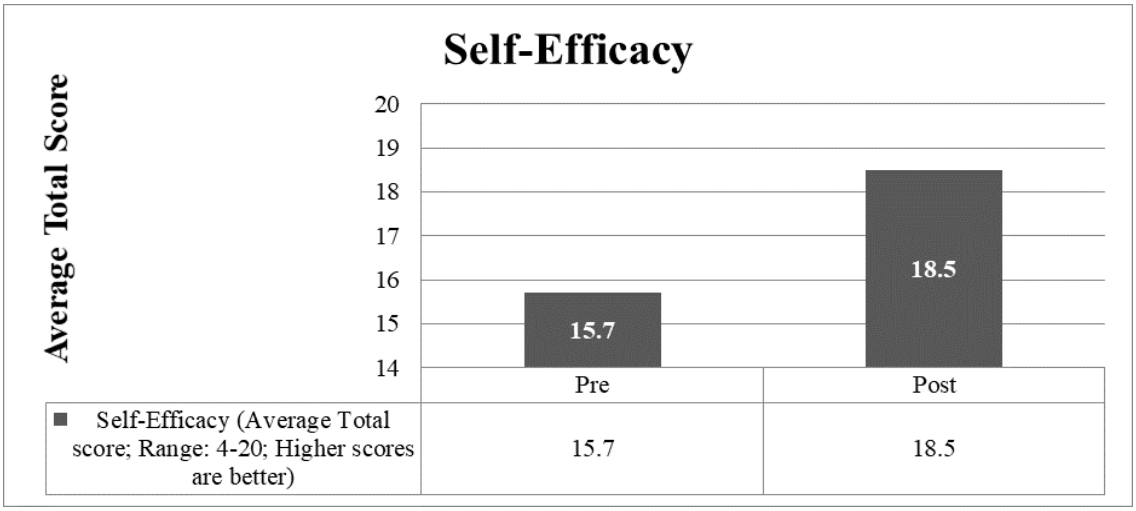

Figure 5. Self-Efficacy – Average total score.

Table 2

Self-Efficacy Subscale

Pre-session self-efficacy scores	Mean	Std. deviation	Post-session self-efficacy scores	Mean	Std. deviation	Wilcoxon-signed ranks Z value	P
Question 1	3.97	.890	Question 1	4.57	.504	-3.5	.000
Question 2	3.77	1.040	Question 2	4.63	.556	-3.6	.000
Question 3	4.30	.915	Question 3	4.73	.450	-2.6	.000
Question 4	3.67	1.124	Question 4	4.57	.568	-3.8	.000

Factual Knowledge

The overall number and percentage of correct responses were higher for the post-EKSs compared to the pre-EKSs for all the eight questions (#1-8). The aggregate percentage of correct responses for the post-EKSs was higher when compared to the pre-EKSs (Figure 6). The Wilcoxon-signed ranks tests were statistically significant for 7 out of 8 factual knowledge questions, p-value < 0.05. Knowledge question #7 was not statistically significant, p-value > 0.05 (see Table 3).

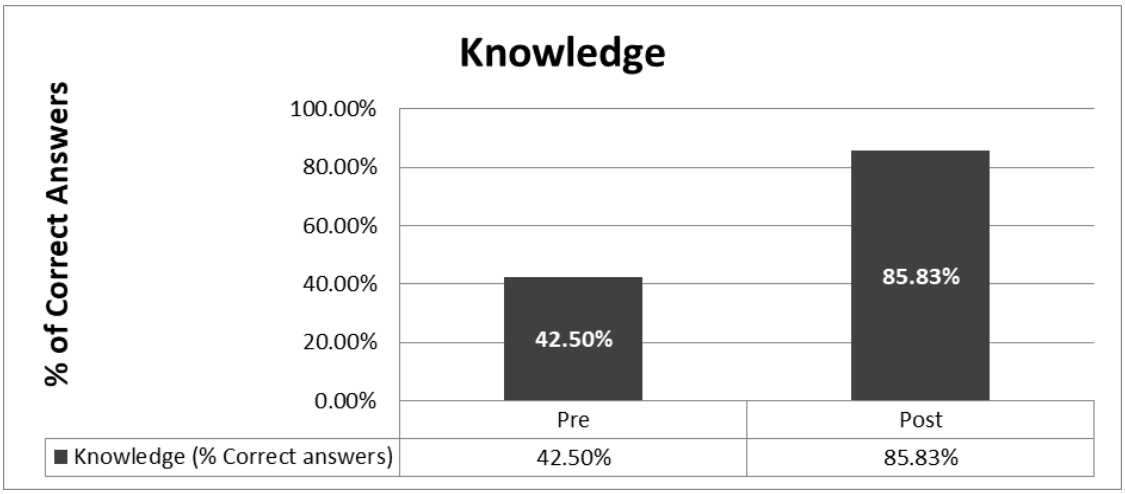

Figure 6. Factual knowledge – Average total score

Table 3

Factual Knowledge Subscale

Pre-session factual knowledge scores	Mean	Std. deviation	Post-session factual knowledge scores	Mean	Std. deviation	Wilcoxon-signed ranks Z value	P
Question 1	1.77	.430	Question 1	1.17	.379	-4.2	.000
Question 2	1.17	.379	Question 2	1.00	.000	-2.2	.000
Question 3	1.47	.507	Question 3	1.03	.183	-3.6	.000
Question 4	1.63	.490	Question 4	1.17	.379	-3.5	.000
Question 5	1.80	.407	Question 5	1.03	.183	-4.8	.000
Question 6	1.47	.507	Question 6	1.00	.000	-3.7	.000
Question 7	1.87	.346	Question 7	1.73	.450	-1.6	.102
Question 8	1.43	.504	Question 8	1.00	.000	-3.6	.000

Application

The combined percentage for questions 9 and 10 show that the aggregate percentage of correct responses for post-EKSs was higher compared to the pre-EKSs (see Figure 7). The descriptive statistics for the application questions (9-10) show that the number and percentage of correct responses were higher for the post-EKSs compared to the pre-EKSs for question 9 but slightly lower for question 10 (see Table 4). The Wilcoxon-signed ranks test was statistically significant for application question 9, p-value < 0.05.

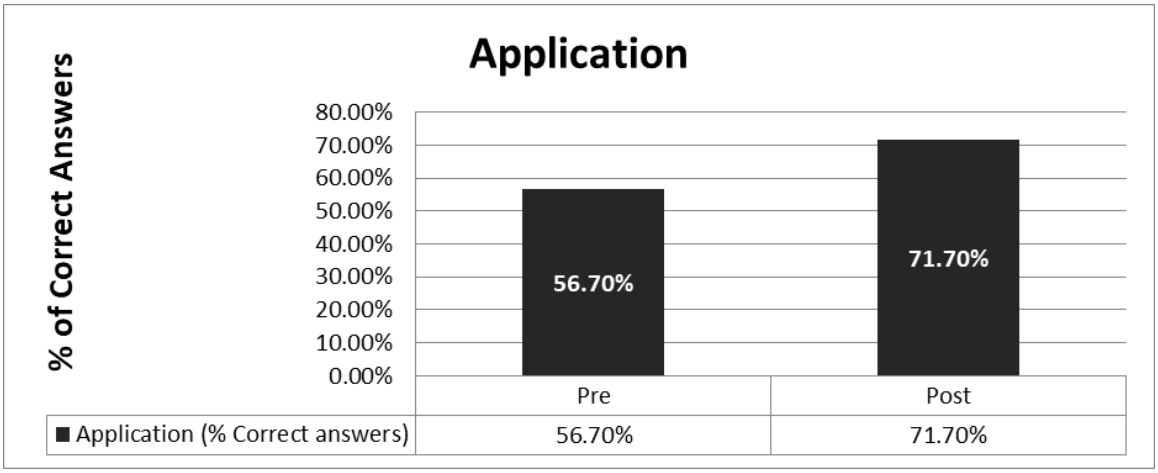

Figure 7. Application – Average total score.

Table 4

Application Subscale

Pre-session application scores	Mean	Std. deviation	Post-session application scores	Mean	Std. deviation	Wilcoxon-signed ranks Z value	P
Question 9	1.67	479	Question 9	1.20	.407	-2.4	.018
Question 10	1.33	479	Question 10	1.23	. 430	-.34	.705

Implications

The implications of this project for individual nurses are learning occurred and their self-efficacy for activating PRRT alerts increased. The overall increase in the nurses' knowledge about the PEWS should enhance their critical-thinking skills, enable them to identify patients at risk for clinical deterioration early, and enable them to follow the PEWS action algorithm to increase patient assessments, implement timely interventions. and activate PRRT alerts when indicated. The confidence and knowledge gained by the nursing staff should have a positive impact on the project site's pediatric population and organization because clinical outcomes are expected to improve following this project. The potential for positive social change because of this project is improved outcomes for the pediatric patient population. Successful education and training for the PEWS program should empower nurses to act and enhance interdisciplinary teamwork and communication skills.

Recommendations

The PEWS education should be reinforced by assigning this project's PEWS PPT presentation to the entire pediatric nursing team as an online, self-learning module. It is also important to educate the pediatric physician team (hospitalists, intensivists, and residents) and PRRT members (nursing supervisors, respiratory therapists, and pediatric critical care nurses) to learn the standardized language, assessment criteria, process for identifying early clinical deterioration, and recommended nursing actions for the PEWS. I further recommend expanding upon this project by increasing the sample size and providing additional learning experiences in the form of simulation. Simulation is highly recommended by the IOM (2004) as a teaching method to strengthen the ongoing acquisition of knowledge and skills among health care professionals (Aebersold & Tcschannen, 2013). Simulation also promotes and reinforces interdisciplinary education, communication, and teamwork (Aebersold & Tcschannen, 2013).

To reinforce the PEWS education, I revised the project site's PEWS policy to include the two components for a comprehensive PEWS: PEWS scoring tool and PEWS action algorithm. The revised PEWS policy was approved by the site's pediatric quality council, PICU multidisciplinary committee, perinatal and child health council, professional practice council (staff nurses), and corporate Nursing Congress (corporate leaders and staff) prior to the commencement of the education intervention (Appendix H). The purpose of the policy was two-fold:

1. To use objective clinical indicators and a risk assessment tool to identify children at risk for clinical deterioration and enable early recognition of changes in a child's physiologic condition.
2. To guide nursing actions to get prompt, immediate help to the bedside for a child at increased risk for clinical deterioration, following the recommended guidelines outlined in the PEWS action algorithm corresponding with the child's PEWS score.

The policy content included the following components in addition to the purpose:

- Scope.
- Operational definitions.
- Policy statement.
- Key points.
- Procedure.
- Protocol for PEWS scoring, PEWS scores, and PEWS scoring tool.
- Protocol for PEWS Action Algorithm.
- Evidence rating scale (strength of evidence and quality of evidence).
- References/level of evidence.
- Stakeholders.
- Authors/reviewers.

Strengths of the Project

My goals for this project were to increase the pediatric nurses' situational awareness of subtle changes in their patients' physiological status and empower them to

activate PRRT alerts when necessary. My data analysis demonstrated increases in the participants' self-efficacy ratings and overall knowledge survey scores (factual knowledge and applicability) after the education session.

Blending key strategies of three adult learning theories increased the likelihood of meeting the preferred learning styles for the participants. The small class size of 2-4 participants was helpful, allowing more time for questions and clarification as needed. Knowles's adult learning theory suggests that adult learners are more interested in the learning process and its relevance to their life circumstances rather than the content of education are (Curran, 2014). All six of Knowles's key assumptions about adult learners were applied in this education project: (a) need to know why they should learn something; (b) need for autonomy and self-direction; (c) life experience serves as a resource for learning; (d) readiness and/or applicability of the information to the learner's life situation; (e) motivation to learn; and (f) problem-solving or task-focused orientation to learning (Curran, 2014; Mitchell & Courtney, 2005).

The interactive nature of the PEWS course supported Kolb's description of learning as the 'process whereby knowledge is created through the transformation of experience' (McLeod, 2013, p. e1). The PEWS education provided didactic information that was reinforced by the learner's experience by doing, while experiencing, with hands on practice, and with reflection (Hill, 2017). Clinical scenarios provided opportunities for learners to calculate PEWS scores and follow the PEWS action algorithm to guide their actions based on the PEWS score.

Bandura's SCT suggests that people learn from one another by means of observation, imitation, and modeling (Garcia, 2016; McEwen & Mills, 2014). SCT is based on the concepts of self-determinism and human agency. The critical element of human agency is self-efficacy (Grossklaus & Marvicsin, 2104; Hodges & Videto, 2011). This education project provided opportunities for continuous, bidirectional interplay of personal factors (cognition, affect, and biological events), environmental influences, and resulting behavior. The nurses were provided with new knowledge, tools, and group exercises and discussions of real-life experiences to facilitate learning and increase self-efficacy to act.

Limitations of the Project

There were several limitations for this project. The sample size was small. As such, the sample may not be truly representative of the general population therefore; it may not be generalizable to the target population of pediatric nurses. Project timelines and the availability of participants were limitations. Most participants attended class on work time and were relieved from their patient care assignments to attend. Although they volunteered to participate, they may have been distracted related to their workload and patient care needs. Participants were occasionally disturbed by relief nurses to be asked questions about their patients. As the clinical nurse educator for this pediatric department, there was a possibility for bias.

Additionally, the project site assigned a generic, online, self-learning PEWS PPT to the entire pediatric nursing staff two weeks prior to the implementation of my teaching sessions. This unanticipated limitation had the potential to negatively impact the results

of my data analysis as all the participants reported that they completed the assigned PEWS PPT prior to attending class. I reviewed the assigned PEWS PPT and noted the algorithm I created for the hospital policy was included in the presentation however; no case scenarios were included. The additional PEWS content and interactive structure for this project's educational session resulted in significantly higher self-efficacy and factual knowledge scores which supports the increased effectiveness of using a face-to-face format as opposed to an online format for educating nurses about PEWS.

Unanticipated Limitations/Outcomes

Participants answered the factual test question 7 incorrectly on the pre-and post-EKSs. The layout of this question was negative, and the participants were likely confused in identifying the "not true" statement. Participants answered question 9 (applicability) on the pre-EKSs correctly at a higher percentage than on the post-EKSs.

Recommendations for Future Projects

Kirkpatrick's four level evaluation model was used to evaluate the outcome of my DNP project however; given the purpose of my project, only levels *I, Reaction* (learner satisfaction) and *II, Learning* (acquisition of knowledge) were evaluated. Accurate evaluation of levels *III, Behaviors* (application of learning into practice) and *IV, Results* (program's impact on outcomes) require a longer timeframe for nurses to apply learning into practice and even longer for practice changes to affect outcomes. Further research is needed to assess for the application of the PEWS action algorithm in practice. One of the goals of this project was to empower nurses to activate PRRT alerts when necessary

to improve patient outcomes. As such, I recommend a follow-up quality improvement (QI) study to compare the PRRT activation rates pre-and post-education.

This project has the potential to be transferable to inpatient pediatric units in other children's hospitals. The use of the PEWS score tool may also be transferable to pediatric EDs to determine the level of patient care assigned for a pediatric patient and PICUs to determine a patient's readiness to be transferred to a lower level of care.

Section 5: Dissemination Plan

Dissemination Plan

As a DNP-prepared nurse, I have a responsibility to disseminate the findings of my project to a greater audience. I plan to employ active and passive methods for dissemination. The first audience to be informed of my findings will be the stakeholders at the project site. I will write a project summary to be distributed via email and posted on the pediatric in-patient unit. I will provide an oral and written presentation of my executive summary to the site's Nursing Research Committee. The site's IRB will receive an electronic copy of the report. I will provide a poster presentation at my organization's annual nursing research day in the fall of 2019. I plan to explore opportunities for publication of my project in a pediatric nursing journal such as the *Journal of Pediatric Nursing*, *HOSPITAL Pediatrics* and/or *Paediatric Nursing*. Lastly, I would like to recruit best practice nurse champions in the in-patient pediatric unit to serve as role models that help to translate the comprehensive PEWS program into action and sustain the practice change long-term.

Analysis of Self

My journey in planning, implementing and evaluating my DNP project has been a positive and enlightening experience as a practitioner, scholar, and project manager. Health care reform and the demand for improving the quality and safety of patient care are driving forces that require transformational leadership to affect and sustain real change. Nursing leaders have a responsibility to advance nursing practice by implementing and enculturating EBP into daily patient care.

As an APN, I serve as a change agent, role model, and mentor for nurses providing direct patient care. All these roles require me to continue my path of lifelong learning. My tenure and established relationships at the project site, years of nursing experience, and diversity of clinical experiences and skills helped me to earn the trust and respect from nurses and members of the interdisciplinary team who participated in this project. Remaining current in my clinical practice was a key element for identifying the gap-in-practice and formulating my practice question. This project experience pushed me beyond my comfort zone and helped me to overcome some of my self-imposed limitations. My experiences throughout this project enhanced my research, leadership, and management skills which will help me to improve clinical practice therefore; lead to improved outcomes.

My intrinsic characteristics led me to embark on this DNP journey. I possess the characteristics described by Bixler and Bixler (1959) that drive nurses to become scholars which include highly intelligent, knowledge seeker, inquiring mind, independent thinker, self-directed, self-learner, effective communicator, engaged, collaborative, innovative, and problem-solver (Robert & Pape, 2011). This DNP project and my field experiences provided many opportunities for me to apply my knowledge and skills for implementing change thereby increasing my confidence and skills as a scholar. My journey toward becoming a scholar required me to gain new knowledge and perform critical analysis, synthesis, and translation of research data into clinical practice. Collaboration with my organization's team of nurse scientists and biostatistician provided valuable guidance for me as they helped me to determine the methodology for my project and interpretation of

the data analysis. I gained a new appreciation for theory and learned its value in planning, implementing, and evaluating my DNP capstone project.

The implementation of EBP is one of my responsibilities as a DNP practitioner. Leading this project was a great learning experience. Early engagement of key stakeholders was essential to the success of my project. Effective communication and listening skills helped me to gain buy-in from numerous stakeholders including staff nurses, senior and department leaders, and intradisciplinary leaders. I learned to be patient, giving practitioners time to process the new information and participate in the decision-making process for the planned changed. I also learned the art of compromise while collaborating with stakeholders on the PEWS scoring tool, PEWS action algorithm, and PEWS policy. They provided valuable insights for the project. I incorporated many of their recommendations into my project plan which enhanced buy-in.

The measurable outcomes achieved from this project helped to establish my credibility and accountability as a leader. I know that my work is not finished with the completion of this project. I must continue to reinforce education and provide opportunities for nurses to apply their new knowledge to sustain permanent changes in clinical practice.

My professional goals are related to improving patient safety, clinical practice, and outcomes. My long-term plan is to create a business plan for my organization to create a pediatric DNP position for me with the primary focus of translating evidence into practice at our children's hospital. My collaboration with interdisciplinary and interdepartmental leaders enabled me to build trusting relationships for future projects.

My research activities and critical appraisal of the research helped me to identify relevant data and choose sources with high levels of evidence. Developing this project proposal taught me how to organize my thoughts and provide a comprehensive plan for future projects.

This education project was completed in a six-week period. The greatest challenge was time. I provided numerous classes at various times per day and per week to provide ample opportunity for nurses to participate. The nurse manager of the pediatric unit was instrumental in helping to provide relief for the nurses to attend class on work time. Analyzing the data was another challenge for me as I am not well-versed on the use of data analysis programs. I am fortunate to have a nursing research center at my organization that is committed to guiding nurses performing research projects. I collaborated with several nurse scientists throughout the planning phase of this project and elicited the expertise of a biostatistician to help me with data analysis.

This scholarly journey was a great learning experience for me. Making changes in clinical practice is a challenging process and requires perseverance. Extensive planning, communication, and collaboration with stakeholders are essential components for implementing EBP changes. An accurate assessment of the clinical environment is necessary to identify gaps in practice. The environmental assessment requires communication with the nursing team to identify barriers and gain buy-in for proposed practice changes. Performing an extensive literature search is time-consuming because it requires critical analysis of the data. I learned how to manage large volumes of research data and methods for organizing my thoughts. I have a new appreciation for the

importance of theory in practice. I was most excited to observe how the theoretical frameworks of this project not only helped me to plan, they were crucial elements to the success of my project.

Summary

Early identification of pediatric patients at risk for clinical deterioration is critical for providing timely interventions and decreasing the rates of negative consequences associated with the failure to rescue. Health care providers often miss observable signs of clinical deterioration exhibited by pediatric patients outside of ICU areas, causing significant delays in implementation of interventions. The PEWS was developed to standardize language, assessment criteria, and the process for identifying early clinical deterioration in pediatric patients in non-ICU areas as well as guiding nursing actions for additional assessments and prompt immediate treatment, including the activation of PRRT alerts (AHRQ, 2009; Murray et al., 2015). Other benefits associated with using a PEWS include improving communication and teamwork between the interdisciplinary health care team and creating a sense of empowerment within the nursing team to act (AHRQ, 2009; Demmel et al., 2010).

Consistent with many studies, the nursing culture of the inpatient pediatric unit at this project site was resistant to activating the PRRT even when a child exhibited clear signs of deterioration (Astroth, et al., 2013; Jenkins et al., 2015). The purpose of this project was to educate the pediatric nursing staff on a comprehensive PEWS program inclusive of a PEWS action algorithm. The nursing staff received education on a revised PEWS scoring tool and the new PEWS action algorithm.

A non-parametric test, Wilcoxon-signed ranks, was used to analyze the matched pair data, $n = 30$. Pre- and post-EKS scores were compared to determine if learning occurred and if the education program impacted the knowledge and attitude of pediatric nurses to activate PRRT alerts. The descriptive statistics and Wilcoxon-signed ranks tests for the four self-efficacy questions show that the overall mean score was higher (more confident) for the post-EKSs compared to the pre-EKSs. The Wilcoxon-signed ranks tests was statistically significant for all four self-efficacy questions, p-value < 0.05.

The descriptive statistics for the factual knowledge questions (1-8) show the overall number and percentage of correct responses were higher for the post-EKSs compared to the pre-EKSs for all the eight questions. The Wilcoxon-signed ranks tests was statistically significant for 7 out of 8 factual knowledge questions, p-value < 0.05. Knowledge question 7 was not statistically significant, p-value > 0.05. The descriptive statistics for the application questions (9-10) show that the number and percentage of correct responses was higher for the post-EKSs compared to the pre-EKSs for question 9 but slightly lower for question 10. The Wilcoxon-signed ranks test was statistically significant for application question 9, p-value < 0.05.

The goals of this project were to increase the nurses' situational awareness of subtle changes in their patients' physiological status and empower nurses to activate PRRT alerts when necessary to improve patient outcomes. The data analysis shows that the pediatric nurses' self-efficacy for activating PRRT alerts and knowledge were increased following this education intervention. I addressed the gap-in-practice with this doctoral project by providing the health care team with a comprehensive PEWS which

included a reliable and valid PEWS scoring tool to identify children at risk for clinical deterioration and an action algorithm to promptly manage clinical deterioration.

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Appendix A1

Information Sheet for Participation in a PEWS Education Project

{Kosick_PEWS (v2) – 8/01/18}

You are being asked to participate in an education project conducted by Ruthann Kosick, MSN, RN, CCRN, CPN, CBC. Ruthann Kosick is a DNP student from Walden University and the pediatric clinical nurse educator for [redacted] Children's Hospital at [redacted] University Medical Center, member of the [redacted] Health System. You are being asked to participate in this project because you currently provide direct patient care to children admitted to the pediatric inpatient unit at [redacted] Children's Hospital. The purpose of this project is to educate the pediatric nursing staff on a comprehensive pediatric early warning system (PEWS).

Please read the information below and ask questions about anything you do not understand before deciding whether or not to participate. Your participation in this education program is completely voluntary.

If you decide to participate, you will be asked to attend one, 75-minute interactive education session. The education session will include time to complete the identical pre- and post- education knowledge surveys, demographic data form and class evaluation. The education knowledge surveys consist of 14 questions (4 Likert scale; and 10 multiple choice). The demographic form consists of 9 questions (4 fill-in the blank; and 4 checkbox). The class evaluation consists of 18 questions (17 rating; and 1 fill-in).

By attending the education session, you are agreeing to participate in this education project. There are no other alternatives to the project other than not participating. Participation is completely voluntary. You may withdraw from the project at any time. Whether you agree to participate or not, will not affect your employment in any way. You have the right to decide not to participate in the project. If you choose not to participate in the project, you may attend the class. RNs attending the education project will be compensated for their time by the healthcare organization (75 minutes of your base rate of

Appendix A2

The information that you give in the project will be confidential. There is no more than minimal risk to you when participating in the project. There are no direct/guaranteed benefits to nurse participants. There may be anticipated benefits to you as you may improve your knowledge, understanding, and skill sets related to the following topics: (a) standardized pediatric early warning system (PEWS) score, assessment criteria, and process for identifying early clinical deterioration in pediatric patients); (b) severity of the patient's condition based on the PEWS score; (c) process of the PEWS action algorithm to ensure a timely response from the medical team to diagnose the issue and order appropriate and timely interventions; (d) communication skills; (e) team building skills; (f) empowerment to act; and (g) self-efficacy to act.

The results from this education project, which will be reported only as grouped data will be published in the academic ProQuest database. The results may be submitted for publication in nursing journals and for poster and podium presentations at professional nursing conferences.

If you have any questions, concerns, or complaints about the project, please contact Ruthann Kosick. She will be glad to answer any of your questions. Ruthann Kosick's number is 732-[redacted] or e-mail at: Ruthann.Kosick@[redacted].

If you have questions about your rights as a project participant, or concerns or complaints about the project, you may contact the [redacted] Institutional Review Board (IRB) Chairperson or the IRB Office at 732-[redacted]. You may also call this number in the event the research staff cannot be reached or you wish to talk to someone else.

In addition, you may also call the Hackensack Meridian Health ComplyLine at 1-877-[redacted] to anonymously report any concerns you have related to the project. Thank you for considering participating in this project. If you decide to participate, please keep this sheet and retain for your records.

Ruthann Kosick, MSN, RN, CCRN, CPN, CBC

Appendix B

Recruitment e-mail to send to prospective pediatric nursing staff participants

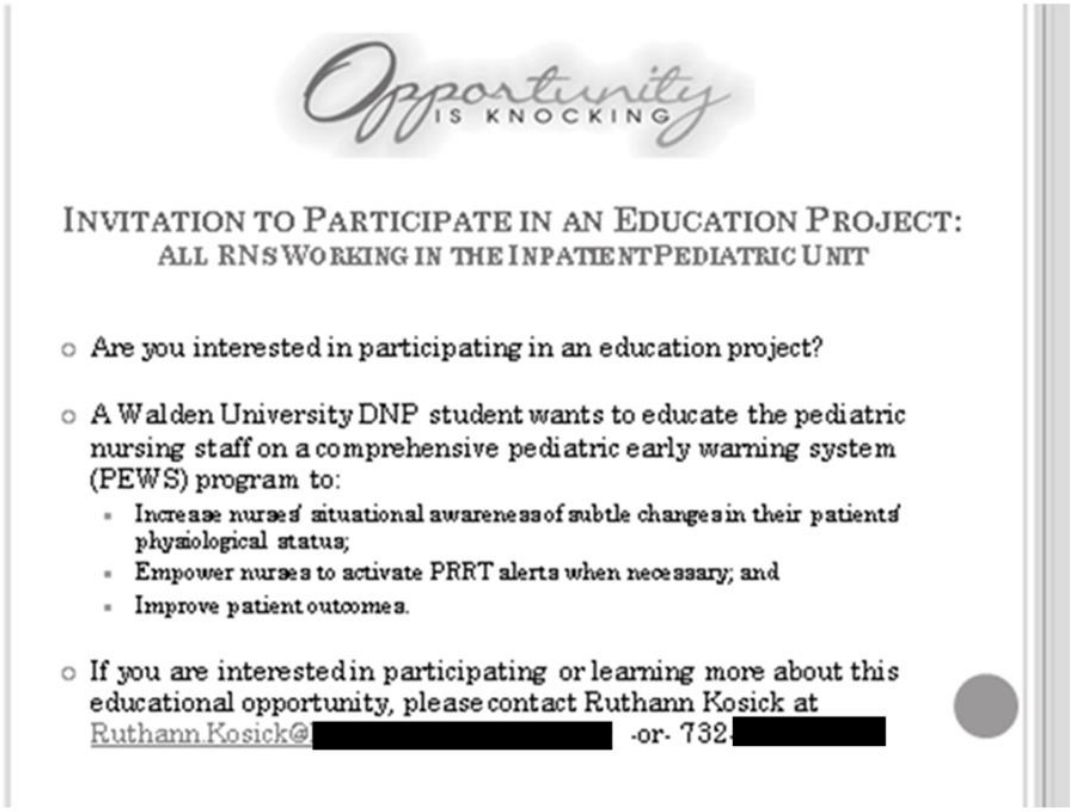
Dear Pediatric Inpatient RN Staff,

My name is Ruthann Kosick. I am a DNP student at Walden University. I am seeking nurses who currently provide direct patient care to children admitted to the pediatric inpatient unit at [redacted] Children's Hospital to participate in an education project. The purpose of this project is to educate the pediatric nursing staff on a comprehensive pediatric early warning system (PEWS) to increase their situational awareness of subtle changes in their patients' physiological status and empower nurses to activate pediatric rapid response (PRRT) alerts when necessary to improve patient outcomes.

Your time commitment to participate in this education project will be approximately 75 minutes. If you are interested in participating or learning more about this educational opportunity, please respond to this e-mail. Thank you.

Ruthann Kosick, MSN, RN, CCRN, CPN, CBC
Ruthann.Kosick@[redacted]

Appendix C: PEWS Recruitment Flyer



Appendix D1: PEWS Preeducation Knowledge Survey

PEWS Pre-Education Knowledge Survey

1A

	Questions: PEWS Self-Efficacy	Confidence Level				
		Not at all Confident		Confident		Extremely Confident
1	How confident are you in your ability to recognize the components of a patient's assessment that serve as early red flags, warning of a patient's increasing risk for the clinical deterioration?	1	2	3	4	5
2	How confident are you in what actions to take to escalate the care needs for a patient based on the PEWS score and/or your recognition of signs of clinical deterioration? (Actions include nursing interventions, additional monitoring, frequency of re-assessments, notifications, and chain of command).	1	2	3	4	5
3	How confident are you in your ability to communicate your concerns effectively to a member of the medical team for the deteriorating status of a patient's condition?	1	2	3	4	5
4	How confident are you in making the decision to active a pediatric rapid response team alert based on a "gut feeling" that something is very wrong with your patient or upon early recognition of clinical deterioration?	1	2	3	4	5

Multiple Choice Questions

1. The PEWS acronym stands for:
   a. Pediatric Early Warning Score
   b. Pediatric Emergency Warning Score
   c. Pediatric Emergency Waring System
   d. Pediatric Early Warning System

2. The primary purpose of the pediatric rapid response team is to:
   a. Assist the nursing team with procedures
   b. Transfer patients to the PICU
   c. Bring skilled, critical care experts directly to the patient's bedside
   d. Provide rapid interventions and transfer the patient to the PICU

3. Identify the specific assessment criteria used to calculate a PEWS score:
   a. Level of consciousness, cardiovascular and respiratory systems
   b. Patient behavior, heart rate, blood pressure, and respiratory system
   c. Level of consciousness, heart rate, blood pressure , and respiratory system
   d. Patient behavior, cardiovascular and respiratory systems

4. What is the point range that can be assigned for each assessment category using the PEWS scoring tool?
   a. 0-2
   b. 0-3
   c. 0-4
   d. 0-5

Appendix D2: PEWS Preeducation Knowledge Survey

5. How many extra points are added to the PEWS score for a patient who is hypotensive?
   a. 2
   b. 3
   c. 4
   d. 5

6. What are the four colors used to identify PEWS scores?
   a. White, yellow, orange, and red
   b. Green, yellow, red, and purple
   c. Green, yellow, orange, and red
   d. White, green, orange, and red

7. Which of the following statements is **not true** regarding the PEWS action algorithm?
   a. The PEWS action algorithm provides a process for timely and appropriate interventions
   b. The PEWS action algorithm provides nurses with minimal guidance for action(s) based on the patient's corresponding PEWS score
   c. The PEWS action algorithm provides nurses with the minimal required actions to be followed based on the patient's corresponding PEWS score
   d. The PEWS action algorithm is tailored to individual child, actions may vary based on special situations

8. How many extra points are added to the patient's PEWS score if a STAT Albuterol nebulizer treatment is repeated twice in 1 hour or if a continuous Albuterol treatment is needed?
   a. 0
   b. 1
   c. 2
   d. 3

9. Your 12:00pm PEWS assessment for your 7 year-old patient admitted for exacerbation of asthma is as follows: awake and resting quietly; color is pink; HR = 118; RR = 35; BP 90/52; respirations rapid but easy; venti-mask at 50% FiO_2 to sustain a pulse oximetry reading $\geq$ 93%; Pulse oximeter = 94%; last albuterol nebulizer treatment at 11:30am. Your PEWS score is "3" in the respiratory system category alone, no additional points scored in the other categories. What action(s) would you take next?
   a. Notify the physician, continue monitoring the patient, reassess and rescore in 2 hours
   b. Notify the physician, continue monitoring the patient, reassess and rescore in 3 hours
   c. Consider activation of the pediatric rapid response team, notify the physician, implement interventions as ordered, and reassess and rescore in 2 hours
   d. Consider activation of the pediatric rapid response team, notify the physician, implement interventions as ordered, and reassess and rescore in 1 hours

10. Your patient's PEWS score has increased from "2" to "4". The pedi resident is at the bedside evaluating the patient. You have a "gut' feeling that something very wrong. What is your next step?
    a. Notify the attending physician and charge nurse, and reassess and rescore in 1 hours
    b. Notify the attending physician and charge nurse, and reassess and rescore in ½ hour
    c. Notify the PICU intensivist, charge nurse, and supervisor, and reassess and rescore in ½ hour
    d. Activate the pediatric rapid response team and notify the attending physician

Appendix E1: PEWS Posteducation Knowledge Survey

PEWS Post-Education Knowledge Survey **2B**

Questions: PEWS Self-Efficacy		Confidence Level				
		Not at all Confident		Confident		Extremely Confident
1	How confident are you in your ability to recognize the components of a patient's assessment that serve as early red flags, warning of a patient's increasing risk for the clinical deterioration?	1	2	3	4	5
2	How confident are you in what actions to take to escalate the care needs for a patient based on the PEWS score and/or your recognition of signs of clinical deterioration? (Actions include nursing interventions, additional monitoring, frequency of re-assessments, notifications, and chain of command).	1	2	3	4	5
3	How confident are you in your ability to communicate your concerns effectively to a member of the medical team for the deteriorating status of a patient's condition?	1	2	3	4	5
4	How confident are you in making the decision to active a pediatric rapid response team alert based on a "gut feeling" that something is very wrong with your patient or upon early recognition of clinical deterioration?	1	2	3	4	5

Multiple Choice Questions

1. The PEWS acronym stands for:
    a. Pediatric Early Warning Score
    b. Pediatric Emergency Warning Score
    c. Pediatric Emergency Waring System
    d. Pediatric Early Warning System

2. The primary purpose of the pediatric rapid response team is to:
    a. Assist the nursing team with procedures
    b. Transfer patients to the PICU
    c. Bring skilled, critical care experts directly to the patient's bedside
    d. Provide rapid interventions and transfer the patient to the PICU

3. Identify the specific assessment criteria used to calculate a PEWS score:
    a. Level of consciousness, cardiovascular and respiratory systems
    b. Patient behavior, heart rate, blood pressure, and respiratory system
    c. Level of consciousness, heart rate, blood pressure , and respiratory system
    d. Patient behavior, cardiovascular and respiratory systems

4. What is the point range that can be assigned for each assessment category using the PEWS scoring tool?
    a. 0-2
    b. 0-3
    c. 0-4
    d. 0-5

Appendix E2: PEWS Posteducation Knowledge Survey

5. How many extra points are added to the PEWS score for a patient who is hypotensive?
    a. 2
    b. 3
    c. 4
    d. 5

6. What are the four colors used to identify PEWS scores?
    a. White, yellow, orange, and red
    b. Green, yellow, red, and purple
    c. Green, yellow, orange, and red
    d. White, green, orange, and red

7. Which of the following statements is **not true** regarding the PEWS action algorithm?
    a. The PEWS action algorithm provides a process for timely and appropriate interventions
    b. The PEWS action algorithm provides nurses with minimal guidance for action(s) based on the patient's corresponding PEWS score
    c. The PEWS action algorithm provides nurses with the minimal required actions to be followed based on the patient's corresponding PEWS score
    d. The PEWS action algorithm is tailored to individual child, actions may vary based on special situations

8. How many extra points are added to the patient's PEWS score if a STAT Albuterol nebulizer treatment is repeated twice in 1 hour or if a continuous Albuterol treatment is needed?
    a. 0
    b. 1
    c. 2
    d. 3

9. Your 12:00pm PEWS assessment for your 7 year-old patient admitted for exacerbation of asthma is as follows: awake and resting quietly; color is pink; HR = 118; RR = 35; BP 90/52; respirations rapid but easy; venti-mask at 50% FiO_2 to sustain a pulse oximetry reading $\geq$ 93%; Pulse oximeter = 94%; last albuterol nebulizer treatment at 11:30am. Your PEWS score is "3" in the respiratory system category alone, no additional points scored in the other categories. What action(s) would you take next?
    a. Notify the physician, continue monitoring the patient, reassess and rescore in 2 hours
    b. Notify the physician, continue monitoring the patient, reassess and rescore in 3 hours
    c. Consider activation of the pediatric rapid response team, notify the physician, implement interventions as ordered, and reassess and rescore in 2 hours
    d. Consider activation of the pediatric rapid response team, notify the physician, implement interventions as ordered, and reassess and rescore in 1 hours

10. Your patient's PEWS score has increased from "2" to "4". The pedi resident is at the bedside evaluating the patient. You have a "gut' feeling that something very wrong. What is your next step?
    a. Notify the attending physician and charge nurse, and reassess and rescore in 1 hours
    b. Notify the attending physician and charge nurse, and reassess and rescore in ½ hour
    c. Notify the PICU intensivist, charge nurse, and supervisor, and reassess and rescore in ½ hour
    d. Activate the pediatric rapid response team and notify the attending physician

Appendix F

Demographic Data Form

1. What is your age? _____

2. What is your gender?
   __ Female
   __ Male
   __ Prefer not to disclose

3. What year did you receive your RN? _____

4. How many years of nursing experience do you have working in pediatrics? _____

5. What is your employment status?
   __ Full time – status I
   __ Part time – status II (≥ 20 hours but < 36 hours per week)
   __ Part time – status III (≤ 19 hours per week)
   __ Per diem – status IV
   __ Agency

6. What is the highest degree you hold?
   __ RN Diploma
   __ Associate Degree
   __ Baccalaureate Degree
   __ Master's Degree
   __ Doctoral Degree

7. What is you C.A.R.E. level?
   __ Level I – CARE Clinician
   __ Level II – CARE Fellow
   __ Level III – CARE Resource
   __ Level IV – CARE Scholar
   __ Specialty Scholar

8. Are you currently certified in specialty practice by the American Nurses Credentialing Center or national nursing specialty organization?
   __ Yes, please provide name of certification: _____
   __ No

Appendix G1: PEWS Education Evaluation Form

Evaluation Form
Using a PEWS algorithm for activating an RRT: A staff education project.

CODE: **A=EXCELLENT, B= GOOD, C = FAIR, D = POOR, E = N/A**

How were the following Learning Outcomes met?

A	B	C	D	E		
☐	☐	☐	☐	☐	1.	Describe your role and responsibility for escalating care immediately upon the recognition of clinical deterioration in any patient.
☐	☐	☐	☐	☐	2.	Define failure to rescue.
☐	☐	☐	☐	☐	3.	Describe the purpose of a PRRT.
☐	☐	☐	☐	☐	4.	Describe clinical signs and symptoms requiring the activation of the PRRT.
☐	☐	☐	☐	☐	5.	Discuss the use of PEWS in clinical practice.
☐	☐	☐	☐	☐	6.	Describe the PEWS scoring tool assessment criteria.
☐	☐	☐	☐	☐	7.	Calculate a PEWS score using the PEWS scoring tool.
☐	☐	☐	☐	☐	8	Discuss the importance of clinical judgement and individualized assessment.
☐	☐	☐	☐	☐	9	Identify children at risk for clinical deterioration.
☐	☐	☐	☐	☐	10.	Describe the level of severity associated with each PEWS score category.
☐	☐	☐	☐	☐	11.	Apply the actions recommended in the PEWS action algorithm that correlate with the PEWS score.
☐	☐	☐	☐	☐	12.	Relationship of learning outcomes to content of the activity?
☐	☐	☐	☐	☐	13.	How well did this nursing education program meet your learning needs?

Please evaluate the author of the self-learning program

☐	☐	☐	☐	☐	14.	Knowledge of subject
☐	☐	☐	☐	☐	15.	Presentation orderly and understandable
☐	☐	☐	☐	☐	16.	Effective use of teaching tools (PowerPoint)
☐	☐	☐	☐	☐	17.	Overall, I found the learning experience.

Appendix G2: PEWS Education Evaluation Form

18. Please list a minimum of 2 changes in practice you will make as a result of this class.

Change #1) _____

_____

_____

_____

Change 2) _____

_____

_____

_____

Additional changes or comments:

_____

_____

_____

_____

_____

_____

_____

Thank You

Appendix H: PEWS Scoring Tool

PEWS Scoring Tool

	0	1	2	3	Score
Behavior	- Playing - Appropriate	- Inconsolable	- Inappropriately sleepy- tired	- Lethargic / Confused - Reduced response to pain	
Cardiovascular	- Pink - Capillary refill 1-2 seconds	- Pale - Capillary refill 2-3 seconds	- Grey - Capillary refill 3-4 seconds - Tachycardia of 20 above normal rate	- Grey and mottled - Capillary refill 5 seconds or above - Tachycardia of 30 above normal rate - Bradycardia	
Respiratory	- Within normal Parameters - No retractions	- > 10 above normal parameters - Mild retractions - Any initiation or continuation of oxygen - Baseline Trach/CPCP/BIPAP	- > 20 above normal parameters - Moderate Retractions - 35-45% FiO_2 on Ventimask	ANY **one** of the following: - 5 below normal parameters - Severe retractions - Grunting - 50% FiO_2 on Ventimask	
****SCORE 5 EXTRA: Hypotension - or - Required use of non-rebreather****					
****SCORE 2 EXTRA: If STAT Albuterol is repeated twice in 1 hour OR if 1 hour continuous Albuterol treatment is necessary****					
				Total	

Green=0-2 Yellow =3 Orange=4 Red=5 or >

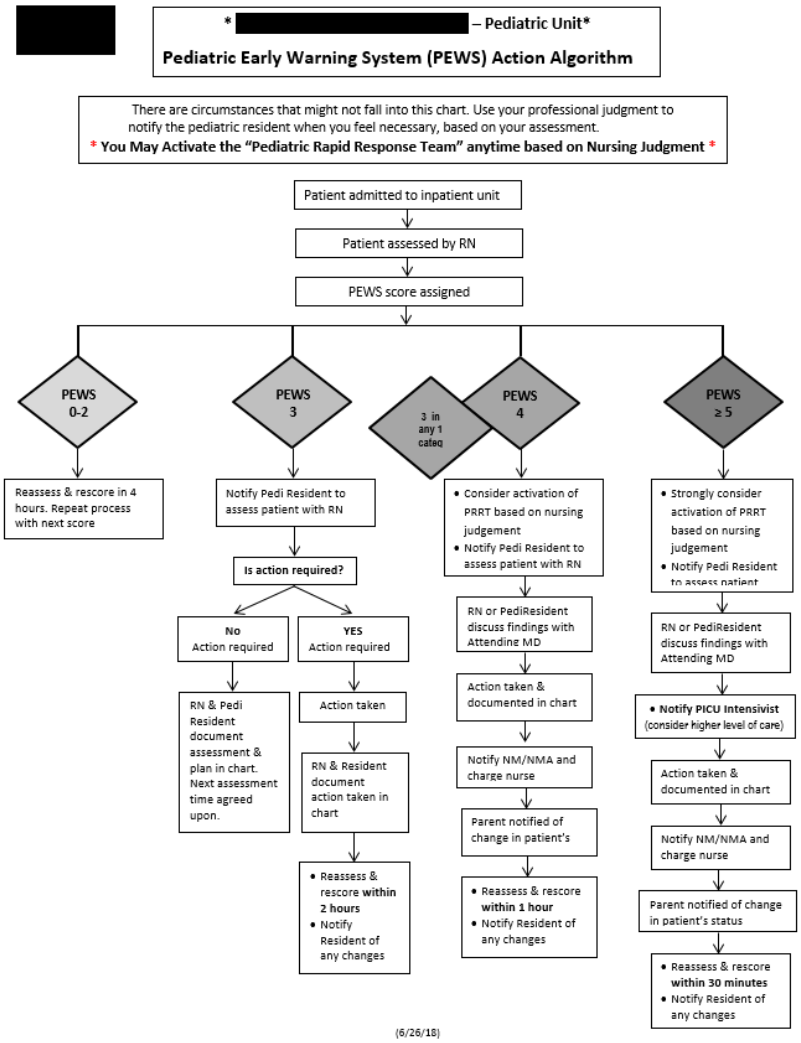
Heart Rate and Respiratory Rate Scoring

Age Specific	Score 0	Score 1	Score 2	Score 3
< 3 months				
HR			170-179	≥180 or ≤109
RR	30-70	71-80	≥81	≤25
>3-12 months				
HR			170-179	≥180 or ≤109
RR	25-60	61-70	≥71	≤20
>1-4 years				
HR			140-149	≥150 or ≤89
RR	20-50	51-60	≥61	≤15
>4-12 years				
HR			130-139	≥140 or ≤69
RR	20-40	41-50	≥51	≤15
>12 years				
HR			120-129	≥130 or ≤59
RR	12-26	27-35	≥36	≤7

Hypotension: Age 1-10: Systolic Blood Pressure less than 70 + 2(age in years)
Age 10+: Systolic Blood Pressure less than 90

References:
Duncan, H., Hutchison, J., & Parshuran, C. (2006). The pediatric early warning system score: A severity of illness score to predict urgent medical need in hospitalized children. *Journal of Critical Care, 21,* 270-279.

Appendix I: PEWS Action Algorithm



Appendix J

Criteria for PRRT Activation

- **Airway if threatened**
- **Breathing:**
  - Increased effort
  - Increased O2 Requirement
  - SPO2 <90%
- **Respiratory Rate:**
  - 0 to 2 yr <20 or 65>
  - 3 yr to 7 yr <18 or 45>
  - 8 yr to 12 yr <12 or 40>
  - 13 yr to 21 yr <10 or 25>
- **Circulation:**
  - Heart rate:
    - 0 day to 2 yr (awake) <85 beats/min 180>
    - (sleeping) <80 beats/min 160>
    - 3 yr to 10 yr <60 beats/min 140>
    - 11 yr to 21 yr <50 beats/min 110>
- **Blood Pressure:**
  - Normal Blood Pressure:
    - Child 1 yr to 10 yr of Age
  - 90 mm Hg + (child's age in years X 2)
- **Systolic Hypotension:**
  - 0 day to 1 month <60 mm Hg
  - 1 month to 12 months <70 mm Hg
  - 1 yr to 10 yr <70 + (age in years X 2)
  - 10 yr to 21 yr <90 mm Hg
- **Systolic Hypertension:**
  - Two times above normal values
- **Neurology:**
  - Change in level or consciousness
  - Change in motor and/or sensory function
  - Repeated or extended seizures
- **Family concern**

Appendix K1: PEWS PPT Presentation

PEWS:
PEDIATRIC EARLY WARNING SYSTEM

Using a PEWS algorithm for activating a RRT: A staff education project.

Presented by Ruthann Kosick, MSN, RN, CCRN, CPN, CBC

1

LEARNING OUTCOMES

BY THE END OF THIS SESSION, YOU WILL BE ABLE TO:

- Describe your role and responsibility for escalating care immediately upon the recognition of clinical deterioration in any patient.
- Define failure to rescue.
- Describe the purpose of a PRRT.
- Describe clinical signs and symptoms requiring the activation of the PRRT.
- Discuss the use of PEWS in clinical practice.
- Describe the PEWS scoring tool assessment criteria.
- Calculate a PEWS score using the PEWS scoring tool.
- Discuss the importance of clinical judgement and individualized assessment.
- Identify children at risk for clinical deterioration.
- Describe the level of severity associated with each PEWS score category.
- Apply the actions recommended in the PEWS action algorithm that correlate with the PEWS score.

2

INTRODUCTION:

PEDIATRIC EARLY WARNING SYSTEM (PEWS)

Safety and Quality Initiative

- Early recognition of clinical deterioration
- Early and appropriate implementation of interventions
- Ensure appropriate level of care

3

SAFETY AND QUALITY INITIATIVE FOR HOSPITALIZED CHILDREN

100k lives · NICE · NHS National Institute for Health and Clinical Excellence · Children's Hospital Association · Institute for Healthcare Improvement · AHRQ · The Joint Commission · CHCA · World Health Organization · CDC Centers for Disease Control and Prevention

4

BACKGROUND

- Signs of clinical deterioration in pediatric patients
  - Exhibited in the hours preceding cardiac and/or respiratory arrest
  - Often missed by healthcare providers
- Implementation of interventions delayed
- Nurses reluctant to activate PRRT
- Failure to rescue
- Flawed healthcare model

5

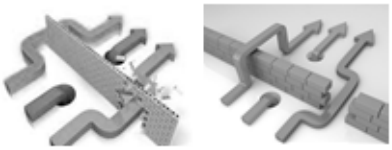
AVOIDABLE ADVERSE CLINICAL EVENTS

- Rarely sudden
- Rarely unpredictable
- Preceded by ≥ 1 signs of physiologic and/or biochemical deterioration
- Related to faults in traditional healthcare model
  - Substantial delays:
    - Early identification
    - Response
    - Initiation of treatment

6

Appendix K2: PEWS PPT Presentation

Breaking Practice Barriers



7

Identify and Respond to Early Signs of Clinical Deterioration

1. Timely and well-coordinated response
2. Correct diagnosis of the problem
3. Communicating an accurate assessment of severity of the patient's condition
4. Prompt and appropriate action
5. Document the actions taken
6. Document the patient response to the intervention(s)

8

Gap in Practice

- Incomplete PEWS program
- Culture is resistant to activating PRRT alerts
  - Not unusual for nurses to decide against activating the PRRT
- Barriers to activation of PRRT alerts
  - Knowledge deficit
  - Negative attitudes and comments expressed by the PRRT
  - Belief that the pediatric resident's and/or attending physician's awareness of the situation was sufficient
  - Insecurities related to nursing competencies

9

A Comprehensive System

PEWS Components:

- PEWS Scoring Tool
- PEWS Action Algorithm

10

PEWS: Pediatric Early Warning System

- Evidence-based program
- Developed to standardize:
  - Language
  - Assessment criteria
  - Process for identifying early clinical deterioration
  - Guide nursing actions
- Incorporates all 6 of DeVita et al. (2006) recommendations
- Goals:
  - Improve patient outcomes
  - Use a reliable and valid PEWS scoring tool
  - Use a PEWS action algorithm to guide nursing actions
  - Prompt and immediate help to the bedside

11

Benefits of a Comprehensive PEWS

- Identify patients at risk of clinical deterioration
- Improving timeliness of response, diagnosis and appropriate interventions
- Decrease the rates of negative consequences associated with the failure to rescue:
- Improve communication and teambuilding skills
- Increase critical thinking skills
- Empowerment within the nursing team to act
- Increase self-efficacy to act

12

Appendix K3: PEWS PPT Presentation

K. Hovnanian Children's Hospital: Purpose of PEWS Policy & Procedure

- To use objective clinical indicators and a risk assessment tool to identify children at risk for clinical deterioration and enable early recognition of changes in a child's physiologic condition.
- To guide nursing actions to get prompt, immediate help to the bedside for a child at increased risk for clinical deterioration, following the recommended guidelines outlined in the PEWS action algorithm corresponding with the child's PEWS score.

13

13

Operational Definitions

PEWS = Pediatric Early Warning System

PEWS Scoring Tool

- The nurse assigns a PEWS score
- Table used to assess specific criteria within three physiologic systems:
  - Patient behavior (neurologic)
  - Cardiovascular
  - Respiratory
- EXTRA points assigned for specific clinical situations

PEWS Action Algorithm

- Step-by-step workflows to follow based on the individual patient's PEWS score and patient
- Includes the activation of the PRRT when necessary

14

14

Key Points

- All patients admitted to pediatrics are assigned PEWS scores
- Clinical judgement and communication are essential
- May be circumstances that don't fall into the PEWS action algorithm
- Escalation guide is a minimum suggested level for observation, alert and response
- ***The RN may activate the "Pediatric Rapid Response Team" anytime based on nursing judgment.***
- Algorithm tailored to individual child – actions may vary based on special situations

15

15

PEWS Procedure and Scoring

- Upon admission, assess the patient's vital signs, behavior, cardiovascular, and respiratory status.
- Calculate a PEWS score using the scoring grid.
- Document PEWS score in patient record.
- Follow the PEWS action algorithm based on the patient's PEWS score.
- The PEWS score is documented on the designated PEWS board located at the main nurses' station.
- Repeat the process with vital signs every 4 hours, or more frequently as indicated by PEWS action algorithm.
- A higher score indicates a worse clinical condition.

16

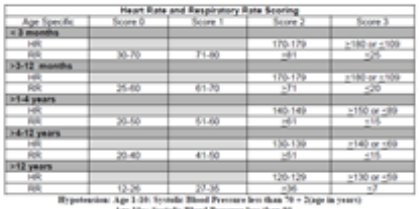
16

Pediatric Early Warning System (PEWS) Scoring Tool

17

17

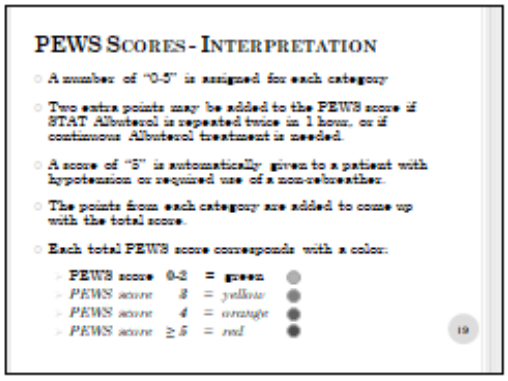
Pediatric Early Warning System (PEWS) Scoring Tool



18

18

Appendix K4: PEWS PPT Presentation



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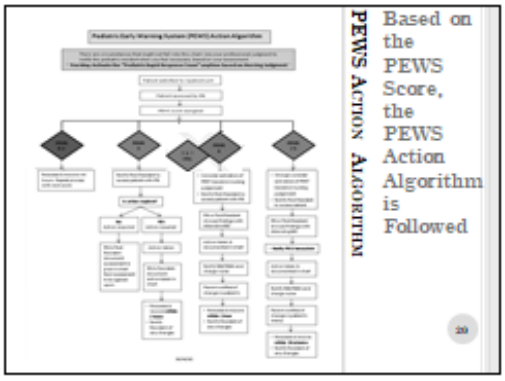

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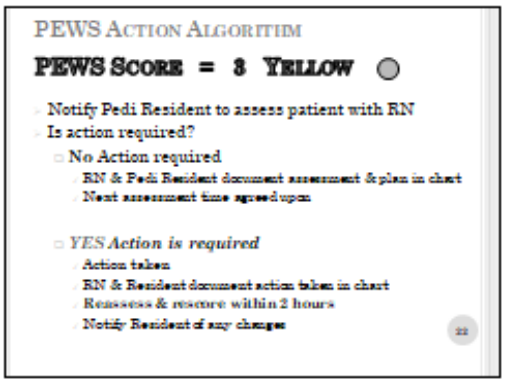

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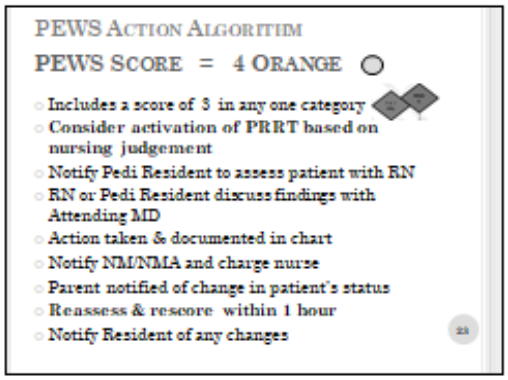

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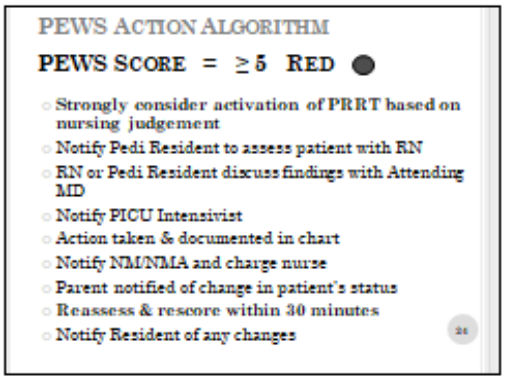

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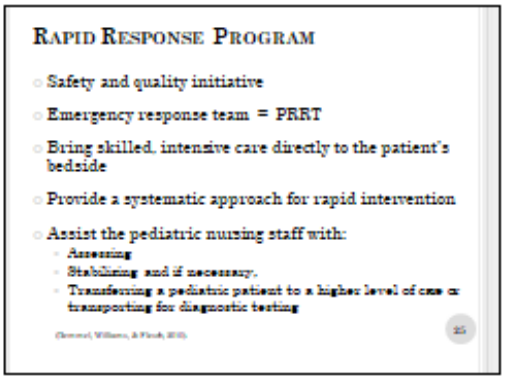
Appendix K5: PEWS PPT Presentation



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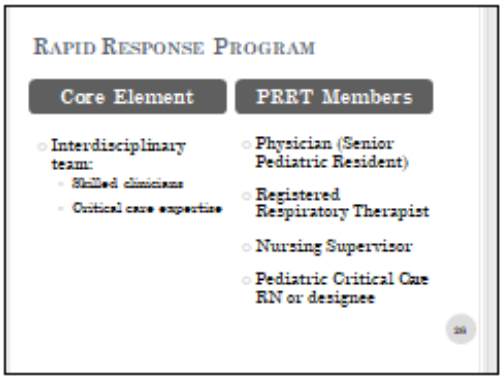

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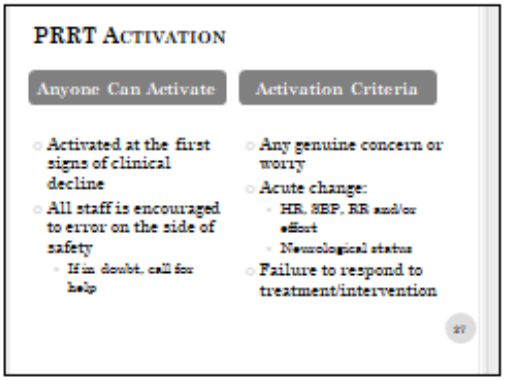

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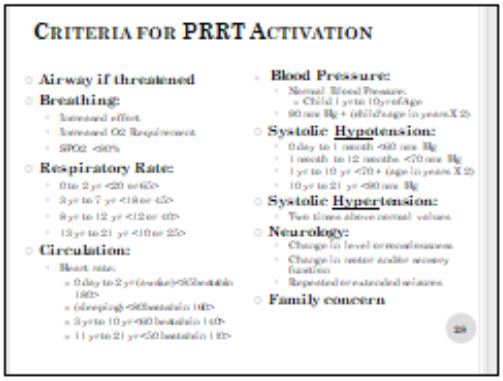

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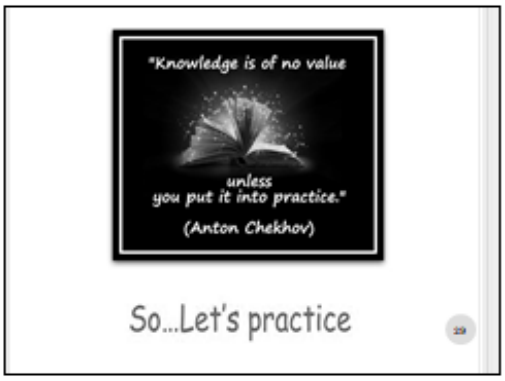

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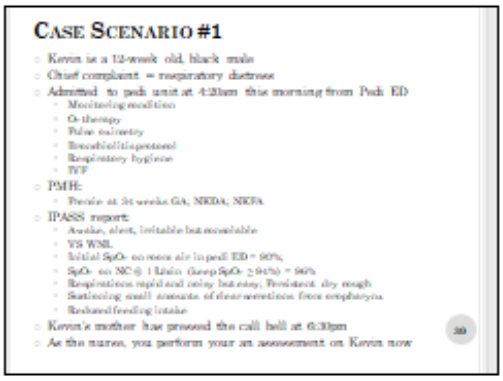

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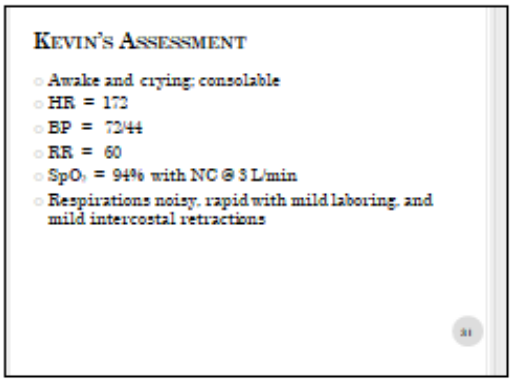

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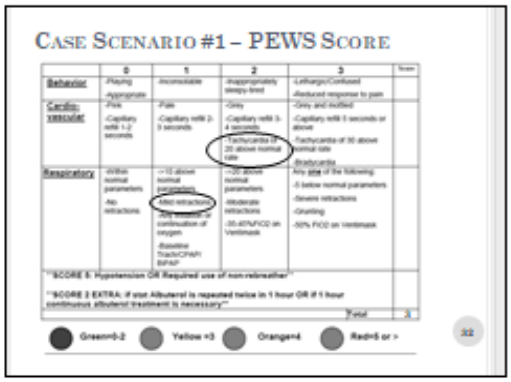

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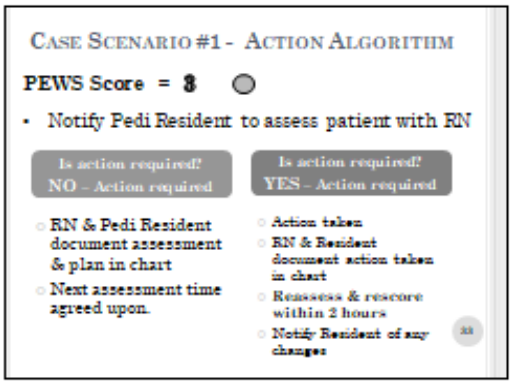

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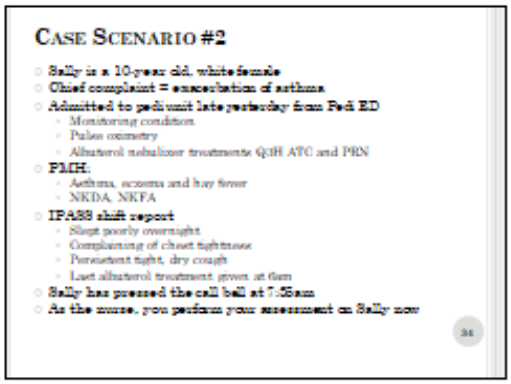

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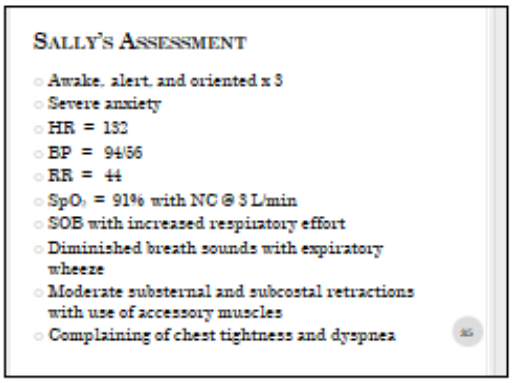

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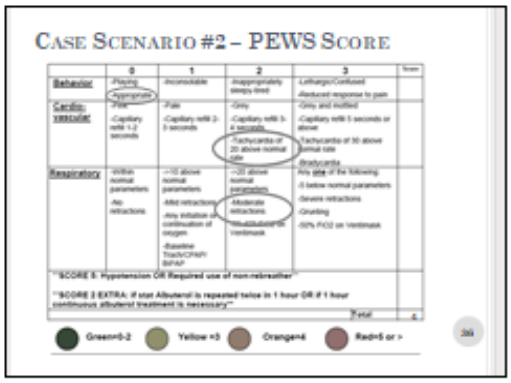

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Appendix K7: PEWS PPT Presentation

Case Scenario #2 - Action Algorithm

PEWS Score = 4

- Consider activation of PRRT based on nursing judgement
- Notify pedi resident to assess patient with RN
- RN or pedi resident discuss findings with attending MD
- Action taken & documented in chart
- Notify NM/NMA and charge nurse
- Parent notified of change in patient's status
- Reassess & rescore within 1 hour
- Notify Resident of any changes

37

Case Scenario #3

- Mark is a 4-year old, Asian male
- Chief complaint = abdominal pain
- Admitted to pedi 2 days ago Pedi ED to R/O appendicitis
  - Monitoring condition
  - IVF
  - Antibiotic therapy
  - Pain management
  - NGT management
- PMH:
  - NKDA, NKFA
- IPASS shift report
  - NPO after midnight; Last PO intake 2:30pm
  - Scheduled for surgery at 8:00am but was postponed for to incoming trauma – 1st on list when OR suite is available
- Mark's mother calls you to the bedside at 10:50am with concerns about Mark not acting "right"
- As the nurse, you perform your assessment on Mark now

38

Mark's Assessment

- Awake but lethargic
- HR = 118
- BP = 110/59
- RR = 32
- SpO_2 = 98% on room air
- Respirations rapid but easy; Lungs clear
- IV patent and intact, infusing well
- Skin cool and clammy to touch

39

Case Scenario #3 – PEWS Score

	0	1	2	3	Score
Behavior	-Playing -Appropriate	-Inconsolable	-Inappropriately sleepy/irritable	-Lethargic/Confused -Reduced response to pain	
Cardio-vascular	-Pink -Capillary refill 1-2 seconds	-Pale -Capillary refill 3-4 seconds	-Grey -Capillary refill 3-4 seconds -Tachycardia of 20 above normal rate	-Grey and mottled -Capillary refill 5 seconds or above -Tachycardia of 30 above normal rate -Bradycardia	
Respiratory	-Within normal parameters -No retractions	-<10 above normal parameters -Mild retractions -Any initiation or continuation of oxygen -Baseline Trach/CPAP/BiPAP	-<20 above normal parameters -Moderate retractions -35-40%FiO2 on Ventimask	Any one of the following: -5 below normal parameters -Severe retractions -Grunting -50% FiO2 on Ventimask	
SCORE 5: Hypotension OR Required use of non-rebreather **SCORE 2 EXTRA: if last Albuterol is repeated twice in 1 hour OR if 1 hour continuous albuterol treatment is necessary"**				Total	/3

Green=0-2 Yellow =3 Orange=4 Red=5 or >

40

Case Scenario #3 - Action Algorithm

PEWS Score = 3 in one category

- Consider activation of PRRT based on nursing judgement
- Notify pedi resident to assess patient with RN
- RN or pedi resident discuss findings with attending MD
- Action taken & documented in chart
- Notify NM/NMA and charge nurse
- Parent notified of change in patient's
- Reassess & rescore within 1 hour
- Notify Resident of any changes

41

Case Scenario #4

- Christina is a 9-month old, Hispanic female
- Chief complaint = 5 day history of vomiting, abdominal pain and bloody mucous stools
- Admitted to pedi unit early this afternoon from Pedi ED for suspected intussusception
  - Monitoring condition
  - Surgical consultation
  - Diagnostic testing
  - Pain management
  - IVFs
  - NGT management
  - Strict I & O (urine bag applied in Pedi ED at 8:30am)
- PMH:
  - None, NKDA, NKFA
- You admitted and assessed Christina at 12:15pm
- Admitting PEWS score was 2
- Christina's mother has pressed the call bell at 5:50pm
- As the nurse, you perform your assessment on Christina now

42

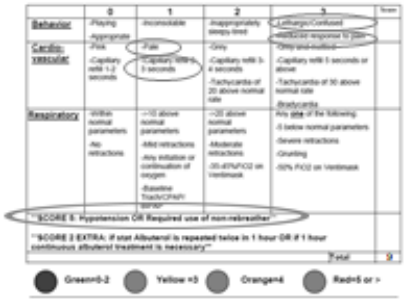
Appendix K8: PEWS PPT Presentation

Christina's Assessment

- Mother expresses serious concern for Christina's "sleepy state" and frequent bloody stools
- Christina is limp and listless
- Color is mottled
- Capillary refill 5 seconds
- HR = 164
- BP = 68/38
- RR = 38
- SpO_2 = 95% on room air
- Respirations rapid but easy; Lungs clear
- IV patent and intact, infusing well
- No urine in bag
- Large amount of red-currant, jelly stools in saved diapers

43

Case Scenario #4 – PEWS Score



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Case Scenario #4 - Action Algorithm

PEWS Score = 9

- Consider activation of PRRT based on nursing judgement
- Notify pedi resident to assess patient with RN
- RN or pedi resident discuss findings with attending MD
- Notify PICU Intensivist
- Action taken & documented in chart
- Notify NM/NMA and charge nurse
- Parent notified of change in patient's
- Reassess & rescore within 30 minutes
- Notify Resident of any changes

45

PEWS Summary:

Evidence-based safety and quality initiative

Key benefits of comprehensive PEWS program:

- Increased situational awareness
- Identify patients at risk of clinical deterioration
- Improve timeliness of response, diagnosis, and appropriate interventions
- Improve patient outcomes

46

- If you have a clinical concern – Escalate Care
- TREAT THE CHILD, NOT the SCORE
- Escalation guide is a minimum suggested level for observation, alert and response:
  - Can be bypassed at any time to reach a higher level of help
- Use your professional judgment
- May Activate PRRT based on Nursing Judgment

47

48

Appendix L1: PEWS Policy

Current Status: *Active* **Policy Stat ID:** *5879212*

[redacted]

Origination Date: *01/2019*
Effective: *01/2019*
Last Approved: 01/2019
Last Revised: 01/2019
Next Review: 01/2022
Owner: *Kristine Galizio: CLINICAL NURSE SPECIALIST*
Policy Area: *Nursing - Perinatal Child*
Applies To:
Applicability: [redacted]

PEWS Pediatric Early Warning System

Purpose:

- To use objective clinical indicators and a risk assessment tool to identify children at risk for clinical deterioration and enable early recognition of changes in a child's physiologic condition.
- To guide nursing actions to get prompt, immediate help to the bedside for a child at increased risk for clinical deterioration, following the recommended guidelines outlined in the PEWS action algorithm corresponding with the child's PEWS score.

Scope:

- K. Hovnanian Children's Hospital (Pediatric Unit, Pedi ED, and PICU)
- RBMC: Pediatric Unit

Operational Definitions:

***PEWS*: Pediatric Early Warning Score**

PEWS Components:

PEWS Scoring Tool (See attachment A)

- The nurse assigns a PEWS score for the pediatric patient by using a table to assess specific criteria within three physiologic systems: patient behavior (neurologic); cardiovascular; and respiratory.

Appendix L2: PEWS Policy

- EXTRA points assigned for specific clinical situation outlined in the PEWS scoring tool

PEWS Action Algorithm (See Attachment B)

- Provides nurses with step-by-step workflows to follow based on the individual patient's PEWS score, including the activation of the emergency teams when necessary:
  - [redacted]-Pediatric Rapid Response Team (PRRT)
  - [redacted]- Code White

Policy Statement:

The pediatric early warning system is used on the general pediatric unit (and in the Pedi ED at [redacted]) to identify pediatric patients who are at risk for or may be in an early stage of clinical deterioration.

- **The PEWS score is based physiological changes within three systems:**
  - **Based on the patient's PEWS score, the nurse will follow the corresponding PEWS action algorithm.**
  - **Patient's behavior (neurological status);**
  - **Cardiovascular status; and**
  - **Respiratory status.**
- **The goal of the system is to provide early and rapid intervention in order to promote better outcomes such as reduced cardiac and/or respiratory arrests outside of the PICU, reduced unexpected returns or transfers to the PICU, decreased rate of adverse outcomes, and reduced number of preventable hospital deaths. Procedure:**

[redacted]-PEWS Score in Pedi ED and PICU

- Every patient being transferred to the general pediatric unit from the Pedi ED or PICU will be assigned a PEWS score within 30 minutes prior to transport.
- The goal of the assigning a PEWS score prior to transfer is to ensure that the patient is being admitted / transferred to the appropriate level of care.
  - PEWS Score ≥ 4:
    - Consider PICU admission / placement

Key Points:

- All patients admitted to the pediatric unit are assigned a PEWS score on admission and every 4 hours with vital signs, or more frequently based on the PEWS action algorithm.
- The PEWS score is documented in the patient's medical record.
- The PEWS score is documented on the designated PEWS board located at the main nurses' station.

Appendix L3: PEWS Policy

- Based on the patient's PEWS score, the nurse will follow the corresponding PEWS action algorithm.
- [redacted] – RN may activate the "Pediatric Rapid Response Team" anytime based on nursing judgment.
- [redacted] – RN may activate the "Code White Team" anytime based on nursing judgment.

Procedure:

Equipment:

- PEWS Scoring Grid
- PEWS Action Algorithm

Procedure:

- Upon admission to, assess the patient's vital signs, behavior, cardiovascular, and respiratory status.
- Calculate a PEWS score using the scoring grid.
- Document PEWS score in patient record.
- Follow the PEWS action algorithm based on the patient's PEWS score.
- Repeat the process with vital signs every 4 hours, or more frequently as indicated by PEWS action algorithm.

Protocol:

1. PEWS Scoring:

- A PEWS score is assigned to all patients admitted to the general pediatric unit.
- A PEWS score is assigned to a patient at least every 4 hours around the clock with vital signs.
- The PEWS score is documented in the patient record.
- The PEWS score is documented on the designated PEWS board located at the main nurses' station.
- A higher score indicates a worse clinical condition.

2. PEWS Scores:

- A number of "0-3" is assigned for each category (See PEWS Scoring Tool Attachment A)
- Two extra points may be added to the PEWS score if STAT Albuterol is repeated twice in 1 hour, or if continuous Albuterol treatment is needed.

Appendix L4: PEWS Policy

- A score of "5" is automatically given to a patient with hypotension or required use of a non-rebreather.
- The points from each category are added to come up with the total score.
- Each total PEWS score corresponds with a color:

PEWS score 0-2 = green
PEWS score 3 = yellow
PEWS score 4 = orange
PEWS score ≥ 5 = red

3. PEWS Action Algorithm

Follow the hospital and unit PEWS action algorithm corresponding with the patient's PEWS score:

Green score = 0-2

1. Reassess & rescore in 4 hours.
2. Repeat process with next score

Yellow Score= 3

1. Notify:

- [redacted] **Pedi = Pedi resident to assess patient with RN**
- [redacted] **ED = ED Physician to assess patient with RN**
- [redacted] **+ Pedi Hospitalist to assess patient with RN**

2. Is action required?

No Action Required

Document assessment and plan in chart:

- [redacted] **+ RN & Pedi Resident**
- [redacted] **ED = RN & ED Physician**
- [redacted] **Pedi = RN & Pedi Hospitalist**

Yes, Action is required:

Action taken and documented in the chart

Document assessment and plan in chart:

- [redacted] **+ RN & Pedi Resident**
- [redacted] **ED= RN & ED Physician**

Appendix L5: PEWS Policy

- [redacted] Pedi= RN & Pedi Hospitalist

Reassess & rescore within 2 hours

Notify physician of any changes

- [redacted] = Pedi Resident
- [redacted] ED= ED Physician
- [redacted] Pedi= Pedi Hospitalist

Orange Score=4

Includes a score of "3" in any one category

1.Consider activation of emergency response team based on nursing judgement:

- [redacted] Pedi = Pediatric Rapid Response Team (PRRT)
- [redacted] = Pediatric Rapid Response Team (PRRT)
- [redacted] Pedi = Code White

2. Notify Physician

- [redacted] Pedi= Pedi Resident to assess patient with RN
- [redacted] ED = ED Physician to assess patient with RN
- [redacted] Pedi= Pedi Hospitalist to assess with RN

3.Discuss findings with Attending MD

- [redacted] Pedi = RN or Pedi Resident
- [redacted] ED = RN or ED Physician
- [redacted] Pedi = RN or Pedi Hospitalist

4. Action taken & documented in chart.

5.Notify NM/NMA and charge nurse.

6. Parent notified of change in patients status

7.*Reassess & rescore within 1 hour.*

8.Notify Pedi Physician of any changes:

- [redacted] Pedi = RN or Pedi Resident
- [redacted] ED = RN or ED Physician
- [redacted] Pedi = RN or Pedi Hospitalist

Red Score= ≥ 5

1. Strongly consider activation of emergency response team based on nursing judgement

Appendix L6: PEWS Policy

- [redacted] Pedi = Pediatric Rapid Response Team (PRRT)
- [redacted] = Pediatric Rapid Response Team (PRRT)
- [redacted] Pedi = Code White

2.Notify Physician:

- [redacted] Pedi= Pedi Resident to assess patient with RN
- [redacted] ED = ED Physician to assess patient with RN
- [redacted] Pedi= Pedi Hospitalist to assess with RN

3. Discuss findings with Attending MD

- [redacted] Pedi = RN or Pedi Resident
- [redacted] ED = RN or ED Physician
- [redacted] Pedi = RN or Pedi Hospitalist

4. Consider higher level of care:

- [redacted] Pedi = Notify PICU Intensivist
- [redacted] ED= Notify PICU Intensivist
- [redacted] Pedi= Hospitalist consults a PICU Intensivist at a Children's Hospital for transfer

5. Action taken & documented in chart

- [redacted] Pedi =RN & Pedi Resident
- [redacted] ED = RN & ED Physician
- [redacted] Pedi = RN & Pedi Hospitalist

6. Notify NM/NMA and charge nurse

7.Parent notified of change in patients status.

8. *Reassess & Rescore within 30 minutes.*

9.Notify Physician of any changes:

- [redacted] Pedi= Pedi Resident to assess patient with RN
- [redacted] ED = ED Physician to assess patient with RN
- [redacted] Pedi= Pedi Hospitalist to assess with RN

The color that corresponds to each patients PEWS score is documented in the patient record.

The color that corresponds to each patients PEWS score is documented on the designated board in the central nursing station.

All actions taken are documented in the patient record.

Appendix L7: PEWS Policy

A PEWS score is re-assessed and documented according to the PEWS algorithm.

There may be circumstances that do not give a patient a high PEWS score or fall into the PEWS action algorithm, but requires intervention:

- The RN is to use professional judgment to notify the in-house physician or attending as necessary.
- ***The RN may activate the emergency response team anytime based on Nursing Judgment.***
- In the instance that a patient has a DNR order, the PEWS score does not have to be documented.
- The color on the board should be blue  to indicate that the patient is DNR status

Strength of the Evidence

Level I Experimental study/randomized control trial (RCT) or meta-analysis of RCT
Level II Quasi-experimental study
Level III Non-experimental study, qualitative study, or meta-analysis
Level IV Opinion of nationally recognized experts based on research evidence or expert consensus panel (systematic review, clinical practice guidelines)
Level V Opinion of individual expert based on non-research evidence (includes case studies;
literature review; organizational experience e.g. quality improvement and financial data, clinical expertise, or personal experience

References / Level of Evidence:

Level V / "B" Good: Demmel, K.M., Williams, L., & Flesch, L. (2010). Implementation of the pediatric early
warning scoring system on a pediatric hematology/oncology unit. *Journal of Pediatric Oncology Nursing, 27*(4), 229-240. doi:10.1177/1043454209358410

Level I / "A" High: Duncan, H., Hutchison, J., & Parshuram, S. (2006). The pediatric early warning system score: A severity of illness score to predict urgent medical need in hospital children. *Journal of Critical Care, 21*(3), 271-279. https://doi.org/10.1016/j.jcrc.2006.06.007

Level V / "B" Good: Monaghan, A. (2005). Detecting and managing deterioration in children. *Paediatric Nursing, 15*(1), 32-35.

Level I / "A" High: Tucker, K. M., Brewer, T. L., Baker, R. B., Dermitt, B., & Vossmeyer, M. T. (2009). Prospective evaluation of a pediatric inpatient early warning score. *Journal for Specialists in Pediatric Nursing, 14*(2), 79-85. http://dx.doi.org/doi:10.1111/j.1744-6155.2008.00178.x

Stakeholders:
Pediatrics, Pedi ED, PICU

Authors: Reviewed by:

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Appendix L8: PEWS Policy

Fran Latourette, RN
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Perinatal Child Health Council

All revision dates:	01/2019
Attachments:	Attachment A. PEWS Scoring Tool.docx Attachment B. PEWS Action Algorithm.docx

Approval Signatures

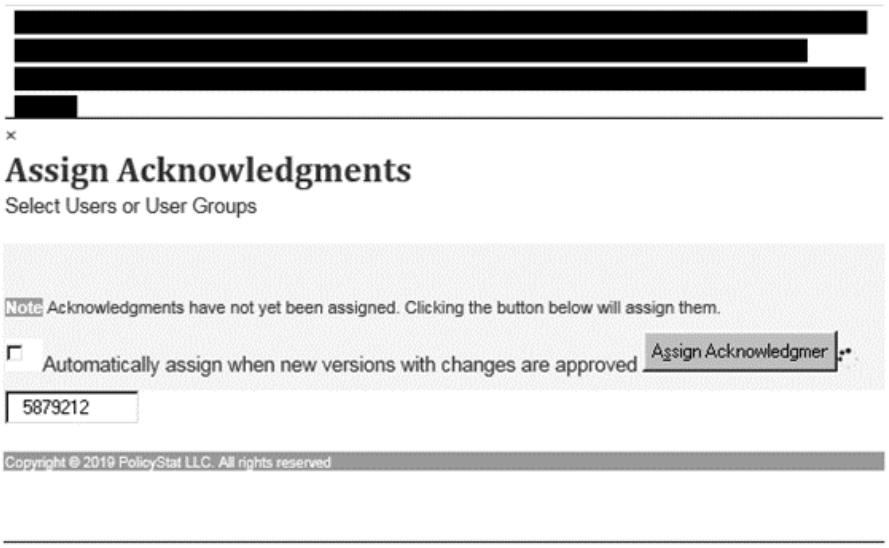
Step Description	Approver	Date
Clinical Policy Admin Approval	Miriam Mcnicholas: CLINICAL NURSE SPECIALIST	01/2019
Perinatal Child Health Council	Roselyn Young: CLINICAL NURSE SPECIALIST	01/2019
	Kristine Galizio: CLINICAL NURSE SPECIALIST	01/2019

Step Description	Approver	Date
Clinical Policy Admin Approval	Miriam Mcnicholas: CLINICAL NURSE SPECIALIST	01/2019
Perinatal Child Health Council	Roselyn Young: CLINICAL NURSE SPECIALIST	01/2019
	Kristine Galizio: CLINICAL NURSE SPECIALIST	01/2019

Older Version Approval Signatures

Applicability

Appendix L9: PEWS Policy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Assign Acknowledgments

Select Users or User Groups

Note Acknowledgments have not yet been assigned. Clicking the button below will assign them.

Automatically assign when new versions with changes are approved Assign Acknowledgmer

5879212

Appendix M1: Abbreviations

AAMC	Association of American Medical Collages (AAMC)
ADC	Average Daily Census
AMA	American Medical Association
ANA	American Nurses Association
CCHMC	Cincinnati Children's Hospital Medical Center
CHCA	Child Health Corporation of America
CLS	Child Life Specialist
CMS	Centers for Medicare and Medicaid Services
CNE	Chief Nurse Executive
CNO	Chief Nursing Officer
EBP	Evidence-Based Practice
ED	Emergency Department
EKS	Education Knowledge Survey
EWS	Early Warning Score
ICU	Intensive Care Unit
IHI	Institute of Healthcare Improvement
IOM	Institute of Medicine
LOS	Length of Stay
NICE	National Institute for Health and Clinical Excellence
NM	Nurse Manager

Appendix M2: Abbreviations

NMA	Nurse Manager Assistant
NP	Nurse Practitioner
NPSG	National Patient Safety Goals
PCT	Patient Care Technician
PEWS	Pediatric Early Warning System
PICU	Pediatric Intensive Care Unit
PPT	PowerPoint
RN	Registered Nurse
PRRT	Pediatric Rapid Response Team
RRT	Rapid Response Team
SCT	Social Cognitive Theory
TJC	The Joint Commission on Accreditation of Healthcare Organizations
YTD	Year-to-Date