Hypothermic Patient Warming in a Pediatric Emergency Department

Daniel Bileth
dbileth@wcupa.edu

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Hypothermic Patient Warming in a Pediatric Emergency Department

A DNP Project

Presented to the Faculty of the

Department of Nursing

West Chester University

West Chester, Pennsylvania

In Partial Fulfillment of the Requirements for

the Degree of

Doctor of Nursing Practice

By

Daniel Bileth, MSN, RN, CPN

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Dedication

This project is dedicated to all the staff within the Emergency Department that helped to make this project a reality during a global pandemic that changed the field of nursing in immeasurable amounts. This continued quality improvement process would not have been possible without you.
Acknowledgements

I have been supported and encouraged in this journey to achieve my DNP by many people. I would like to express my overwhelming gratitude to the guidance and mentorship throughout this journey to my DNP mentor Dr. Thomas Pearson. He was always willing to listen and guide me through any obstacle that arose, and he kept me grounded through some self-defined catastrophes, I wouldn’t have this project topic without him. Dr. Catherine Haut and Dr. Julie Nair provided unmeasurable support with the IRB process and their guidance is greatly appreciated. My friend, Dr. John Taylor was always a visible reminder that you can do it, he did and is now getting his PhD, I had no room to complain when he was going through this journey a second time.

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Thank you to my family and friends who supported me along this crazy journey. Thank you, Jimmy, for being such an amazing and supportive husband, you always listened when I was stressed and talked me into completing this degree multiple times. Without your support I would not have obtained my DNP, which helps me to be the best role model for our son. Keo, I am so proud to call myself your dad and I thank you for all the ways you love and support me, even though you don’t know it.
Abstract

Hypothermia has been associated with increased morbidity and mortality in adults and increased mortality in children. Unplanned hypothermia increases adverse outcomes in patients, including increased blood loss, increased risk for blood transfusion, decreased oxygenation to major organs, and decreased immune response (Beedle et al., 2017; Brozanski et al., 2020; Erdoğan et al., 2019; Granum et al., 2019). Collaboration with Emergency Department (ED) physician leadership, clinical educators, and trauma leadership determined the need for a formal warming procedure. The purpose of this project was to implement a clinical warming algorithm for pediatric patients within the ED who had a temperature of ≤35.9°C Celsius at any point during their stay. The pre-intervention group contained 13 cases of hypothermia in the months of January, February, and March of the year 2021, post-intervention included 12 cases in the same period of the year 2022. Statistically significant findings were not established during this quality improvement project. Clinical significance was achieved, which showed an increase in the percent of patients reaching normothermia and an increase in body temperatures on average, in those that did not reach normothermia versus the retrospective population. It is recommended to perform a longer quality improvement project with a larger sample size to achieve statistical significance.

Keywords: (Pediatric, hypothermia, warming, emergency care.)
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Chapter 1

Introduction and Background

Hypothermia has been associated with poor patient outcomes, especially in critically ill patients, including children. Children who experience trauma, due to the uncontrolled environment and nature of an accident can be predisposed to experience hypothermia either from the scene of the event or in the transport process (Mota et al., 2021). This project focused on unintended hypothermia in pediatrics within the Emergency Department (ED). Consequences of hypothermia include increased blood loss, decreased perfusion to the major organs and brain, reduced immune response and increased risk for infection (Beedle et al., 2017; Brozanski et al., 2020; Erdoğan et al., 2019; Granum et al., 2019).

Within the study institution there were 66 children with documented unplanned hypothermia from January 1, 2021 to December 31, 2021, averaging five to six patients per month. More patients experience hypothermia in the winter months due to environmental exposure. The trauma program research coordinator expressed concern over the number of patients that are presenting or experiencing hypothermia within the ED. It was determined that no official warming procedures were followed within the ED. Pediatric literature is lacking in the relationship between hypothermia and morbidity or mortality. It is known that pediatric patients who arrive hypothermic after a traumatic brain injury (TBI) or other traumatic injury were as high as 9.5 times more likely to die than patients who arrived normothermic (Sundberg et al., 2011).

Research on the effectiveness of active warming on pediatric patients within various surgical service areas has shown to positively impact patient outcomes. Forced air warming has
been shown to warm pediatric patients two-times faster than traditional blankets and led to a
decrease in post-procedure complications including arrythmias, shivering, nausea, and vomiting.
These positive patient outcomes resulted in less medication use post-procedure and shorter
length of stay within the pediatric population (Liu et al., 2017; Sundberg et al., 2011). The use of
a consistent clinical algorithm for active warming procedures may provide an effective treatment
for hypothermic patients. Therefore, this project focused on pediatric patients who experienced
hypothermia at the time of ED admission or at any other point during their ED stay, and aimed to
address the problem of unintended pediatric hypothermia. This project added a clinical care
algorithm for management of pediatric patients who are hypothermic, beginning at the time of
admission to the ED or at any time during their care. The outcome measure will be the time to
normothermia. The clinical care algorithm was developed and presented to the relevant
stakeholders and was unanimously approved for implementation for the purposes of this project.

Methodology

This project utilized a retrospective pre- and post- implementation quality improvement
design. Data was collected from the electronic health record (EHR) where staff documented the
patient’s hypothermic status within the vital sign’s flowsheet, data was manually extracted
regarding the temperature and warming interventions that were documented. IRB approval was
obtained by West Chester University and the implementing organization. Retrospective data was
analyzed to determine the extent of interventions utilized for patients with unintentional
hypothermia and the time in minutes it took to achieve normothermia.
Chapter 2  
Literature Review

Chapter two will include an overview of hypothermia and its effects on negative outcomes. It will discuss the institution of a hypothermic patient warming algorithm (HPWA) on pediatric emergency room patients. It will include definitions, search strategy, summary of research, gaps in research, purpose, and research questions. Donabedian’s Model of Healthcare Quality (DMHQ) guided this literature search by focusing on the structure, processes, and outcomes of warming pediatric patients to prevent correct hypothermia.

Overview and Definitions

Hypothermia’s effects on morbidity and mortality have been widely researched in the adult population, but research is lacking in the pediatric population. This DNP project focused on hypothermic pediatric patients in the emergency department (ED) and if a HPWA will achieve normothermia before the patients meet their disposition. Unplanned hypothermia of only 1°C Celsius increases blood loss during procedures and increases the risk for requiring a blood transfusion. Vasoconstriction occurs when a patient is hypothermic, resulting in decreased oxygenation perfusion to the heart, brain and lungs, reduction in immune response, decreased healing ability and increased risk for infection. Infants are at greater risk for hypothermia due to their increased body surface area to weight ratio, non-matured thermoregulation mechanisms and limited subcutaneous fat stores. Infant hypothermia increases the basal metabolic rate, which increases oxygen and glucose consumption by up to three times and if left untreated leads to hypoxia, hypoglycemia and metabolic acidosis. (Beedle et al., 2017; Brozanski et al., 2020; Erdoğan et al., 2019; Granum et al., 2019). An active re-warming protocol, driven by nursing, is needed to decrease unintended hypothermia and avoid the patient complications listed above.
The implementing institution has an evidence-based protocol for hypothermic patient management that is utilized in the pediatric intensive care unit and this tool was altered to fit the ED setting where it was implemented.

For the purpose of this project, hypothermia will be defined as body temperature \( \leq 35.9^\circ \text{Celsius} \). Normothermia will be defined as \( \geq 36.0^\circ \text{to} \leq 37.9^\circ \text{Celsius} \). Hyperthermia will be defined as a body temperature \( \geq 38.0^\circ \text{Celsius} \). Tools that will be used are defined as warming blanket (Bair Hugger), warmed blankets, warmed IV fluids and neonatal transport warming pad.

**Theoretical Framework**

Donabedian’s Model of Healthcare Quality was utilized for this quality improvement project. This framework is commonly used to evaluate the outcomes of care delivery and is composed of three concepts: structure, process, and outcome. Outcome measures are important because they reflect the impact an intervention can have on a patient’s health status (Types of Healthcare Quality Measures, 2015). Donabedian’s model states that the structure of an organization, when evaluating an outcome, is comprised of finances, staffing, resources, available tools, or equipment (Zaccagnini & White, 2017).

The application of DMHQ looked at the (structure) standard of care, equipment utilization, and education. Secondly, it examined the (process) policies, procedures, and interventions that occur when a patient suffers unplanned hypothermia within the ED. Lastly, it assessed the (outcome) stakeholder’s willingness to change practice and patient outcomes after the intervention (Figure 1). This QI project measured outcomes of an evidence-based process in practice. The standardized use of a HPWA was utilized for unplanned hypothermic patients in the ED. No additional equipment was needed for the utilization of this project, all equipment was available within the ED and was utilized routinely with the HPWA.
Search Strategy

The search for the literature for this project began in Spring 2021 and will continue through Spring 2022. The search strategy was developed in consultation with a subject specialist librarian. The literature search was completed using both CINAHL and MEDLINE databases; dates for inclusion were 2010-2021. The inclusion dates were expanded beyond the 5-7 year standard due to lack of research in pediatrics. Most articles ranged from 2016-2020 with two being from 2010 and 2013, which were specific to pediatric trauma and pediatric traumatic brain injuries. Search terms included the major heading of hypothermia and subject headings: emergency care, warming techniques, perioperative nursing, trauma and resuscitation. The subject headings were grouped together and searched with the boolean term “or” and resulted in 4,483 results. This group of subject headings was then searched with the major heading using the boolean term “and” and resulted in 54 results after limitations of English language, all child (1 month – 18 years-of-age), and publication dates of 2010-2021 were included. Ten keeper articles were identified and chosen based on an inclusion criterion of active warming intervention studies that included pediatrics or adult population, trauma patients, and perioperative patients. Exclusion criteria included articles that discussed therapeutic hypothermia, pre-hospital intervention, oncology patients, active cardiopulmonary bypass, extra corporeal membrane oxygenation, dialysis, wilderness or environmental articles and obstetrics and gynecologic articles. Recent research about hypothermia and active warming specific to the pediatric population is limited and no systematic reviews were found using Cochrane database.
Review of the Literature

Hypothermia Mortality

Hypothermia has been studied and shown to increase mortality rates in adults, but research in pediatrics is lacking. However, two retrospective analysis studies were completed looking at the effect of hypothermia on outcomes with pediatric patients who suffered a traumatic brain injury (TBI) and other traumatic injuries (Rubiano et al., 2013; Sundberg et al., 2011). Reviewing over 11,000 patients within the Pennsylvania Trauma Outcome Study database, which includes patients of all ages, there is a statistically significant increase in the number of deaths in the patients who had accompanying hypothermia (p < 0.001). Thus, stating that patients who arrive to the hospital hypothermic are 1.7 times more likely to die versus patients who arrive normothermic (Rubiano et al., 2013). The odds ratio of patients dying that arrived hypothermic was 8.7 to 9.5 times that of the patients who arrived normothermic. With major trauma being rated as an Injury Severity Score (ISS) of >15, hypothermic patients had an average ISS of 30 thus increasing the odds of mortality from their injuries (Sundberg et al., 2011).

Active Warming

Results of this literature search revealed six randomized controlled trials (RCTs) in which an active warming technique was being used. Active warming is defined by the use of forced air warmers (Bair Hugger), warmed blankets, electric blankets, warmed IV fluids/blood, or any combination of these (Erdoğan et al., 2019; Granum et al., 2019; 2019; Kang & Park, 2020; Liu et al., 2017; Min et al., 2018; Stewart, 2019). Demographic information regarding race, ethnicity, socioeconomic status or health insurance information was not disclosed in any of the RCTs. Results also revealed a quantitative descriptive design study, a literature review with expert
opinion and benchmarking, and two retrospective data analysis studies. Demographic information listed above was also not discussed in this literature. The studies were conducted primarily in the pre-operational, intra-operational, post-operational or post anesthesia care units (Beedle et al., 2017; Brozanski et al., 2020; Erdoğan et al., 2019; Granum et al., 2019; Kang & Park, 2020; Liu et al., 2017; Min et al., 2018; Rubiano et al., 2013; Stewart, 2019; Sundberg et al., 2011).

**Blankets Versus Forced Air Warming.** Blankets have been used to keep patients warm and are the standard protocol in many studies. Studying the effectiveness of regular blankets and electrical blankets versus a Forced Air Warming Blanket (FAWB) forced air warming system, was the main focus of many of these studies. The FAWB warming system demonstrated the ability to decrease inadvertent hypothermia when applied pre-operatively to a patient undergoing a procedure in the operating room (OR). Whether it was placed over or under the body, it remained effective versus blankets alone (Brozanski et al., 2020; Granum et al., 2019; Kang & Park, 2020). However, the placement of the FAWB on the upper body versus the lower body did show an increased incidence of post-operative hypothermia when only placed on the lower body (Min et al., 2018). Utilizing the FAWB pre-operatively showed a complete decrease in peri-operative hypothermia, where 52% of patients with only regular blankets developed hypothermia (Kang & Park, 2020). It is also noted that there was an increase in hyperthermia from 1.1% to 2.2% during the warming phase; no thermal burns were reported (Brozanski et al., 2020).

While the positive aspects of the FAWB have been made clear, it has also been shown to significantly decrease re-warming time and reduce adverse events in the post-operative period when paired with an electric blanket. Re-warming time for patients who became hypothermic peri-operatively was achieved quicker at 35.6 minutes with the electric blankets and FAWB
versus 54.8 minutes with only the electrical blanket and 63.4 minutes with only a regular blanket (Liu et al., 2017). Post-operative complications were reduced significantly in both studies using the electrical blanket and FAWB combined. Decreases in arrhythmias, shivering, nausea and vomiting were seen, which resulted in less medication usage to treat those complications and decreased length of stay (Liu et al., 2017; Sundberg et al., 2011).

**Forced Air Warming Versus Intravenous Fluid Warming.** Forced air warming has been shown effective in rewarming versus blankets alone and there is minimal research on warmed intravenous fluids (IVF) versus FAWB as interventions for maintaining normothermia in pediatric patients during an OR procedure. IVF warming when started in the OR showed no significant difference in maintaining normothermia versus the FAWB (Erdoğan et al., 2019). However, in neonatal patients the IVF warming did not provide enough warming ability to maintain normothermia. This is due to the small amount of IVF that is infused on this very specific population of patients, where a BH can maintain normothermia more effectively (Brozanski et al., 2020).

**Gaps in Literature**

Throughout the review of the literature there were identified gaps. Primarily the studies were done on patients scheduled to go into the OR for a procedure and not patients in the ED with hypothermia. There is a lack of demographic information reported on race, ethnicity, or socioeconomic status from all studies leading to issues with generalizing the findings to a population. Conducting research in the pediatric population can be difficult when measuring outcomes. During this literature review RCTs that included adult populations were included to help define the scope of the problem, risks of hypothermia, and potentially harmful outcomes. Despite these gaps, the knowledge gained here supports the use of forced air warming in
conjunction with warmed blankets and warmed intravenous fluids. Therefore, this DNP project utilized a FAWB as part of an HPWA and answered the following research questions concerning all patients at the pediatric level I trauma center who have a temperature recorded $\leq 35.9$ degrees Celsius to address the following clinical questions.

**Clinical Questions**

1. In pediatric emergency department patients suffering unintended hypothermia, will the use of a hypothermic patient warming algorithm, achieve normothermia prior to disposition?
2. Will the use of a Forced Air Warming Blanket on pediatric patients with unintended hypothermia achieve normothermia prior to disposition?

**Research Questions**

A series of bivariate tests were used to produce inferential findings to address the following research questions that were derived from the data analysis.

1. Is there a significant difference in the percentage of patients that reach 36 degrees as a final measurement (yes/no) by the Retrospective and Current group status?
2. Is there a significant difference in the percentage of patients that reach 36 degrees as a final measurement (yes/no) by the intervention device type used (FAWB vs Other)?
3. Does a 1-degree positive warming change from initial temperature ($< 36$ degrees) to first time measurement vary significantly by a FAWB temperature Setting of 43 vs 38?
4. Does the mean difference between the first-time measurement and last time temperature measurement vary significantly by Retrospective and Current group status?
Chapter 3

Methods

Design

This quality improvement (QI) project utilized a retrospective pre- and post-implementation quality improvement design to evaluate the use of a hypothermic patient warming algorithm (HPWA) on pediatric patients with UH in a Pediatric Emergency Department (ED). This design allowed comparison of pre-intervention data when no formal process for warming hypothermic pediatric patients existed in the ED. This allowed the HPWA to be used with the same assessment measures on participants both before and after the implementation period, the advantage was determining if there was a statistical change in the number of minutes to achieve normothermia after implementation. A retrospective pre-implementation review was completed within the electronic health record (EHR). The information obtained included patient time of hypothermic temperature, time and type of warming interventions, temperature setting of warming blankets during intervention, age, sex, weight, race, and time to achieve normothermia. The HPWA (Appendix A) intervention was implemented within the emergency department operating in 4-week implementation cycles and data was analyzed and evaluated on a continuous basis. During and after the evaluation period, problems and barriers were identified and changes were made prior to implementation of subsequent cycles. The pre- and post- intervention data was analyzed to determine if implementing a HPWA for patients experiencing UH helps achieve better patient outcomes (less time in minutes to normothermia after implementation).
Setting

The setting for this practice change occurred in a rural ED which is a level one pediatric trauma center that holds Magnet designation and is the recipient of the Emergency Nurses Association Lantern Award. The Lantern award is only awarded to ED’s that demonstrate excellence and innovation in leadership, practice, education, and research (ENA, n.d.). This ED is part of a large pediatric health system which treats on average 70,000 patients per year. Patients treated in the ED come from all rural and urban areas in Delaware, Maryland, New Jersey, and Pennsylvania. Influences that could affect the implementation of this project are poor staffing numbers, increased nurse to patient ratios, equipment availability and willingness of nursing to initiate and follow the HPWA. Working with a dedicated QI specialist throughout this implementation provided access to a data dashboard built within the EHR that automatically retrieves post-implementation data for comparison.

Sample

This QI project utilized the HPWA intervention for patients within the ED that experience UH on arrival or during their course of treatment. Inclusion criteria includes all patients within the ED 60 days of age or older that weight > 5 kilograms, despite their primary language. Patients were excluded for the following: weight ≤ 5 kilograms, patients actively receiving or previously received cardiopulmonary resuscitation (CPR), patients undergoing target temperature management (cooling), or specific physician requests to exclude. No other active recruitment was performed by the nurses or PI. The retrospective data yielded a year-to-date number of patients with UH is 66, with an average of five to six patients per month. Completion of two to three intervention cycles yielded 18-20 patients. The sample method used
was convenience sampling, subjects were included from the same months (January, February, and March) pre-intervention 2021 versus post-intervention 2022, this method was chosen to help try to control potential significant bias.

**Ethical Consideration**

Approval was obtained from NCHD for this QI project (Appendix B). Additionally, Institutional Review Board (IRB) exemption was obtained prior to implementation from West Chester University (Appendix C).

After initial chart reviews, the medical record number, which is needed to identify specific patients, was eliminated from documentation at the point of transfer of information from the patient chart. Patient data was identified with a code, a numerical value assigned by the Primary Investigator (PI) and starting with the number one. Data that includes the medical record number was not be saved, viewed, sent, received, or opened on a non-institution secure connection and/or PC. De-identified patient data was stored on a WCU password-protected computer located with the principal investigator. No human subjects were enrolled for this project and consent was not needed, as this project is not identified as research.

**Data Collection**

The collection of data occurred within the EHR. The staff documented the presence of hypothermia within the vital sign’s flowsheet of the EHR. Data was manually extracted regarding the flowsheet rows specific to temperature and warming intervention documentation.

**Stakeholders**

The stakeholders for this project were the ED leadership team, ED registered nurses (RN) and PCT’s, ED physician team, trauma service, surgical services, EPIC analysts, clinical nurse specialist, clinical educator, ED continuous quality improvement specialist and the clinical nurse
researcher within the institution. Upon completion of this project, results of the pre- and post-implementation comparison was disseminated via presentation to the stakeholders listed above.

**Implementation**

The implementation methods for this quality improvement project are listed in order below. All chart data will be de-identified as it is added to the spreadsheet (attached).

1. IRB approval was obtained from the implementing facility and West Chester University.
2. Retrospective data was obtained from the EHR to include the patient’s medical record number, date, temperature on admission or during the time in the ED that was captured \( \leq 35.9^\circ \text{Celsius} \), patient diagnosis and demographic information (age, sex, race). This data was de-identified after the initial chart review to determine the length of time from initial hypothermia to the time (in minutes) they achieved normothermia (\( \geq 36.0^\circ \text{Celsius} \)).
3. A hypothermic patient warming algorithm (Appendix A) intervention was implemented within the emergency department.
4. Chart reviews were completed to include the same information as pre-implementation of the HPWA in four-week cycles. Qliksense will be used to identify patient charts. MR numbers will be eliminated when transferring data to spreadsheets.
5. Data was analyzed using descriptive statistics and comparison tests to assess the time to normothermia for patients who experience UH.
6. Problems with the algorithm or recommendations for improvement were made, problems or barriers were identified, and changes were made prior to implementation of the second implementation cycle.
7. Patients with UH were treated with the HPWA starting with the first temperature entered in the EHR \( \leq 35.9^\circ \text{Celsius} \).
8. The RNs followed the HPWA in order of steps listed and data was analyzed to assess the time in minutes to achieve normothermia.

9. A total of 2 four-week cycles were completed.

10. Post-intervention data was analyzed to determine if implementing a HPWA for hypothermic patients helps achieve better patient outcomes (less time in minutes to normothermia after implementation).

**Barriers and Facilitators**

Barriers were limited number of patients with hypothermia, lack of nurses or physicians to follow the HPWA or utilize the FAWB device, lack of completion of charting in the EHR about warming techniques used and limited amount of time to complete intervention cycles and determine the effectiveness of the HWPA on patients with UH. The education interventions discussed in the next section were utilized to combat the barriers listed and ensure the HPWA was utilized effectively to achieve optimum data analysis.

**Education Interventions**

Education on the HPWA was imperative to achieve use of the algorithm during the implementation phase. The education plan for RNs and Patient Care Technicians (PCT) included face-to-face demonstration of the algorithm with follow up questions at mandatory staff meetings and patient care huddles, laminated HPWA sheets for quick reference during implementation, step by step instruction folder with in-depth instructions and pictures, EHR charting demonstration to ensure accurate data collection, and a mandatory web-based training designed by the principal investigator with post-test for knowledge recall. The Clinical Nurse Specialist, Clinical Educator and Primary investigator were the primary educators on the unit prior to implementation. Super-users were identified and utilized across all shifts.
Budget

The budget for this quality improvement project was minimal. The PI spent a small amount to provide staff with snacks during educational sessions. The implementing institution incurred no direct cost during implementation of this project.

Data Analysis

The retrospective data and post-intervention data was analyzed using comparison statistics to determine if the process led to a change in patient outcomes (less time to achieve normothermia versus pre-intervention patients). Next, a series of bivariate tests were used to produce inferential findings. Chi-square analysis tested the association between the categorical variables and independent samples $t$-test was used to examine the relationship between the dichotomous and continuous variables. The demographic information included during the data retrieval process was not analyzed as part of this QI project.
Chapter 4

Results

This project used a retrospective pre- and post-implementation quality improvement design to evaluate the use of a hypothermic patient warming algorithm (HPWA) on pediatric patients with UH in a Pediatric Emergency Department (ED). Retrospective data was collected from January 1, 2021 to March 30, 2022. There were 13 participants in the pre-intervention group. Post-implementation data was collected from January 1, 2022 to March 16, 2022. There were 12 participants in the post-intervention group.

Data Analysis Plan

The latest version on SPSS (26.0) was used for all statistical analysis. The data analysis plan was conducted in two phases. First, all study variables were presented using descriptive statistics, such as, means, standard deviation, and minimum/maximum values for continuous variables (Interval/Ratio level) and frequencies and percentages for categorical variables (Nominal/Ordinal level). Next, a series of bivariate tests were used to produce inferential findings (Statistical significance set at: $p<.05$). Chi-square analysis tested the association between the categorical variables within research questions 1-3. An independent samples $t$-test was used to examine the relationship between the dichotomous and continuous variables within research question 4.

All necessary statistical test assumptions were examined. For research questions 1-3, there was some issue regarding the number of study participants in each cell totaling less than five study participants. For research question 4, the assumptions of normality and no undue influence of outliers were met. Regarding missing data for research question 3, there were only nine study participants that provided data for both study variables and were included in the
analysis. The other research questions had full data. In terms of statistical power, the SPSS software program indicated that within a chi-square analysis, a large effect size effect (OR=11.00) would be detected between dichotomous variables (event rate difference = .45) with power set at .80 and alpha set at .05, with a sample size of 25 study participants. The G*Power software program indicated that within an independent samples t-test (one-tail), a large effect size effect (Cohen’s $d=1.1$) would be detected with power set at .80 and alpha set at .05 with 22 study participants. Thus, the current sample size of 25 study participants provides approximately sufficient statistical power for the current analysis.

**Descriptive Analysis**

Table 1 presents a descriptive analysis of categorical variables. Data indicated that the sample was about half female ($n=15; 60.0\%$), age 3 or older ($n=14; 56.0\%$). The majority of the sample was of a Non-Latino/Hispanic ethnic identity ($n=21; 84.0\%$). The sample was almost evenly divided by study group (Retrospective: $n=13, 52.0\%$ vs. Current: $n=12, 48.0\%$). About one-third of the sample reached a final temperature of 36 degrees or more ($n=9, 36.0\%$). The majority of the sample used a forced air warming blanket (FAWB) ($n=15, 60.0\%$) as the type of warming device used. Regarding the nine study participants involved in answering research question 3, about three-quarters reported a FAWB temperature setting of 38 ($n=7, 77.8\%$) and did not evidence a change in 1 positive degree from initial to first measurement ($n=7, 77.8\%$).

Table 2 presents a descriptive analysis of the continuous study variables. Data indicated that the average study participant weighed 21.20 ($SD=14.00, \text{MIN/MAX}=6.47-53.20$) kilograms. The average initial temperature measurement was 34.84 ($SD=.87, \text{MIN/MAX}=32.50-35.80$) and final temperature measurement was 35.52 ($SD=1.16, \text{MIN/MAX}=32.90-37.40$), evidencing an average difference score of .68 ($SD=1.31, \text{MIN/MAX}=-2.00-4.30$). The distribution of the
difference score was approximately normal as the skewness and kurtosis were not approximately three times the respective standard error of each. Figure 2 presents the distribution of difference scores regarding the initial temperature minus the last temperature measurement.

**Research Question 1: Is there a significant difference in the percentage of patients that reach 36 degrees as a final measurement (yes/no) by the Retrospective and Current group status?**

Table 3 presents a chi-square analysis of final temperature 36 degrees or more (Yes/No) by study group. Bivariate analysis indicated that the percentage of study participants that reached a final temperature 36 degrees or more did not vary at a statistically significant level by study group (Retrospective: \( n=4 \), 30.8% vs. Current: \( n=5 \), 41.7%), \( \chi^2(1)=.32, p=.57 \) (Table 3).

**Research Question 2: Is there a significant difference in the percentage of patients that reach 36 degrees as a final measurement (yes/no) by the intervention device type used (FAWB vs Other)?**

Table 4 presents a chi-square analysis of final temperature 36 degrees or more (Yes/No) by intervention device type used. Bivariate analysis indicated that the percentage of study participants that reached a final temperature 36 degrees or more did not vary at a statistically significant level by intervention device type used (Forced Air Warming Blanket: \( n=5 \), 33.3% vs. Other: \( n=4 \), 40.0%), \( \chi^2(1)=.12, p=.73 \) (Table 4).

**Research Question 3: Does a 1-degree positive warming change from initial temperature (< 36 degrees) to first time measurement vary significantly by a FAWB temperature Setting of 43 vs 38?**

Table 5 presents a chi-square analysis of 1-degree positive warming change from initial temperature (< 36 degrees) to first time measurement (Yes/No) by forced air warming blanket temperature setting. Bivariate analysis indicated that the percentage of study participants that
reached 1-degree positive warming change from initial temperature (< 36 degrees) to first time measurement did not vary at a statistically significant level by forced air warming blanket temperature setting (38 degrees: n=1, 14.3% vs. 43 degrees: n=1, 50.0%), $X^2(1)=1.15, p=.28$ (Table 5).

**Research Question 4: Does the mean difference between the first-time measurement and last time temperature measurement vary significantly by Retrospective and Current group status?**

Table 6 presents an independent samples t-test analysis of the mean difference between the initial and last time temperature measurement by study group. Bivariate analysis indicated that the mean temperature difference score did not vary at a statistically significant level by study group (Retrospective: $M=.38, SD=.96$ vs. Current: $M=1.00, SD=1.58$), $t(23)=-1.18, p=.25$ Table 6).
Chapter 5

Discussion

Unplanned hypothermia in pediatric patients has been associated with poor patient outcomes, especially those who have suffered a traumatic injury or traumatic brain injury (Rubiano et al., 2013; Sundberg et al., 2011). Unplanned hypothermia leads to decreased in blood flow to major organs and the brain, increased blood loss, increased risk for blood transfusion, decreased immune response and increased risks for arrhythmia, nausea, vomiting and post-procedure complications. Infants are at greater risk for hypothermia which can lead to hypoxia, metabolic acidosis, and death (Beedle et al., 2017; Brozanski et al., 2020; Erdoğan et al., 2019; Granum et al., 2019).

The purpose of this project was to evaluate the implementation of a HPWA and its ability to achieve normothermia in pediatric patients suffering unintended hypothermia. The statistical conclusions of this project were not as expected. Due to a small sample size and short implementation time frame the number of patients that reached normothermia prior to disposition did not statically increase. Clinical significance was obtained and showed an increase in patients who achieved normothermia, an increase in the average temperature of patients who were warmed, and a more positive rate of warming when the FAWB was set to 43°.

This quality improvement project did achieve clinical significance among its participants. First, it showed an increase in the percentage of participants who reached normothermia prior to disposition (Table 3). Pre-implementation showed an achievement of normothermia in 30.8% of participants. Post-implementation showed an achievement of normothermia in 41.7% of participants, a 10.9% increase. Secondly, there was an increase in the mean from first temperature measurement to last temperature measurement from 0.38° Celsius to 1.00° Celsius,
from the pre-implementation measurements to the post-implementation measurements, respectively (Table 6). Lastly, setting the FAWB to 43° Celsius showed a 50% positive rate of warming versus 14.3% in the participants warmed at 38° Celsius. The pre- and post-implementation participants included 60% Female (n=15) and 40% male (10), with 13 participants in the pre-implementation groups and 12 in the post-implementation group (Table 1). The post-implementation time frame was nine weeks for data collection occurring in the same months as the pre-implementation retrospective participants from 2021. The clinical results from this project support utilizing a HPWA to warm pediatric patients suffering from UH, but also recommend completing a longitudinal project in the future with a larger sample size, which may be valuable to further examine if there is statistical significance.

**Theoretical Framework Application**

This project correlates with the Donabedian Model of Healthcare Quality Framework (Figure 1). The three components of this framework focus on structure, process, and outcomes in relation to quality of care (Zaccagnini & White, 2017). Applying a change at the process level will ultimately affect outcomes. Utilizing the already existing structure of care within the ED, this project altered the process phase by implementing a HPWA process to participants during the intervention phase, which utilized a FAWB as a major component in warming, it had a direct effect on clinical outcomes versus the pre-implementation group. This project shows the potential for continuous care improvement in the future within other pediatric emergency departments, if a larger study is completed over a longer timeframe with a larger implementation population.
Implications for Practice, Educations, & Policy

This quality improvement project led to implications for practice, education, and policy. Implications for practice include continuing use of the HPWA with changes made to continue data collection within the implanting institution. Practice changes to the continuous temperature monitoring alarm limits are needed to promote patient safety and decrease potential overwarming, this change would eliminate the need for it to be changed manually with every participant that utilizes the HPWA. This change would set the continuous temperature alarm high limit to 36.5° Fahrenheit to alert the nurse that the patient has been successfully warmed. This alarm high limit was discussed with the stakeholders and the consensus during that meeting was the set point listed above.

Nursing education implications included the importance of treating hypothermia in the pediatric populations and the potential complications to morbidity and mortality. The importance of monitoring the patients continuously during warming to prevent overwarming or potential thermal injury. A major component leading to successful data collection was appropriate charting within the EHR and multiple modes of education were utilized to disseminate this information (quick tips sheet, education binder with step-by-step instructions, photos of correct charting technique, and personal one-on-one education). Involving nurse peers to deliver this one-on-one education of all the components listed was optimal for successful implementation and data collection phases.

Policy implications include the potential to institute this HPWA as a formal policy within the implementing institution that will expand its use to the other ED within the hospital system. This policy change would allow for additional longitudinal data collection during ongoing implementation. Modifying this HPWA to apply to patients that need to be warmed during
patient transport within or outside of the institution is a future potential policy implication.

Warming within the ED setting would support the need for patient warming during transport and would provide a continuum of optimal patient treatment and ideally positive outcomes.

**Study Limitations**

A total of 25 participants made up the pre- and post- implementation participant groups. This supports the most significant limitation, the post-implementation small sample size of 12 participants. This was further exacerbated by the allowed for implementation time of this project. Completing this project during the height of the global pandemic limited in-person interactions, made meetings harder to schedule due to remote work limitations and lengthened time between meetings. Utilizing one implementation site in a northeastern state in the winter months may affect generalizability, despite replication with a larger sample size.

**Recommendations**

A recommendation for future quality improvement projects is to replicate this project with a larger sample size utilizing a longitudinal study design. To achieve a larger sample size, implementation and data should be collected over 12 months and compared to the same 12 months of the previous year. Creating a report within the EHR that could automatically extract the data variables that are needed would increase the ease of data collection by eliminating the tedious manual chart reviews for each data variable. Ideally statistical significance could be achieved with an increased sample size and longitudinal study, which would further validate the clinical findings.

It is recommended to continue to warm patients utilizing the HPWA with the main intervention including the FAWB. It is demonstrated in the evidence that FAWB achieves and maintains normothermia in the pediatric population in the pre-operative, surgical, and post-
operative setting. With this already validated tool, a larger sample population may provide more significant clinical significance for its continued use. Setting the FAWB temperature to 43°C Celsius for all UH patients within the ED is a recommended change to the next implementation cycle to determine if the degree setting more positively impacts patients achieving normothermia prior to disposition. Implementing this process at the hospital system’s Florida campus will also increase the sample size and allow for comparison in two different external climate environments. After further research is conducted it would be beneficial to publish clinical guidelines for the warming of UH in pediatric patients.

Conclusion

Unintended hypothermia will continue to be a problem that needs clinical guidelines and recommendations. The role of nursing in this process is to continue with quality improvement projects to determine the best way to achieve positive patient outcomes utilizing evidence-based practice interventions. FAWB blankets are a validated warming tool in the clinical setting, proven to decrease potential perfusion issues, blood loss, hypoxia, arrythmias, and other negative clinical outcomes. This project highlighted the clinical significance achieved by implementing and analyzing a HPWA utilizing a FAWB. The outcomes of this limited project and the literature support the need for continuation of ongoing research and replication of this project in the future.
References


Table 1

Descriptive Analysis of Categorical Study Variables (n=25)

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>10</td>
<td>40.0</td>
</tr>
<tr>
<td>Female</td>
<td>15</td>
<td>60.0</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 1 year</td>
<td>3</td>
<td>12.0</td>
</tr>
<tr>
<td>1-2 years</td>
<td>8</td>
<td>32.0</td>
</tr>
<tr>
<td>3-5 years</td>
<td>5</td>
<td>20.0</td>
</tr>
<tr>
<td>7-11 years</td>
<td>5</td>
<td>20.0</td>
</tr>
<tr>
<td>13-19 years</td>
<td>4</td>
<td>16.0</td>
</tr>
<tr>
<td><strong>Ethnic Group</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Latino/Hispanic</td>
<td>4</td>
<td>16.0</td>
</tr>
<tr>
<td>Non-Latino/Hispanic</td>
<td>21</td>
<td>84.0</td>
</tr>
<tr>
<td><strong>Study Group</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retrospective</td>
<td>13</td>
<td>52.0</td>
</tr>
<tr>
<td>Current</td>
<td>12</td>
<td>48.0</td>
</tr>
</tbody>
</table>
Table 1 (continued)

Descriptive Analysis of Categorical Study Variables (n=25)

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Final Temperature 36 Degrees or More</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>9</td>
<td>36.0</td>
</tr>
<tr>
<td>No</td>
<td>16</td>
<td>64.0</td>
</tr>
<tr>
<td><strong>Type of Warming Device Used</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forced Air Warming Blanket</td>
<td>15</td>
<td>60.0</td>
</tr>
<tr>
<td>Other</td>
<td>10</td>
<td>40.0</td>
</tr>
<tr>
<td><strong>Type of Warming Device Used (Expanded)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FAWB</td>
<td>5</td>
<td>20.0</td>
</tr>
<tr>
<td>FAWB/Gel Warmer/WB</td>
<td>1</td>
<td>4.0</td>
</tr>
<tr>
<td>FAWB/WB</td>
<td>7</td>
<td>28.0</td>
</tr>
<tr>
<td>FAWB/WIVF</td>
<td>1</td>
<td>4.0</td>
</tr>
<tr>
<td>FAWB/WIVF/WB</td>
<td>1</td>
<td>4.0</td>
</tr>
<tr>
<td>Gel Warmer</td>
<td>1</td>
<td>4.0</td>
</tr>
<tr>
<td>WB</td>
<td>3</td>
<td>12.0</td>
</tr>
<tr>
<td>WB, WIVF</td>
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<td>4.0</td>
</tr>
<tr>
<td>None/NA</td>
<td>5</td>
<td>20.0</td>
</tr>
<tr>
<td><strong>FAWB Temperature Setting (n=9)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>7</td>
<td>77.8</td>
</tr>
<tr>
<td>43</td>
<td>2</td>
<td>22.2</td>
</tr>
<tr>
<td><strong>Change in 1 Positive Degree from Initial to First Measurement (n=9)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>2</td>
<td>22.2</td>
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<tr>
<td>No</td>
<td>7</td>
<td>77.8</td>
</tr>
</tbody>
</table>

*Note.* This table describes the descriptive analysis of the demographic information of participants and the four study variables.
Table 2

*Descriptive Analysis of Continuous Study Variables (n=25)*

<table>
<thead>
<tr>
<th>Variable</th>
<th>M (SD)</th>
<th>Minimum/Maximum</th>
<th>Skew (SE)</th>
<th>Kurtosis (SE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight in kg (n=24)</td>
<td>21.20 (14.00)</td>
<td>6.47-53.20</td>
<td>.84 (.47)</td>
<td>-.36 (.92)</td>
</tr>
<tr>
<td>Initial Temperature (IT)</td>
<td>34.84 (.87)</td>
<td>32.50-35.80</td>
<td>-1.85 (.46)</td>
<td>2.83 (.90)</td>
</tr>
<tr>
<td>Last Temperature (LT)</td>
<td>35.52 (1.16)</td>
<td>32.90-37.40</td>
<td>-.36 (.46)</td>
<td>-.41 (.90)</td>
</tr>
<tr>
<td>LT - IT Difference Scores</td>
<td>.68 (1.31)</td>
<td>-2.00-4.30</td>
<td>.52 (.46)</td>
<td>1.84 (.90)</td>
</tr>
</tbody>
</table>

*Note.* This table describes the average weight, initial temperature, last temperature, and difference score for all participants.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Final Temperature 36 Degrees or More</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Yes</td>
<td>No</td>
<td>X²(df)</td>
<td>p</td>
</tr>
<tr>
<td>Study Group</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retrospective</td>
<td></td>
<td>4 (30.8)</td>
<td>9 (69.2)</td>
<td>.32 (1)</td>
<td>.57</td>
</tr>
<tr>
<td>Current</td>
<td></td>
<td>5 (41.7)</td>
<td>7 (58.3)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.* Percentage represents study group reaching 36° Celsius.
Table 4

Chi-Square Analysis of Final Temperature 36 Degrees or More (Yes/No) By Intervention

Device Type used (FAWB vs Other) (n=25)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Yes</th>
<th></th>
<th>No</th>
<th></th>
<th>X²(df)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention Device Type Used</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forced Air Warming Blanket (FAWB)</td>
<td>5</td>
<td>(33.3)</td>
<td>10</td>
<td>(66.7)</td>
<td>.12 (1)</td>
<td>.73</td>
</tr>
<tr>
<td>Other</td>
<td>4</td>
<td>(40.0)</td>
<td>6</td>
<td>(60.0)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. Percentage represents intervention device used to reach 36° Celsius.
### Table 5

**Chi-Square Analysis of 1-degree positive warming change from initial temperature (< 36 degrees) to first time measurement by a FAWB temperature Setting of 43 vs 38 (n=9)**

<table>
<thead>
<tr>
<th>Variable</th>
<th>1 Degree Positive Warming Change</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes (n) (%)</td>
<td>No (n)</td>
<td>X²(df)</td>
<td>p</td>
<td></td>
</tr>
<tr>
<td>Forced Air Warming Blanket (FAWB) Temperature Setting</td>
<td>1 (14.3)</td>
<td>6 (85.7)</td>
<td>1.15 (1)</td>
<td>.28</td>
<td></td>
</tr>
<tr>
<td>38 Degrees</td>
<td>1 (14.3)</td>
<td>6 (85.7)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>43 Degrees</td>
<td>1 (50.0)</td>
<td>1 (50.0)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note. Percentage represents 1° Celsius increase in temperature based on FAWB setting.*
Table 6

*Independent Samples T-Test Analysis of the Mean Difference Between the Initial and Last Time Temperature Measurement by Retrospective vs. Current group status (n=25)*

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>M (SD)</th>
<th>t(df)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study Group</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retrospective</td>
<td>13</td>
<td>.38 (.96)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current</td>
<td>12</td>
<td>1.00 (1.58)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. Increase in temperature from first to last temperature between study groups.
Donabedian’s Model of Healthcare Quality

<table>
<thead>
<tr>
<th>Structure</th>
<th>Outcome</th>
<th>Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthcare Institution</td>
<td>Education</td>
<td>Policies</td>
</tr>
<tr>
<td>Standard of Care</td>
<td>Stakeholder involvement</td>
<td>Procedures</td>
</tr>
<tr>
<td>Equipment</td>
<td>Patient Outcome</td>
<td>Interventions</td>
</tr>
<tr>
<td>Education/Training</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: The application of Donabedian’s model will look at the (structure) standard of care, equipment utilization, and education. The (process) policies, procedures, and interventions that occur when a patient suffers unplanned hypothermia within the ED. Lastly, it will assess the (outcome) stakeholder’s willingness to change practice and patient outcome after intervention.
Figure 2

Distribution of Difference Scores Regarding the Initial Temperature Minus the Last Temperature Measurements

*Note.* Difference in scores between the initial and last temperature.
Appendix A

Hypothermic Patient Warming Algorithm

Patient with temperature ≤ 35.9 degrees Celsius?
Is the patient greater than 5kg?
Is patient ≥ 60 days old
*DO NOT USE IF PATIENT RECEIVING/RECEIVED

---

1. Alert the Physician of patient hypothermic status and warming procedure.
2. COMPLETE SHOCK ASSESSMENT and FILE SHOCK SCORE.
3. Start ACTIVE WARMING (IN ORDER) with Warming Blanket* (Bair Hugger).
   a. Temp < 34.0 degrees Celsius, set BH to 34.0 degrees Celsius.
   b. Temp >34.0 degrees, set BH to 35.0 degrees Celsius.
   c. Do not change settings until temp reaches 35.5 degree Celsius.
4. Cover warming blanket with warmed blankets* to prevent heat loss.
5. Warmed IV Fluids* (if ordered).
6. Neonatal transport warming pad (if applicable)
7. Attach skin temperature probe (first line) and secure to the patient and connect to the monitor. Rectal temperature probe prn for continuous temperature monitoring. (See contraindication criteria for rectal temperature probes)
8. Place patient on continuous cardiorespiratory monitoring.
9. Q15 minute Vital signs – set BP to automatic
10. Set continuous temperature alarm high limit to 36.5 C (To avoid overwarming)
11. When patient achieves normothermia and if discontinuing active warming, confirm central temperature with core temperature measurement. If temp >36.5 confirmed, RN may discontinue continuous temperature monitoring and active warming.
* - Term used in EPIC under temp control management.

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*Rectal probes are contraindicated in patient with recent rectal surgery, actively seizing, immunocompromised or oncologic patients, patients with bleeding disorders, patients with GI disorders, patient with spinal dysfunction and newborns.
Appendix B

Nemours Office of Human Subjects Protection
Nemours/Alfred I. duPont Hospital for Children
1600 Rockland Road
Wilmington, DE 19803
Fax: 302-651-4683
Office: 302-298-7613

DATE: November 11, 2021
TO: Daniel Bileth, MSN, RN
FROM: Nemours IRB 1
STUDY TITLE: [1817817-1] Hypothermic Patient Warming Algorithm
IRB #: 1817817
SUBMISSION TYPE: New Project
ACTION: NOT RESEARCH
REVIEW DATE: November 11, 2021

Thank you for your submission of New Project materials for this project. Nemours IRB 1 has determined this project does not meet the definition of human subject research under the purview of the IRB according to federal regulations.

Please note that any project modifications that may alter this non-human subject research determination must be submitted to the IRB for review.

Reviewed documents in this submission:

- Application Form - IRBAppRRDFormBileth.docx (UPDATED: 10/26/2021)
- Letter - IRBLetterBileth.docx (UPDATED: 10/26/2021)
- Other - Hypothermia Warming Algorithm Data.xlsx (UPDATED: 10/25/2021)
- Proposal - RevisedIRBApplicationBilethFinal.docx (UPDATED: 10/29/2021)
- Proposal - IRBApplicationBilethFinal.docx (UPDATED: 10/25/2021)
- Protocol - Hypothermic Patient Warming Algorithm IRB.pdf (UPDATED: 10/29/2021)

If you have any questions, please contact Soniya Anis at AI duPont Hospital for Children 1600 Rockland Road, ARB Room 162-D, Wilmington, Delaware 19803 at (302) 651-6807 or Soniya.Anis@nemours.org. Please include your study title and reference number in all correspondence with this office.
Appendix C

Jan 20, 2022 3:44:23 PM EST

To: Daniel Bileth
Department: School of Nursing, Nursing

Re: Exempt - Initial - IRB-FY2021-167 QUALITY IMPROVEMENT OR EVIDENCE BASED PRACTICE PROJECT. "Hypothermic warming algorithm for unintended pediatric hypothermia within the Emergency Department.

Dear Daniel Bileth:

Thank you for your submitted application to the WCUPA Institutional Review Board. We have had the opportunity to review your application and have rendered the decision below for QUALITY IMPROVEMENT OR EVIDENCE BASED PRACTICE PROJECT. "Hypothermic warming algorithm for unintended pediatric hypothermia within the Emergency Department.

Decision: Exempt

If there are any questions, please don’t hesitate to reach out to irb@wcupa.edu

Sincerely,

WCUPA Institutional Review Board

IORM: IORG0004242

IRB #: IRB00003030

FWA#:FWA00014155