IMPLEMENTATION OF A WARMING PROTOCOL TO PREVENT UNINTENTIONAL PERIOPERATIVE HYPOTHERMIA IN PACU

by

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ABSTRACT

MICHELLE JOHNSON. Implementing of a Warming Protocol to Prevent Unintentional Perioperative Hypothermia in PACU. (Under the direction of DR. KATHERINE SHUE MCGUFFIN)

The incidence of hypothermia continues to rise in hospital patients post-surgically. As a result, healthcare providers are seeking more cost-effective and preventive measures to reduce hypothermia (Danzl, 2017). Hypothermia occurs as the body temperature falls below 36°C. The average body temperature is around 37°C (Bordes, Corsino, Harmon, Hart, & Hart, 2011). Nevertheless, perioperative hypothermia is a frequent and severe complication of surgery; it is associated with many undesirable outcomes, including patient discomfort, delayed or prolonged recovery, coagulopathy, surgical infection, and adverse cardiac events (Foushee et al., 2018). If left untreated, hypothermia can lead to complete heart and respiratory system failure or death (Mayo Clinic, 2017). Given the critical nature of threat posed to post-surgical patients by hypothermia, there is evidence to support the importance of preventing hypothermia in surgical patients. The purpose of this quantitative study is to; implement a warming protocol to prevent perioperative hypothermia in the Post Anesthesia Care Unit (PACU). A total of 30 Gynecology Oncology patients receiving robotic or laparoscopic surgery, between the ages of 35-75 years old, were enrolled in the study. The clinical question stated that prewarming the patients prior to coming into the operating room improved patients' overall temperature. Evaluation of the protocol showed that prewarming the patient prior to coming into the operating room was effective. The data was collected on a qualitative improvement tracking sheet that was obtained from Methodist Medical Center

in Peoria, Illinois and modified for this pilot study. The results showed that preoperative to intraoperative temperatures improved (significant, $P<0.001$), intraoperative to PACU temperatures improved (significant, $P<0.01$), and intraoperative to PACU discharge temperatures also improved after using a Bair Hugger device (significant, $P<0.001$). The results illustrated that a prewarming protocol with the Bair Hugger warming device can improve the patient's overall temperature, throughout the perioperative process.

DEDICATION

This scholarly project is dedicated to the Almighty God who gives strength and knowledge to everyday life. To my loving husband **Bobby Jr**., who instilled in me the virtues of perseverance and commitment and relentlessly encouraged me to strive for excellence. To my son **Bobby III** my eternal gratitude for his encouraging word. To my sister, brother, pastor, and church family for unlimited prayers for me.

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This scholarly project would not have been possible without the love, support, and encouragement I received from my family and my pastor. Only now am I beginning to realize how much my husband sacrificed so that I could attend college. I do not have words to adequately describe my deep gratitude for all he has done to provide for me, though I hope to show him in the years to come.

I have benefited greatly from the mentoring of Dr. Christine McKenzie and comments received from Dr. Victoria Bae-Jump. I studied nursing because of what I saw in my mother as I was a child - a tremendous desire to learn and understand, and a wonderful fascination with helping others. I am truly indebted to UNC perioperative staff for fostering the same pursuit and fascination in me and, of course, for being patient and considerate during my years as a student. I also would like to thank the Bair Hugger company for donating the product for the project. My sincere acknowledgement goes to Keliang Gao who sacrificed his time to do the statistics data for the project.

TABLE OF CONTENTS

List of Figures

CHAPTER 1: INTRODUCTION

The incidence of hypothermia continues to rise in hospital patients post-surgically. As a result, healthcare providers are seeking more cost-effective and preventive measures to reduce hypothermia (Danzl, 2017). Hypothermia occurs as the body temperature falls below 36 degrees Celsius. The average body temperature is around 37 degrees Celsius. Hypothermia is common in the elective surgical patient population due to the inefficiency of warming the patient (Danzl, 2017). When the body loses heat faster than it can produce heat, hypothermia occurs, causing a hazardously low body temperature. Perioperative hypothermia is a frequent and severe complication of surgery; it is associated with many undesirable outcomes including patient discomfort, delayed or prolonged recovery, coagulopathy, surgical infection and adverse cardiac events (Foushee et al., 2018). If left untreated, hypothermia can lead to complete heart and respiratory system failure or death. (Mayo Clinic, 2017). Given the critical nature of the threat posed to post-surgical patients by hypothermia, this pilot study explored the background issues, problem statement, and current literature on the subject. The conceptual framework, the project design, and project findings show that prewarming is effective for surgical patients.

1.1 Background

According to the American Association of Nurse Anesthetists (2018), Enhanced Recovery After Surgery (ERAS) is an evidenced-based, patient-centered, multidisciplinary team-developed pathway. The pathway is developed specifically for a variety of surgical specialties to help reduce the patients' surgical stress response, optimize physiologic function, and facilitate recovery (American Association of Nurse

Anesthetists [AANA], 2018). A medical center in the Piedmont region of North Carolina has also implemented this national initiative hospital-wide. In 2014, the Anesthesia department implemented a standard ERAS protocol (APPENDIX A). At the time, quality information for Gynecology Oncology surgical patients was not accessible; in 2016-2017, the Anesthesia department developed a protocol specific for these patients as an adjunct to the ERAS protocol. This addition was designed to improve intraoperative temperatures and reduce the incidence of hypothermia by increasing ambient room temperature. In this DNP Scholarly practice project, the ERAS protocol was further enhanced by prewarming the patient in the preoperative area approximately 15 to 30 minutes before surgery.

1.2 Practice Problem

The colleagues at the medical center conducted a retrospective chart review of 165 patients who underwent laparoscopic hysterectomy on an ERAS pathway, from September 2015 through August 2016 with the focus on the hospital length of stay (Hance, 2016). In 2016, UNC colleagues, at the medical center conducted another retrospective chart review; their focus was on hypothermia. The retrospective chart review consisted of 100 patients that underwent a laparoscopic/robotic hysterectomy. Their focus was on hypothermia. The results showed that the average hypothermia temperature of 42 out of 100 patients was hypothermic – 35.5 degrees Celsius. The anesthesia department increased the ambient room temperature and administered warm intravenous fluids; intraoperative temperatures improve by 10%. The anesthesia department stated that the Gynecologic Oncology patients never reached an intraoperative temperature of 36 degrees Celsius. The anesthesia department concluded

that an ERAS protocol is necessary for the Gynecology Oncology population (APPENDIX A).

A hypothermia prevention protocol is necessary for the care of Gynecology Oncology patients (Personal Communication, March 10, 2018). Since the implementation of the ERAS protocol in the Gynecology Oncology Surgery patient population, hypothermia has decreased. However, as of the year 2018, hypothermia is still a concern for this patient population. According to the anesthesia department, even with improved awareness and techniques to reduce heat loss, there is an unacceptable number of patients who are hypothermic during surgery. As a result, the goal of this department is to implement more effective methods of intraoperative warming and preoperative warming techniques. In combination with the measures already in place such as the ERAS protocol, the department goal is to have a more significant impact on temperature control in Gynecology Oncology Surgical patients. The DNP student implemented a prewarming device protocol, to help reduce or eliminate hypothermia from the Gynecology Oncology Surgical patients in the Post Anesthesia Care Unit (PACU).

1.3 Purpose

The purpose of this DNP Scholarly project was to develop and implement a clinical protocol to reduce and eliminate hypothermia from the Gynecologic Oncology patients.

1.4 Project Aims and Objectives

The DNP scholarly project aims and objectives were to reduce or eliminate

hypothermia in Gynecology Oncology patients. The indicators for this scholarly project were: 75% of Gynecology Oncology patients between the ages of 35-75 will not experience hypothermia. The steps to accomplish the DNP scholarly project consisted of the following steps: (1) Research, (2) Choose the board members, (3) Meet with the stakeholders, (4) CITI training. Next, (5) DNP scholarly project approval, (6) IRB submission, (7) Meet with the stakeholders, (8) Initiate the DNP scholarly project, (9) Data collection, and (10) Data analysis.

1.5 PICOT Question

In Surgical Gynecology Oncology patients with hypothermia, how does prewarming (forced- air-warming), compared to non-prewarming of patients, affect surgical Gynecology Oncology patient's temperature in the Post Anesthesia Care Unit (PACU)?

CHAPTER 2: SYNTHESIS OF LITERATURE AND CONCEPUTAL/ THEORETICAL FRAMEWORK

2.1 Treatment and Prevention

Inadvertent hypothermia is a common problem in the operating room. Research authors state that hypothermia results in many unfavorable outcomes, increased complications, and higher morbidity rates. Research suggests that forced-air-warming is the most effective in preventing perioperative hypothermia. Eighty-percent of the experimental studies reviewed found that there was a significantly higher temperature throughout surgery and in the PACU for patients who received forced-air-warming. Research authors also suggest that treatment and prevention are the key factors in reducing the incidence of hypothermia (Bauer, Grote, Menzel, &Wetz, 2014; Bitner, Duvendack, Hall, & Hilde, 2007; Connelly et al., 2017; Cooper, 2006). Maintaining normothermia temperature by prewarming the patient will lead to a decrease in intraoperative bleeding, a faster recovery, lower infection rates, and an improved thermal comfort level.

Further, prewarming the patient from a team approach leads to prevention of hypothermia in the postoperative area. The team approach consists of the preoperative nurse applying the forced-air-warming blanket, and the intraoperative nurse increasing the ambient room air temperature in the operating room and replacing the forced-air-warming blanket at the end of surgery. The postoperative nurse will continue with the forced-air-warming blanket until the patient is fully alert from anesthesia, and ready for discharge. Studies agree that prewarming is efficient for the treatment of hypothermia (Bauer et al., 2014; Bitner et al., 2007; Connelly et al., 2017; Cooper, 2006).

2.2 Surgical Site Infection

Surgical Site Infections (SSI) account for approximately 40% of all hospital-associated infections. Those with SSI are also up to 60% more likely to spend time in intensive care. Rates of numerous postoperative complications have been frequently reported in the surgical literature. For instance, contingent upon the surgical methodology and technique, surgical site infections have been estimated to occur in between of 1.8% to 8% of cases. The patient's thermoregulatory balance is compromised by anesthesia time that is greater than one hour. Mild perioperative hypothermia triggers thermoregulatory vasoconstriction and reduced level of oxygen. Mild perioperative hypothermia also lowers resistance to infection and impairs wound healing. Hypothermia is associated with clinical complications such as surgical site infections and wound-healing delay, increased bleeding, and cardiovascular events. Researchers suggest that forced-air warming seems to have a beneficial effect regarding the lower rate of surgical site infection and complications. The review of literature suggests that prewarming is efficient to reducing surgical site infection as well as other complications of surgery (Campos et al., 2016; Boltz, Dillon, Hollenbeak, & Ortenzi, 2012; Sedei, 2010).

2.3 Comparing Two Different Types of Warming

Other authors conducted studies on the two different types of warming active (force-air-warming) and passive (cloth blankets). Their focus was on identifying the most effective strategies for the prevention and management of hypothermia in the intraoperative and postoperative phases of surgical care. By utilizing passive or active warming, forced-air-warming was effective in maintaining intraoperative normothermia when compared to passive warming. They also suggested that forced-air-warming

compared with alternate forms of warming (passive), reduces the incidence of shivering and wound infections, increases thermal comfort, and reduces morbid cardiac events (DeBerg, Schweizer, Shaw, & Steelman, 2017; Geertsen, Gerven, Raeder, & Torossian, 2016; Lockwood & Moola, 2010). A systematic review and meta-analysis study were conducted to answer the authors' PICO question: Does the type of warming intervention influence the frequency or severity of inadvertent perioperative hypothermia (IPH) in a surgical patient, receiving neuraxial anesthesia? The study showed that passive warming interventions consistently resulted in low temperatures and a higher incidence of hypothermic patients. The forced-air-warming blanket indicates it is useful for patients receiving neuraxial anesthesia and preventing hypothermia.

Researchers conducting a randomized control trial also compared the two types of warming. The results of their study suggested that prewarming the patient with the novel (Barrier) EasyWarm blanket 30 minutes before anesthesia reduces the risk of perioperative hypothermia when compared to thermal insulation with standard hospital cotton blankets. The use of the EasyWarm blanket resulted in improved patient thermal comfort without any severe adverse effects (DeBerg et al., 2017; Geertsen et al., 2016; Lockwood & Moola, 2010). The consensus of the literature supports prewarming for hypothermia, surgical site infections, and improvement of patient outcomes.

2.4 Conceptual/Theoretical Framework

The theoretical model that guided the development and implementation of this scholarly project was Betty Neuman's System Model for Hypothermic Patients (APPENDIX B). This model includes the nursing actions through prevention and aims to reduce the stress factors as well as adverse conditions that affect the patients. This model

highlights primary prevention performed before the person encounters a producing strain. The goal is to prevent the producing strain from penetrating the standard line of defense.

Prewarming the patient in the perioperative area is the primary prevention. Secondary prevention involves the intraoperative nurse being attentive to the patient temperature. The intraoperative nurse must think before a situation arises and understand that the patient's temperature will more than likely decrease intraoperatively. Tertiary prevention restores the equilibrium while focusing on rehabilitation to prevent the same incidences from recurring. The prewarming performance protocol is a method that may prevent perioperative, intraoperative, and postoperative hypothermia. Future studies, which include the use of Betty Neuman's model, may serve as a first step in establishing an evidence-based practice that uses prewarming with a forced-air warming device to efficiently maintain a patient's temperature and efficiently prevent hypothermia on arrival in the PACU (Cooper, 2006).

CHAPTER 3: PROJECT IMPLEMENTATION PLAN

3.1 Location

The research medical center has over 40 operating rooms at four distinct areas to provide both inpatient and outpatient surgical care. This research medical center has an open scholastic therapeutic focus. It offers the full range of surgical care and represents considerable authority in the most complex diseases and conditions (UNC Medical Center, 2018). The specialists are perceived as pioneers in surgical care, giving a full supplement of surgical subspecialties to patients. They are among the most experienced in the nation, performing over 30,000 surgical techniques every year. Moreover, the operating rooms utilize inventive advancements and procedures to help enhance patient results including:

- Robotic-helped surgery empowers specialists to perform numerous sorts of complex techniques with more exactness, adaptability, and control.
- Transcatheter Aortic Valve Replacement: a crossover technique with the most recent and most creative cardiovascular imaging and surgical hardware for population that are not ready to have conventional surgery to repair harmed valves.
- Simulation lab: where doctors from everywhere throughout the world are prepared in the most recent surgical systems (UNC Medical Center, 2018).

The actual unit for the implementation of this DNP Scholarly Project is the research medical center's women's hospital. The following areas will include in this study: perioperative, intraoperative, and the postoperative area.

3.2 Population and Intervention

The population is comprised of 35-75 year-old women of all ethnicities and races, who were scheduled for robotic/laparoscopic surgery. Gynecology Oncology patients were recruited and informed of the scholarly project. IRB was obtained through UNC Healthcare; no consent was required for the project.

In order to decrease the incidence of perioperative hypothermia, the practice change intervention was to apply a forced-air-warming blanket on the patient prior to entering the intraoperative area. The significant focal point of this project was to implement an evidence-based practice protocol and to decrease the risk of perioperative hypothermia. The project implementation step is provided in APPENDIX C.

3.3 Data Collection

The data was collected for 30 randomized Gynecology Oncology patients over six to eight weeks. The nurse recorded temperatures during the preoperative, intraoperative, and postoperative (arrival and discharge) phases of surgery. Descriptive statistics were used and uploaded in Statistical Package for Social Sciences (SPSS). A temperature tracking sheet is a tool that was used for this DNP scholarly project (Bitner et al., 2007).

Bitner et al. (2007) used a temperature tracking sheet to compare the postoperative temperature of patients who underwent total joint arthroplasty procedures at Methodist Medical Center in Peoria, Illinois. The temperature tracking sheet was useful for postoperative patients who underwent complete joint arthroplasty procedures. After obtaining permission from the authors, the temperature tracking sheet was modified for the Gynecology Oncology patient population (APPENDIX D).

The DNP student conducted an in-depth meeting with all the stakeholders such as directors, supervisors, nursing staff, and the anesthesia department. The purpose of the meeting was to educate all key stakeholders on the frequency of hypothermic temperatures in the Gynecology Oncology patient population. The DNP student presented the project to all stakeholders. Specifically, the student presented the evidence-based practice of prewarming the patients prior to surgery.

3.4 Methods and Procedure

As stated above, permission was obtained from the Methodist Medical Center in Illinois to modify a tracking tool they used to track patients' temperatures undergoing total joint replacement (APPENDIX D). The following data are included in the tool:

- Participant age
- Preoperative temperature
- Forced-air-warming applied
- Intraoperative temperature
- Room temperature
- Humidity operating room temperature
- Reapply forced-air-warming blanket
- PACU temperature on arrival
- Discharge temperature

Using the tool to track temperatures, nurses assessed and recorded the initial temperature during the preoperative phase and applied the forced-air (Bair Hugger) warming device to the Gynecology Oncology patients. The intraoperative nurses removed the Bair Hugger during surgery and increased the room temperature. The

intraoperative nurses recorded the patient temperatures during surgery and reapplied the Bair Hugger upon extubating. Finally, the postoperative nurses recorded the temperature on arrival to the PACU, removed the Bair Hugger device, and recorded temperatures on discharge from the PACU.

3.5 Inclusion and Exclusion

The chart below shows the criteria for inclusion and the exclusion for this study.

INCLUSION	EXCLUSION
35-75 Year- old	Under 35 Over 75
Women	Pediatrics
Gynecology Oncology patients	Non-Gynecology Oncology patients
Robotics/Laparoscopic Surgery General Anesthesia (analgesia, paralysis, amnesia)	General Surgery/other Non-General Anesthesia (regional and local anesthesia)

Figure 1. Inclusion and Exclusion

3.6 Confidentiality, Storage, and Destruction of Data

Confidentiality was maintained by the perioperative nurses. The data was recorded on a tracking sheet which does not require a name and address. The data was stored in a locked box located on the front desk of the preoperative area. The DNP student will keep the data up to one year in the locked box. At the end of the one year, the data will be shredded. The data analysis stored on a USB drive will be physically destroyed by the DNP student (University of Virginia, 2012).

3.7 Analysis, Evaluation Outcome, and Fiscal Impact

The study tracked the preoperative, intraoperative, and postoperative temperatures of 30 Gynecology Oncology patients, age 35-75 years old. Descriptive statistics were used to analyze the data. The evaluation outcome was based on the following:

PERIOPERATIVE TEMPERATURES		
Preoperative--- Intraoperative Temperatures	Intraoperative--- Postoperative Temperatures	Postoperative--- Postoperative Discharge Temperatures

Figure 2. Perioperative Temperatures

The fiscal impact to UNC hospital patient temperatures occurred during the prewarming in the perioperative area by reducing time spent rewarming in PACU. As a result of the prewarming protocol, the postoperative nurses did not have to wait until the patients' temperature reached 36 degrees Celsius to discharge the patients. The patients arrived in PACU with temperatures of 36 degrees Celsius and were discharged sooner, saving the patient additional costs.

Also, a key goal of the DNP scholarly project was to make sure that the Bair Huggers were available to the Gynecology Oncology patients. There was no cost associated with the intervention. The representative of the Bair Hugger Company donated 30 Bair Huggers to the project.

CHAPTER 4: PROJECT FINDINGS

The initial step in the project was to make sure that the Gynecology Oncology tracking sheet was filled out and placed in the locked black box. The preoperative nurses, the intraoperative nurses, and the postoperative nurses collected the data on 30 patients. The data was collected over six to eight weeks**.** The preoperative nurse applied the Bair Hugger on the patient. The intraoperative nurse increased the room temperature and reapplied the Bair Hugger before extubating. The postoperative nurse evaluated the patient temperature on arrival and on discharge.

4.1 Data Analysis

Data collected from the Gynecology Oncology tracking sheet showed the raw data from 30 patients' temperatures ranging from 36 degrees Celsius to 37 degrees Celsius. Of the 30 patients, one patient was converted to an open procedure and no temperatures were recorded. In addition, the intraoperative nurses did not record the intraoperative temperatures for five patients; however, the five patients' data were used in the study because the preoperative and the postoperative temperatures on arrival and discharge were recorded. In total, there were 29 patients' temperatures recorded from preoperative to postoperative discharge. The temperatures were obtained in the preoperative holding area and intraoperative area as well as on arrival in the PACU and discharge from the PACU (APPENDIX E).

The descriptive method was chosen for this study because it is known to describe the basic features of data in a study and it is easy to understand/interpret the data. According to the Social Research Methods Center (2006), it states that descriptive

statistical method provides simple summaries about the sample and the measures. A paired difference t-test was used to compare the mean difference in patient temperatures.

4.2 Data Distribution

The data distribution is displayed as a boxplot t-test. In the preoperative holding area, the mean temperature of the patient was 36.4 degrees Celsius. In the intraoperative area, the mean temperature was 36 degrees Celsius. On arrival to PACU, the mean temperature was 36.3 degrees Celsius, and on discharge from the PACU, the mean temperature was 36.4 degrees Celsius (APPENDIX F). The boxplot data result showed that the surgical patient's temperature remained 36 degrees Celsius through-out the perioperative process.

4.3 Test of Difference: Preoperative to Intraoperative

The test of difference between preoperative holding area and the intraoperative area showed a mild decrease in temperatures. The patients' mean arrival temperature was 36.49 degrees Celsius; when the patients left the preoperative area, the Bair Hugger was disconnected. The patients arrived in the intraoperative area with a mean temperature of 36.02 degrees Celsius. The test results showed that compared with preoperative temperatures, the intraoperative body temperatures decreased significantly, but did not induce hypothermia. The finding was statistically significant ($P<0.001$) (APPENDIX G).

4.4 Test of Difference Continue: Intraoperative to PACU Arrival

The test of difference between the temperatures in the intraoperative area and arrival in the PACU showed an increase in body temperatures from the intraoperative area (36.02 degrees Celsius). The patients' mean temperature on arrival to the PACU was 36.34 degrees Celsius. The temperatures obtained in PACU increased significantly from

the intraoperative area. The intraoperative nurse replaced the Bair Hugger before extubating the patient; this resulted in an increase in temperature upon arrival to PACU. The finding was statistically significant ($P<0.01$) (APPENDIX H).

4.5 Test of Difference: Intraoperative to PACU Discharge

The test of difference between intraoperative and PACU discharge showed an increase in temperatures. The intraoperative temperatures increased from 36.02 degrees Celsius to 36.49 degrees Celsius on discharge from the PACU. The patient temperature increased significantly (APPENDIX I). Once the patient arrived in the PACU from the intraoperative area, the Bair Hugger was reapplied.

4.6 Result

When analyzing the data in SPSS, a t-test box plot showed that when comparing the mean preoperative temperature (36.49 degrees Celsius) to the mean intraoperative body temperature (36.02 degrees Celsius), the temperatures decreased slightly, but the patients' temperatures remained above hypothermic conditions (below 36 degrees Celsius). When comparing the mean intraoperative temperature (36.02 degrees Celsius), to the mean PACU arrival body temperature (36.34 degrees Celsius), temperatures increased significantly, and again, the patients' temperatures remained above the hypothermia threshold. The data comparing the mean intraoperative temperature (36.02 degree Celsius), to the mean body temperature of PACU discharge (36.49 degree Celsius) increased significantly. Considering the temperatures of the 29 patients, the data results displayed the patients' temperature above the hypothermia ranges.

CHAPTER 5: IMPLICATIONS

The objective of this study was to reduce the prevalence of hypothermia in preoperative, intraoperative, and postoperative area by utilizing a forced-air-warming Bair Hugger device for all patients receiving Gynecology Oncology surgeries. As previously discussed, hypothermia is defined as a core body temperature of less than 36 degrees Celsius (Mayo Clinic, 2017). Following implementation of a Bair Hugger device, the patients' body temperatures remained above or at 36 degrees Celsius. The data suggested that prewarming is effective in preventing hypothermia in Gynecology Oncology patients.

Additionally, this study ensured that perioperative nurses at UNC Hospital obtained Bair Hugger devices, and in the process, received education about the importance and the use of the Bair Hugger. This strategy fostered a link between the patients of UNC Hospital and the perioperative service. The results of the study indicated that there was an improvement in body temperatures after application of a Bair Hugger device. Knowledge of preventing hypothermia practices following an educational intervention regarding the use of the Bair Hugger will increase temperature awareness. Strategies such as education regarding hypothermia prevention combined with forced-air-warming devices, Bair Hugger, should be promoted by UNC Hospital in order to increase knowledge in relation to preventing hypothermia practices and reduce potential risks of hypothermia among Gynecology Oncology patients. Similar prewarming protocols could be utilized in hospitals nation-wide.

Preventing hypothermia is fundamental to the surgical patient. Education regarding hypothermia should be promoted along with other evidence-based

interventions such as implementing a universal protocol in the perioperative department. Nurses are essential to the implementation of the Bair Hugger protocol for Gynecology Oncology patients as well as all surgical patients.

5.1 Limitations

There were limitations in this study such as the nurses having the time to apply the Bair Hugger. Due to the time restraints, the intraoperative nurses forgot to record the intraoperative temperatures for five patients. Another limitation occurred when the patients' surgery converted to a laparotomy, and the patient went immediately to the intensive care unit. In addition, this study targeted solely Gynecology Oncology women who are having robotic/laparoscopic surgery, but it is also important to consider other genders and all surgical patients, as well as to ensure that health-education messages are not only given to nurses that are taking care of Gynecology Oncology patients, but to all nurses in the perioperative services.

5.2 Recommendations

In the perioperative service department where a high proportion of Gynecology Oncology women having robotic/laparoscopic surgeries, forced-air-warming supplies need to be available for all surgical services patients. Making sure that Bair Huggers are available at all UNC hospital facilities as well as implementing an educational intervention can improve hypothermia temperatures among the Gynecology Oncology patients/perioperative patients and improve patient outcomes in PACU. Strategically educating and providing Bair Huggers to all UNC perioperative facilities has the potential to foster a stronger link between surgical patients who receive traditional warming practices with evidence-based care. In areas where hypothermia is common, the Bair Hugger can serve as an important role in preventing hypothermia in surgical

patients. As a result, the patients will have a better outcome.

5.3 Sustaining the Change

By educating the perioperative staff at the hospital, a primary objective was to improve patients' temperatures intraoperatively and postoperatively. A subsequent objective was to raise awareness of the need for Bair Huggers and improve knowledge regarding preventing hypothermia according to the Association of Perioperative Registered Nurses (AORN) standards. By implementing the prewarming protocol, the objective is for the perioperative service to continue with the protocol and to educate other departments and perioperative nurses. The benefits of preventing hypothermia in surgical patients have long been recognized. The goal of ending hypothermia is a call to action across all perioperative services. Efforts to prevent hypothermia must be accelerated and complemented with research, education, and evidence-based healthcare.

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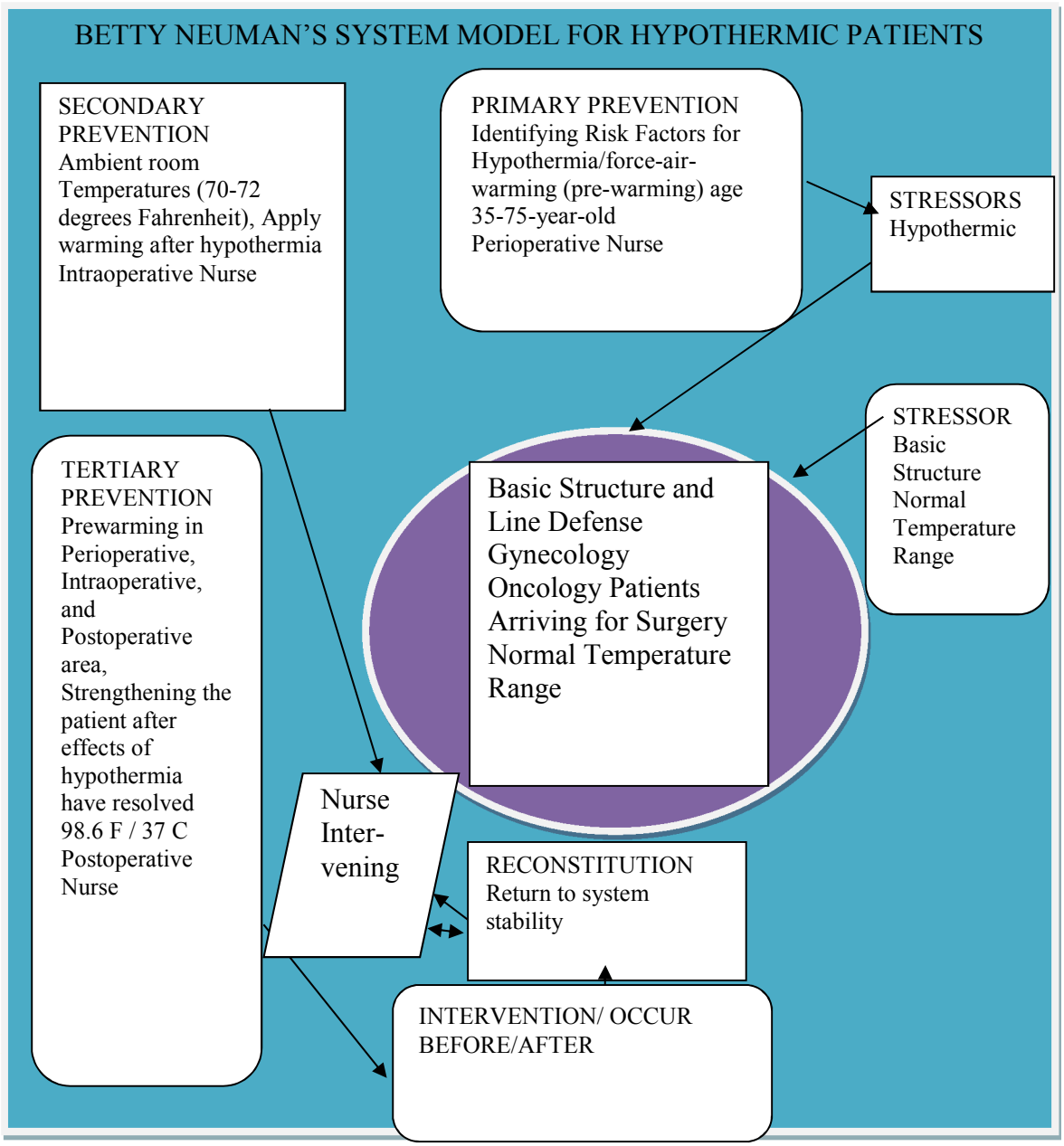
APPENDIX A

UNC ERAS PROTOCOL RESULT

University of North Carolina	**Pre-Intervention**	**Post-Intervention**	**% Improvement**
% of Patients never reaching 36 degrees	42%	32%	10% (p=0.144)
% of Patients never reaching 35.5 degrees	15%	5%	10% (p=0.018)
% of Patients with last OR temp < 36	53%	41%	12% (p=0.089)
% of Patients with last OR < 35.5	30%	18%	12% (p=0.047)

APPENDIX B

BETTY NEUMEN MODEL



APPENDIX C

STEP BY STEP IMPLEMENTATION

Preoperative Phase

1. Measure and document patient temperature on arrival.
2. Initiate force-air-warming intervention (15-30 mins.) before surgery.

Transfer to OR

Intraoperative Phase

1. Intraoperative nurse increases ambient room temperature according to AORN guideline.
2. Measure and document patient temperature every 15 minutes. The Certified Registered Nurse Anesthetist (CRNA) will record the median temperature before leaving the operating room.
3. After the surgery, the Intraoperative nurse replaces the force-air-warming blanket, on lower extremities.

Transfer to Recovery

Postoperative Care Unit (PACU)

1. The Postoperative Nurse.
2. Measure and document patient temperature on admission to the PACU.
3. Assist patient's thermal comfort level.
4. Keep patient comfortably warm.

Discharge Teaching

1. Instruct patient and patient family of methods to maintain normothermia after discharge.
    a. Warm liquids
    b. Blankets
    c. Increase clothing
    d. Increase room temperature (Slagle, 2015).

APPENDIX D

GYNECOLOGY ONCOLOGY SURGICAL/TRACKING SHEET

Patients Robotics/Laparoscopic Surgeries

Age: 35-75
Age: _____

Date: _____

Preoperative Holding Area:

Temperature on admission: _____ C

If not oral temperature, document site: _____

Apply force air warming device _____Yes _____ No

Preoperative RN: _____

Intraoperative:

Temperature on admission: _____C

Room temperature: _____F Humidity: _____%

Reapply force air warming blanket: _____Yes _____No

Intraoperative RN: _____

Postoperative care unit (PACU)

Temperature on admission _____C

Temperature on discharge _____C

Postoperative RN: _____

APPENDIX E

GYNECOLOGY TRACKING SHEET DATA

No.	Preoperative	Intraoperative	Intra.Disch.	PACU	P.Disch.
1	36.7	36.3	36.1	36.2	36.2
2	36.4	37.1	37.1	36.7	37.8
3	36.7	36.0	34.6	36.5	36.1
4	36.2	36.0	36.4	36.9	36.6
5	36.6	36.0	35.4	36.0	36.0
6*	36.9	35.5	35.0	NA*	NA*
7	37.1	35.9	36.7	36.1	36.6
8	36.1	36.4	36.4	36.9	36.8
9	35.7	35.8	36.0	36.0	36.0
10	37.0	36.0	36.8	36.8	37.1
11	36.8	36.5	35.6	36.2	36.4
12	36.2	36.3	37.1	36.4	36.4
13	36.2	35.6	35.9	36.6	37.0
14*	36.1	NA**	NA**	NA**	NA**
15	36.4	35.7	35.6	36.0	36.7
16	35.6	36.1	36.5	36.3	36.2
17	36.2	36.1	36.1	36.4	36.7

18	36.2	35.4	NA*	35.7	36.0
19	36.8	36.6	35.9	36.4	36.8
20	35.9	35.4	35.0	36.3	37.0
21	36.8	35.4	35.8	36.2	36.4
22	36.8	36.0	36.7	36.2	36.4
23	36.6	35.6	NA*	36.3	36.2
24	37.0	36.8	36.2	37.4	36.9
25	36.8	36.5	35.1	36.0	36.3
26	36.1	35.3	36.2	36.1	36.1
27	36.4	35.9	NA*	35.9	36.0
28	36.4	NA*	NA*	36.7	36.7
29	36.7	36.5	36.9	36.5	36.2
30	37.3	36.0	35.7	36.0	36.3

Note:

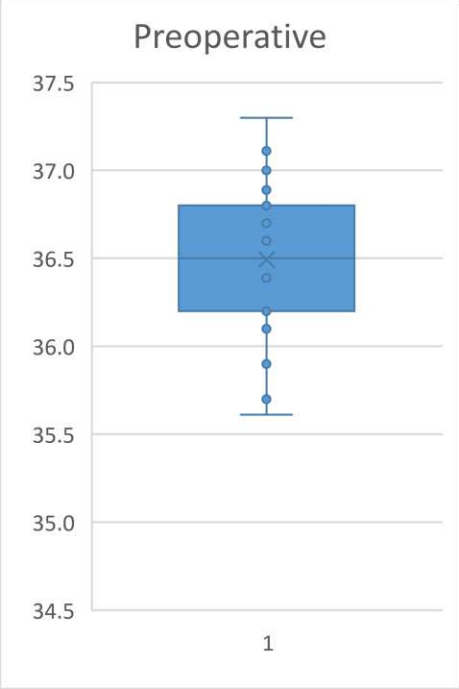
*: Data was not recorded on the sheet by the nurse.

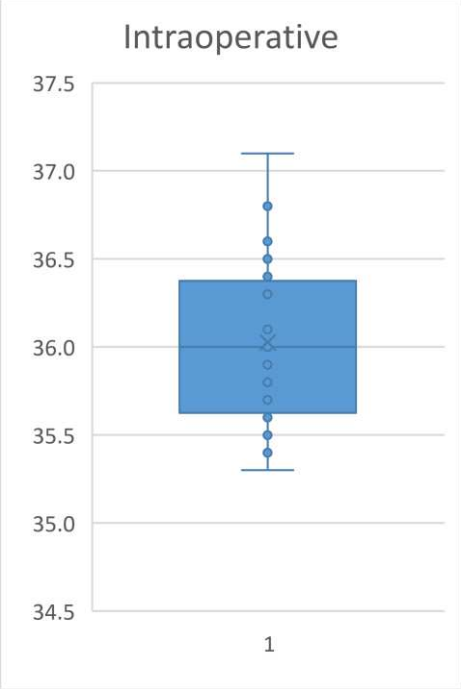
**: Patient refused, and no data collected.

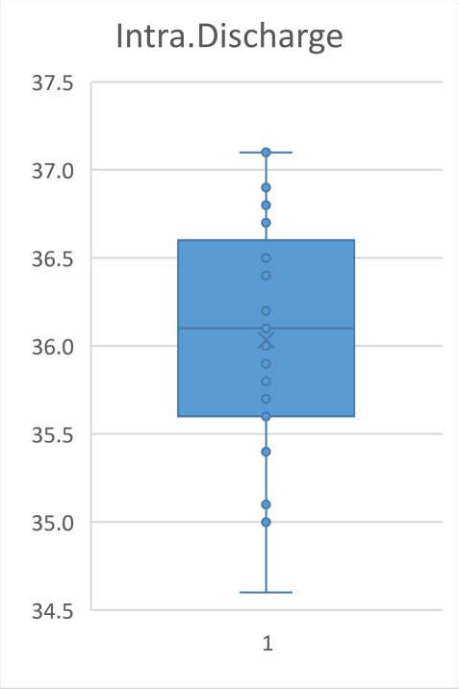
APPENDIX F

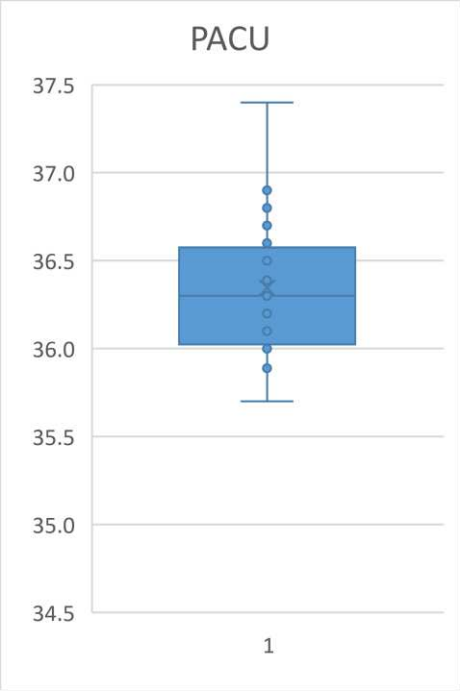
DATA DISTRIBUTION (BOXPLOT)

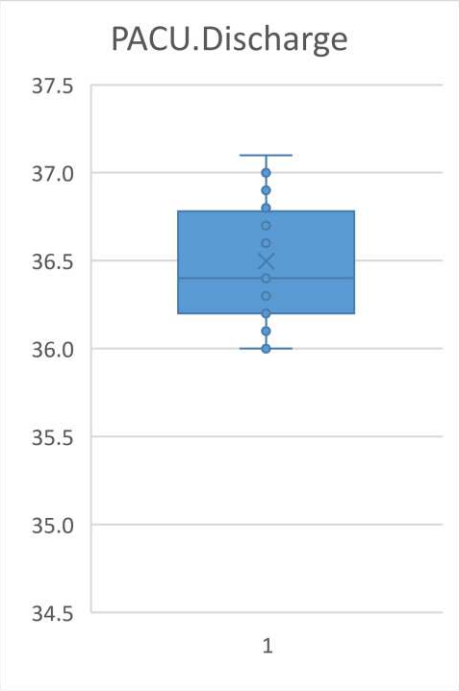
5.2 Data distribution








PACU
37.5
37.0
36.5
36.0
35.5
35.0
34.5
1


PACU.Discharge
37.5
37.0
36.5
36.0
35.5
35.0
34.5
1

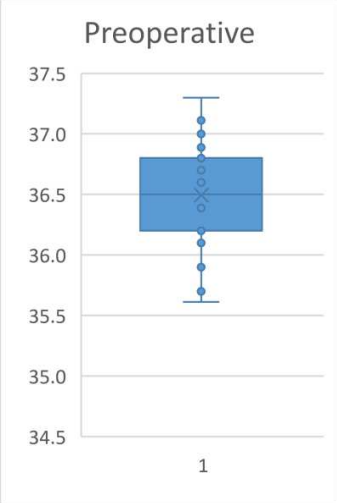
APPENDIX G

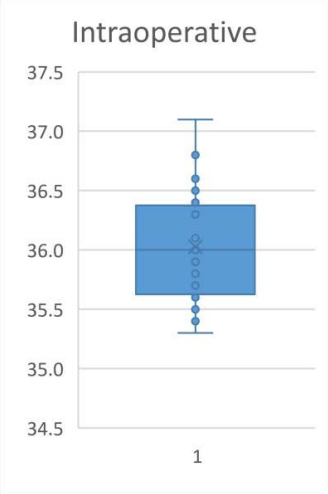
TEST OF DIFFERENCE
PREOPERATIVE AND INTRAOPERATIVE

5.3 Test of difference

Test difference between preoperative and intraoperative

(significant, P<0.001)





t-Test: Two-Sample Assuming Unequal Variances

	Pre	In
	Variable 1	*Variable 2*
Mean	36.49296	36.0254
Variance	0.171728	0.207196
Observations	30	28
Hypothesized Mean Difference	0	
Df	55	
t Stat	4.081388	
P(T<=t) one-tail	**7.3E-05**	
t Critical one-tail	1.673034	
P(T<=t) two-tail	0.000146	
t Critical two-tail	2.004045	

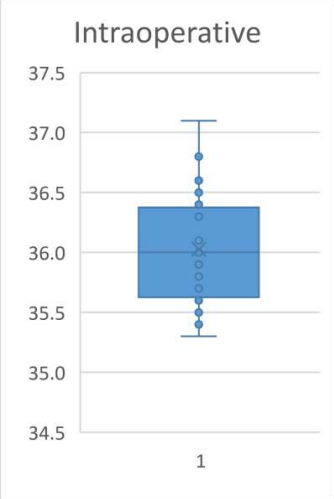
The test results show that compared with preoperative temperature, the intraoperative body temperature decreased significantly.

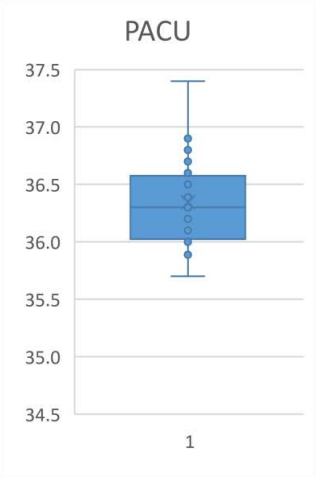
APPENDIX H

TEST DIFFERENCE CONTINUE INTRAOPERATIVE AND PACU

Test difference between intraoperative and PACU

(significant, P<0.01)





t-Test: Two-Sample Assuming Unequal Variances

	Intraoperative	PACU
	Variable 1	*Variable 2*
Mean	36.0254	36.34563
Variance	0.207196	0.138467
Observations	28	28
Hypothesized Mean Difference	0	
Df	52	
t Stat	-2.88221	
P(T<=t) one-tail	**0.002864**	
t Critical one-tail	1.674689	
P(T<=t) two-tail	0.005728	
t Critical two-tail	2.006647	

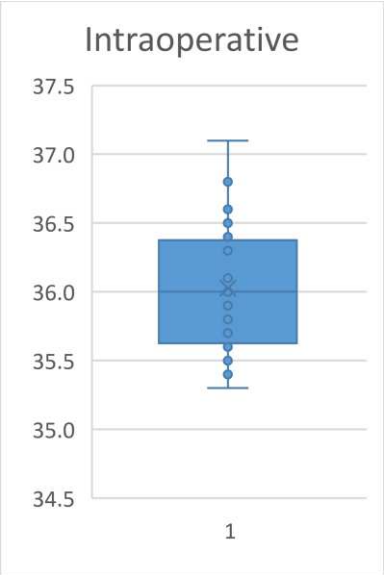
The test results show that compared with intraoperative temperature, the PACU body temperature increased significantly.

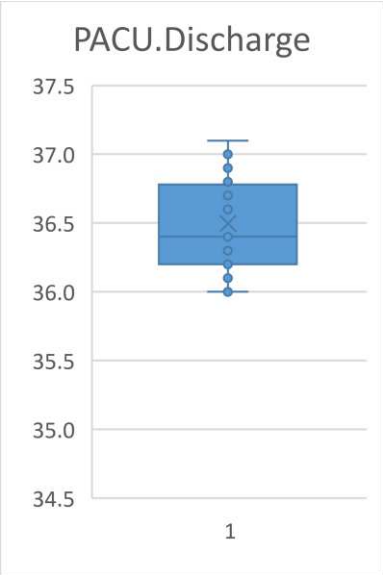
APPENDIX I

TEST DIFFERENCE CONTINUE INTRAOPERATIVE AND PACU DISCHARGE

Test difference between intraoperative and PACU discharge

(significant, P<0.001)





t-Test: Two-Sample Assuming Unequal Variances

	In	*PACU.Dis*
Mean	36.0254	36.49722
Variance	0.207196	0.179228
Observations	28	28
Hypothesized Mean Difference	0	
Df	54	
t Stat	-4.01632	
P(T<=t) one-tail	**9.2E-05**	
t Critical one-tail	1.673565	
P(T<=t) two-tail	0.000184	
t Critical two-tail	2.004879	