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Developing an Impella Education Program for the Critical Care Registered Nurse

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This is to certify that the doctoral study by

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Abstract

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MSN, Olivet Nazarene University, 2014

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Project Submitted in Fulfillment

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Abstract

Every year, hundreds of thousands of patients have coronary angiograms performed in the United States. The Impella is a percutaneous ventricular support device that provides hemodynamic support for patients if hemodynamic instability occurs during the procedure. The critical care nurse is responsible for the recovery and management of the patient with the Impella device in place. The purpose of this scholarly project is to provide registered nurses (RN) who have not previously managed the Impella device with the appropriate education in order to demonstrate competency. The program demonstrated improved RN knowledge about the Impella and increased confidence when managing the Impella device and controller. King's goal attainment theory was used as a framework to develop nurse-patient collaboration. Kirkpatrick's 4-level training evaluation model provided the framework for evaluation of the RN educational program. The sources of evidence included literature and an expert panel that was recruited to evaluate the material prior to implementation of the educational program. The data were analyzed by comparing the results of the preeducational and posteducational questionnaires. The paired *t* test demonstrated statistical significance based on the scores from the pre- and post-tests taken by the RNs before and after the Impella educational program as $p < .001$. Increased RN confidence was demonstrated by $p < .001$, while a change in RN attitude towards the Impella established improvement by $p < .001$. Providing professional development opportunities has been shown to benefit RNs to allow the delivery of safe care while allowing for positive social change by impacting patient lifestyle and outcomes.

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Dedication

I would like to dedicate this project to the community members who deserve advanced care during complex heart procedures in the cardiac catheterization laboratory and improved outcomes postprocedure.

Acknowledgments

I would like to thank my family for supporting me during this journey through the Doctorate of Nursing Practice degree.

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Section 1: Nature of the Project

Introduction

New technologies have been emerging for the management of heart disease, which is the number one cause of death in the United States (American Heart Association [AHA], 2014). An estimated 735,000 Americans suffer from myocardial infarctions (MI) annually, 120,000 of which will result in death (AHA, 2014). Over the past 10 years, new products have been developed and approved by the Federal Drug Administration (FDA) to support patients post percutaneous coronary intervention (PCI), including the Impella device (Abiomed, 2013). Nurses who have worked in the areas that use this new technology have needed rigorous training to be able to practice effectively. Without such training, a significant gap in practice exists, which must be resolved to assure patient safety, reduce the possibility of complication, and contribute to social change. Formulating and implementing an Impella educational program achieves social change by providing registered nurses (RN) with information that is evidence based for the appropriate assessment and management of the patient with the Impella device, which further creates a culture at the health system that focuses on improved patient outcomes.

Problem Statement

The organization that was the subject of this DNP project has been reliant on intraaortic balloon pump (IABP) technology since the inception of their cardiac program in 1997. However, in the last 6 months, the health system made the decision to invest in Impella technology, which is a new device that is specifically indicated for the management of high-risk cardiology patients. According to hospital administration, the

nurses currently employed in this setting do not have the knowledge or skill set to appropriately manage this new technology. Nurses who have never been trained to manage the Impella device have a knowledge deficit that is a preeminent problem and must be addressed to assure patient safety.

The RN has many assessment requirements to evaluate the femoral site for swelling or bleeding, using an ultrasound doppler to assess pedal pulses for adequate limb perfusion, hourly vital signs, and verifying the Impella console settings hourly or when changes are made (Abiomed, 2016a). Impella devices have been shown to require intense intervention by the RN, especially if the device has a suction alarm that requires an intervention of additional IV fluids or if the high-pressure alarm triggers, which requires an intervention for the purge cassette to be changed (Abiomed, 2016a). The most important intervention the RN must assess for is when the Impella console alarms for incorrect positioning of the Impella catheter due to device migration (Abiomed, 2016a). RNs are required to immediately order an echocardiogram and notify the physician to verify catheter placement (Abiomed, 2016a). If the device has migrated, the patient loses the supportive function of the Impella device (Abiomed, 2016a). The patient may become unstable due to the lack of support from the Impella device, and the physician is required to reposition the device immediately (Burzotta et al., 2015). Properly educating the RN is necessary to provide the required information to appropriately assess the patient and intervene according to policy and procedure.

Implementation of an Impella educational program provides RNs with information and knowledge to assess and manage the patient with the Impella device.

According to O'Neill et al. (2012), the outcome after using the Impella device versus the IABP demonstrated a reduced risk of major adverse events (death/stroke/MI) by 22% at 90-day postprocedure. The improvement in the individual's functionality after having an Impella procedure was shown to improve the New York Heart Association functional class by 58% based on the prior patient New York Heart Association functional class of III/IV (O'Neill et al., 2012). Patient outcome improvements after the Impella device was used demonstrated a 22% increase in the left ventricular ejection fraction, which indicates strengthening of the myocardium to increase blood flow (O'Neill et al., 2012). By offering education to the RN about the management of the Impella device, the patient benefits by improved functional capacity, decreased long-term needs of rehabilitation, decreased assistance for activities of daily living, and increased longevity. Improved patient outcomes is an important driver in the field of nursing and for the health system due to improved patient functionality, cost saving measures, and reduced readmissions to the hospital.

Purpose

The purpose of this doctoral project was to develop an Impella educational program for RNs practicing in the Critical Care Unit. If the knowledge and skill deficit that presented as a result of this new technology is not addressed, a significant gap in practice will exist, as the management of the Impella device is very different from the management of the IABP. The practice-focused question that guided this DNP project is as follows: Will implementing an Impella educational program for critical care RNs at

the health system allow the nurses to deliver prepared and safe care of the adult patient who has an Impella device inserted?

With the implementation of this program, the RNs would have the required education on the Impella device, the policies, and the procedures to care for the patient appropriately. The expectation guiding the project is that after the education is completed, the RN would demonstrate proven competency to care for the high-risk cardiac patient with the Impella device. RNs practicing in the critical care setting are expected to care for the patient with an Impella device on a one-to-one basis, or if the patient is unstable, then two nurses would care for the patient to safely deliver the management required. The RN must have the education and understanding of the Impella device to assess and intervene when necessary to safely care for the patient and prevent a harmful outcome.

Nature of the Doctoral Project

The intended practice setting for the research and collection of data was at a community health system located in the Midwest. An Impella educational program was developed for RNs in the CCU who care for patients with an Impella device. The health system's cardiac catheterization laboratory department had previously used the IABP and had recently implemented the Impella device. Appropriate education of the Impella was a requirement to deliver safe care.

Development of an Impella education program was important to prepare critical care nurses for the care and management of the patient with the Impella device inserted post-PCI or if the patient was diagnosed with cardiogenic shock. I obtained the possible

sources of evidence on the safe use of Impella from the literature in the form of published research, clinical studies, and cost effectiveness. I then incorporated this collected evidence into the educational program, policies, and procedures so that RNs are prepared to care for the complex cardiac patient with the Impella device. An expert panel was comprised of the director and manager of the Cardiac Catheterization Laboratory, the interventional cardiologists, the cardiology nurse practitioners, the director of pharmacy, and the Abiomed regional representative to collaborate on the evaluation of the Impella educational program prior to implementation. The expert panel thoroughly evaluated the educational program according to evidence-based practice and approved the program with appropriate changes applied. Once the educational program was approved, the effectiveness of the educational program was evaluated by a pretest taken by the RN before the Impella education program was delivered and a posttest taken by the RN after the Impella educational program was completed. Checklists and simulation was a requirement to assure that psychomotor skills had been acquired to demonstrate competency.

Significance

Implementation of an Impella education program provides the patient with competent care from the RN after the patient had undergone a planned or emergent cardiac procedure. The stakeholders included the patient, RN, multidisciplinary team, pharmacist, physician, health system, and the community. Patient outcomes could demonstrate improvement due to proven reduction in major adverse events at 90 days post-PCI procedure with an Impella device (39.5%) versus the IABP device (51.0%;

Kovacic et al., 2015). The RN is expected to care for the patient dependent on the Impella device by providing safe and competent care. Impella devices are inserted by the physician, and then the physician has the responsibility to lead the patient's care by transferring the patient for recovery and management to the RN in the CCU.

The educational program for RNs emphasized the importance of not only knowing how to assess and intervene on the signs and symptoms of adverse reactions but also providing support by having a protocol and policy in place for patient management. Complications that can occur when the IABP is in place can potentially include limb ischemia, vascular obstruction, hemorrhage, amputation, and infection (Assis, Azzolin, Boaz & Rabelo, 2009). When the IABP and Impella device are being used, frequent assessments are required of the sheath site in the groin for bleeding complications. The patient with the Impella device in place must have laboratory tests drawn at 6-hour intervals to assess hemoglobin and bleeding times to adjust heparin infusions and to determine if blood transfusions are necessary. RNs must collaborate with the pharmacist to assure that the patient is receiving the correct intravenous heparin dose per hour based on the purge solution and the additional systemic heparin infusion (Jennings, Nemerovski, & Kalus, 2014). Accordingly, the multidisciplinary aspect of patient care with the Impella device is heightened by the nature of these care ramifications. Although the patient is looked upon as the most important stakeholder, the nurse has to recognize the importance and value of the involvement of the multidisciplinary team.

Once the doctoral project is completed and approved, other health systems that contemplated the implementation of an Impella program would be able to use the

educational program for RNs at their site. After an RN has received training, the competent RN is eligible to manage the Impella device at other medical centers. Educating the RN to care for the Impella dependent patient brings positive social change by providing a service to the patient who may have critical needs at the time of intervention in the cardiac catheterization laboratory or post- MI in cardiogenic shock. The implementation of this project allows for the health system to transform the views of the community on the services that are provided at the heart hospital within the health system. This not only provides social change for the community members who may use this service but also provides increased self-esteem for the RN and hospital staff who assist to provide complex services to the patients served.

Summary

Coronary heart disease has continued to be the leading cause of death for men and women in the United States (AHA, 2014), which demonstrated that there is a continued need to improve the way that patients are managed during complex PCI and cardiogenic shock. Health systems around the world have implemented the Impella device to assist in supporting the critically ill patient with heart disease (Abiomed, 2013). More medical centers have invested in FDA-approved assist devices to improve patient outcomes beyond the critical time of managing the patient postprocedure (Abiomed, 2016b). Thus, the opportunity to increase social change in the community was achieved by the provision of a level of care that would normally be expected from metropolitan based hospitals. Therefore, to allow for the implementation of the Impella device, I created an educational program to train the CCU-based RN to manage the Impella device along with

the critically ill patient requiring one-on-one bedside monitoring. Providing consistent and competent care of the patient was the objective of the stakeholders involved in this project.

Section 2: Background and Context

Introduction

The practice problem of RNs who had a knowledge deficit regarding management of the patient with the Impella device was an issue at the health system site. Using the Impella device was an important intervention for the cardiology patients of the health system. The practice focused question that has guided this DNP project is: Will implementing an Impella education program for critical care RNs at the health system allow the nurses to deliver prepared and safe care of the adult patient who has an Impella device inserted? The Impella educational program enhanced the care provided by the CCU RN to the cardiac patient to allow a learning opportunity about the device, the controller, and the policies and procedures. The concepts, models, and theories further clarify the framework for the educational program. Using the existing research emphasized the complexity in the management of the critically ill patient who requires support from the Impella device. Understanding the background of the Impella device and the change in practice exemplifies the gap-in-practice that demonstrated the learning requirements for the CCU RN.

Concepts, Models, and Theories

Concepts

The John Hopkins' Nursing Evidence-Based Practice Evidence Rating Scales delineate the research on a topic to rate the strength and quality of the evidence (Dearholt & Dang, 2012). It is important to distinguish the strength of the literature to understand if the information is based on a randomized control study or an expert opinion. Research

quality is determined by the method from which the research was conducted. The levels of quality were developed to distinguish the high to low levels to determine if the research has consistent methods and results to decide if the results are credible (Dearholt & Dang, 2012).

Models

I used Kirkpatrick's four-level training evaluation model to properly apply and evaluate the educational program in the creation of an educational program for critical care RNs in regard to the care of a patient with an Impella device. For over 50 years, Kirkpatrick's four-level model has determined the effectiveness of training programs by applying the concepts of reaction, learning, behaviors, and results (Abdulghani et al., 2014). By using Kirkpatrick's model, the educational program has been developed to optimize critical thinking skills and to apply the knowledge required to care for the patient with the Impella device. Kirkpatrick's model was appropriate to apply to the Impella educational program because the RN must demonstrate competencies that are taught in the educational program, and Kirkpatrick's model assists in gathering the evaluation information regarding the educational program.

Theories

The concepts developed by King applicable to the Impella education program include communication, interpersonal relationships, information, energy, and social organizations (Frey, Sieloff, & Norris, 2002). King's concepts demonstrate the importance of nurse-patient collaboration for goal attainment (Frey et al., 2002). King's concepts have also demonstrated that the development of an educational program for

critical care RNs is appropriate due to the RNs' goal to optimize patient health (Frey et al., 2002). According to Norris and Frey (2002), critical thinking as applied by the nursing process has been shown to be an important component of King's goal attainment theory.

King's theory of goal attainment was used to apply the concepts of an educational program for critical care nurses providing care for the patient with an Impella device in place. The educational program encompassed the central concepts of goal attainment by instructing on the proper use of the Impella equipment, while implementing the nursing process. The RN applies the nursing process as an assessment of the patient, diagnosis of the patient response, planning for variances in patient care, necessary interventions, and evaluation for further modification to the plan of care.

Imogene King's Theory of Goal Attainment

King's (1999) theory of goal attainment was developed to further understand the human experience related to nursing practice. The conceptual focus of King's theory includes self, perception, role, communication, interaction, transaction, growth, development, time, space, and stress. Understanding the complexity of human relationships and interactions between the nurse and the patient can assist in directing the process of goal attainment to improve the patient's health status (King, 1999). The basis of achieved interaction between nurse and patient takes into account the known needs versus the perceived needs of the patient (King, 1999). The nurse/patient interaction is fulfilled when perception, judgment, action, reaction, interaction, and transaction activities complete the transaction process model (see Figure 1) to demonstrate human

worth (King, 1999). King's theory of goal attainment uses mutual goal setting between nurse and patient, which is valuable to demonstrate outcomes and evidence-based practice (King, 2006).

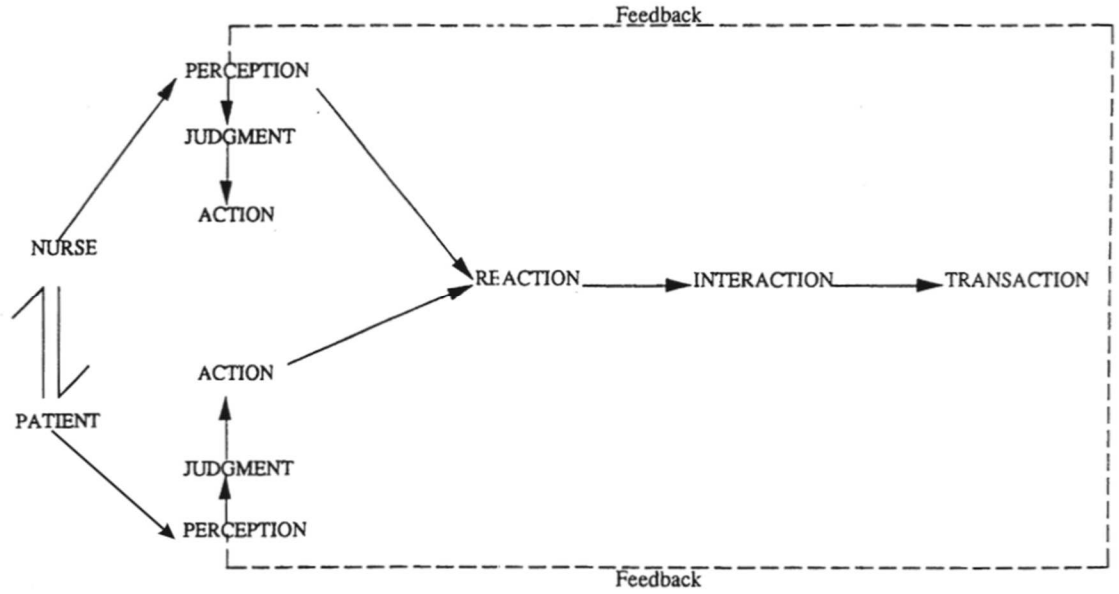

Figure 1. Transaction process model. Representing presenting conditions, activities relating to the situation, and interacting to achieve goals. Adapted from "A Theory of Goal Attainment: Philosophical and Ethical Implications," by I. M. King (1999), *Nursing Science Quarterly, 12*(4), p. 294. Permission to use granted from Sage Publishing.

Relevance to Nursing Practice

The patient with heart disease commonly has comorbidities that may limit the patient's ability to qualify for complex procedures in the cardiac catheterization laboratory. Currently, patients who do not qualify for high-risk procedures can endure ongoing issues with symptoms of angina or shortness of breath because of the risk involved with performing unprotected interventions on the arteries of the heart. If the patient did have a high-risk procedure with complications, an IABP would be placed as a

supportive measure for hemodynamic support of the patient diagnosed with acute coronary syndrome (Perera et al., 2010).

Over the past 10 years, new products have been developed and approved by the FDA to support patients during and post PCI, including the Impella device (Abiomed, 2013). The critical care nurse is expected to care for complex patients along with the management of medical devices that support the patient. Critical care nurses have adapted to care for the intubated patient with a trans-venous pacemaker, IABP, while titrating multiple intravenous vasopressors to support the patient's hemodynamic status. The Impella device is one of the newer additions to supporting the patient in cardiogenic shock or post PCI. The problem with the Impella device is that the device controller needs constant assessment and evaluation in order to act on necessary changes within a moment's notice. A RN who has demonstrated competency for the Impella device and console performs assessment and monitoring of the patient with an Impella in place to reduce adverse outcomes.

Currently, the critical care RN is offered online training, and if the RN is considered a candidate as a super user, the RN is offered in-person training. The critical care units have depended on the Abiomed representatives to accompany a patient with the device in place for the initial 10 cases or so in a given venue. The nurses who attain the most experience with the representative may gain a comfort level, but the representative is not measuring or documenting competency when assisting in the care of the patient with the Impella in place. The current practice must be improved to include an educational checklist with documented yearly competency to ensure patient safety.

This doctoral project advances nursing practice by educating on the anatomy and physiology of the patient with the Impella device in place. The project also allows for the RN to have initial exposure to the Impella controller and the most critical values that must be acted upon in order to prevent patient harm. RNs will have a sense of familiarity with the device and controller. Once the educational program is completed, the RN is validated that the competencies are in place to deliver care to the patient with the Impella device.

Local Background and Context

The health system determined that the Impella device would be purchased and implemented at the hospital, which raised the question as to whether the staff was ready to care for the patient with the Impella device in place. RN staff have had limited understanding of the Impella device, and, according to administration, only three RNs working in the critical care unit have had limited exposure to the Impella device. The need to educate the nurses adequately was necessary to prepare the nurse to care for the complex patient with the Impella device. The Abiomed Corporation offers online education sessions that the RNs can complete at their convenience. The American Nurses Credentialing Center (ANCC, 2015) offers accreditation for nursing skills competency, especially when the skill set may be used to improve patient safety measures or improved quality outcome measures. This notwithstanding, an educational program that meets the ANCC criteria is a program that is sound. Though the pursuit of contact hours for the Impella educational program is out of the scope of this DNP project, the ANCC criteria for educational soundness can be applied. It is important to demonstrate

that the RN is educated and competent to care for the complex patient with the Impella device.

This DNP educational program was instituted at a community based hospital, which has 256 licensed beds; of these, 12 are critical care beds. The health system is expanding the critical care beds up to 20 by the end of 2017. In the calendar year 2016, there were approximately 1,100 procedures documented and performed by the interventional cardiologists in the cardiac catheterization laboratory. The cardiac catheterization laboratory procedures included PCI, placement of Swan Ganz catheter, minimally invasive abdominal aortic aneurysm stenting, cardiogenic shock with IABP placement, diagnostic cardiac angiograms, peripheral angiograms, carotid stenting, dialysis graft venogram, and tunneled dialysis catheter placements. Implementing an Impella program expanded the services provided by the hospital to improve the health and availability of services to the community.

The state of Wisconsin does not currently report on the statistics or quality of the cardiac catheterization laboratory procedures. However, New York state reports on cardiac surgery and PCI (angioplasty) to measure risk, outcomes, and quality (New York State Department of Health, 2016). Nationally, Impella devices have supported 37,673 patients with various diagnoses such as cardiogenic shock, heart failure, and complex PCI (Abiomed, 2016b). Locally and nationally, the leading cause of death for the patient with myocardial infarction was found to be cardiogenic shock, which demonstrated the need to support complex patients by use of the Impella device in order to improve outcomes (Ren, 2017).

Role of the DNP Student

With 15 years of critical care experience at a Level 1 trauma center, my critical care nurse experience exposed my practice to the Impella device postprocedure from the cardiac catheterization laboratory to be managed in the surgical intensive care unit by the RN. At that time, the device was newly released and no online education was available. The only source of information was the company representative who would come to the facility and stay on the unit for the first few cases to mentor the RN. I am currently employed as a family nurse practitioner in the cardiology outpatient clinic.

As an outpatient cardiology nurse practitioner I was observing an ongoing trend in patients coming into the clinic for appointments to plan for staged complex PCI procedures. More patients with comorbidities were requiring complex procedures and were not candidates for open-heart surgery. The health system determined that fiscally supporting the Impella program would provide a service to the community to improve the outcomes of patients who are determined to be high risk for interventional procedures or surgery. The Impella device is ideal to use in complex PCI procedures, which reduce the need to return to the cardiac catheterization laboratory for staging. The Impella device can safely be used to support the patient and allow one procedure to intervene on multiple vessels. While conducting my practicum hours, it was obvious that the RN would be required to care for the complex patient with the Impella device and would lack experience and familiarity with the device and console. Designing and implementing an education program for the RN working with the patient with an Impella device in place

would provide the necessary information for the RN to deliver safe and competent care to the patient.

The motivations for this DNP project are based on the provision to allow for safe, high quality care for patients, while improving the patient's quality of life with improved outcomes. Providing safe care cannot be accomplished without providing the RN with adequate education to understand the basic function of the device and how it supports the patient. The education expands the RN's understanding on how to troubleshoot the Impella controller and to make critical decisions for the patient based on hemodynamics, orders, policies, and protocols.

Summary

The gap-in-practice demonstrated that RNs were lacking educational information and training to effectively manage the CCU patient with the Impella device in place. King's (1999) theory of goal attainment appropriately assists the nurse to care for the patient with the Impella device by using the transaction process model to effectively interact with the patient and achieve health goals. Education must be provided for the RN about the process and policies necessary to care for the critical care patient with the Impella device in place to allow for safe care and improved patient outcomes. Equally important to identifying the gap-in-practice was shown to provide evidence and analysis to support the need for the Impella educational program.

Section 3: Collection and Analysis of Evidence

Introduction

Heart disease continues to be the number one cause of death in the United States (AHA, 2014). Many healthcare facilities have adopted the use of the Impella cardiac ventricular assist device to be used after the diagnosis of MI to support the function of the heart. The purpose of this DNP project was to develop an Impella educational program for the critical care RN to provide the necessary information for the nurse to safely provide care to the patient with an Impella device. The Impella device requires frequent assessment and intervention, along with appropriate critical thinking skills, to follow policies to implement necessary changes. Providing education for the RN on the process and policies necessary to care for the critical care patient with the Impella device allows for safe care and improved patient outcomes. The critical care nursing staff must have the appropriate education to demonstrate proficiency and competency to care for the complex cardiac patient with the Impella device.

Practice-Focused Questions

In this project, I focused on the development of an Impella educational program for RNs practicing in critical care. The RNs required further education on the Impella device, the policies, and the procedures to care for the patient with the Impella device. The gap in practice was identified as a lack of standardized methods to educate RNs about the Impella product and to deliver ongoing education with methods to prove competency. RNs must have the education and understanding of the Impella device to assess and intervene when necessary to safely care for the patient and prevent a harmful

outcome. The practice-focused question regarding the implementation of an Impella educational program for critical care RNs at the health system would allow the nurses to deliver prepared and safe care of the adult patient who has an Impella device inserted. Providing care to the complex critically ill patient is a responsibility that critical care RNs are required to assume to improve patient care and clinical outcomes.

Sources of Evidence

An educational program was used to provide the information necessary for RNs to obtain information to competently care for patients with the Impella device. The primary objective of the project initiative was to determine if the intervention of the Impella education program would impact the validated competencies for the critical care RN. The expert panel recruited to evaluate the education program included interventional cardiologists, the director of critical care, the director of the cardiac catheterization laboratory, the director of pharmacy, and the Abiomed RN representative. The Impella educational program featured a pretest-posttest design to determine the extent to which the nurses completing the Impella educational program would improve posttest scores, level of confidence, patient outcomes, and clinical competency. Improved posttest scores reflect the outcome measures that would define if the Impella educational program was deemed effective.

Published Outcomes and Research

Databases, search engines, and search terms. The literature search was completed over the past year by use of CINAHL and PUBMED databases to locate articles with the search terms *VAD, Impella, Abiomed, IABP, outcomes, implementation,*

education, nursing, Kirtkpatrick's model, and *King's theory*, which includes Boolean operators. Additional articles were also found by a search for the above terms under Cath Lab Digest, a journal designed specifically for the cardiac catheterization laboratory and the procedures conducted there. When searching for literature, there were some difficulties in finding appropriate articles related to education regarding the Impella device. The literature search revealed other articles that were important about the Impella device use and outcomes but did not focus on the education of the registered nurse. The research about the Impella device has been comprehensive with use of recent information when possible (see Appendix C).

Research. The retrospective study by Khera et al. (2015) described that the use of percutaneous ventricular devices (PVAD) have increased due to increased safety in using the PVAD while performing protective PCI on high risk patients. The FDA approved the use of the Impella device for circulatory support during cardiogenic shock, acute myocardial infarction with cardiogenic shock, and high risk PCI (Khera et al., 2015). The research method was based on inpatient discharges from 2007 to 2012 that included patients who had either the IABP or PVAD in place (Khera et al., 2015). The sample size included 1,446 patients who received the PVAD, and 2,888 patients who had the IABP in place (Khera et al., 2015). The research demonstrated statistical significance ($p < .001$) with the use of PVAD due to a higher mortality rate over IABP (Khera et al., 2015). A potential reason for the higher mortality when the PVAD was used is the increased use in unstable patients with cardiogenic shock (Khera et al., 2015). The Impella device is capable of delivering 5L/min of circulatory support, and the IABP is

only able to provide 0.5L/min to improve the cardiac output (Khera et al., 2015). A demonstrated strength in this DNP project was that PVADs were used more frequently in the elderly and patients with comorbidities due to increased surgical risk (Khera et al., 2015). A weakness in this research was that there is no randomization with the research method limiting the internal validity of the research.

Venugopal et al. (2015) evaluated the interventional cardiology database to determine data on patients who had the Impella device in place. PCI has become a popular patient choice over the traditional open-heart surgery option due to the comorbidities that many patients are diagnosed with (Venugopal et al., 2015). The sample size was limited to a single facility, which included 49 participants who had an attempted placement of the Impella device (Venugopal et al., 2015). The method included the indications and outcomes of patients who had the Impella device placed (Venugopal et al., 2015). Venugopal et al. demonstrated safety and viability by providing effective hemodynamic support and decreased periprocedural complications when using all three varieties of the Impella device. Complex PCI has traditionally needed to be staged in many procedural attempts, but the Impella device allows the support necessary to complete all of the high risk PCI in one session (Venugopal et al., 2015). According to Venugopal et al., the majority of patients who had the Impella device used had left ventricle impairment with the ejection fraction being less than 35%.

Burzotta et al. (2015) conducted a systematic review and summarized the various uses of the Impella device in Europe with consideration of best practice in the clinical setting. The experienced European physicians collaborated to determine the most

effective ways to start an Impella program and what method of initiation utilized the device effectively for improved patient outcomes (Burzotta et al., 2015). The recommendations included initial use of the Impella with three to five elective PCI cases to establish experience with the device before progressing to using the Impella for emergent cardiogenic shock patients (Burzotta et al., 2015). Nurses will need to demonstrate competency in order to care for the patient who has the Impella device in place. The Impella device requires weaning after long-term use, and the registered nurse will assure that the patient tolerates the weaning by maintaining hemodynamic stability (Burzotta et al., 2015). Thus, the interventional cardiologist, according to hospital policy, will remove the Impella device when the patient tolerates the weaning of the device.

The randomized controlled trial study by Perera et al. (2010) was designed to determine if placement of an IABP prior to high risk PCI would improve patient outcomes. Ischemic events and arrhythmias may occur during PCI, deeming a need for supportive therapy such as the IABP (Perera et al., 2010). According to Perera et al., the IABP supports the coronary blood flow, which decreases myocardial oxygen demand. The IABP is also used as a supportive measure for patients who are at high risk for a PCI procedure and are predicted to be at risk for hemodynamic instability (Perera et al., 2010). Perera et al.'s results do not support using the IABP prior to a PCI intervention in patients with severe left ventricular dysfunction or severe coronary artery disease because of static outcomes at discharge concerning major adverse cardiac and cardiovascular events.

Rushdy, Morsy, and Elfeky (2010) conducted descriptive exploratory research and investigated nurses' backgrounds, knowledge base, and observed competency to effectively manage the IABP device and determine necessary interventions to maintain hemostasis. The study consisted of a convenience sample of 40 nurses employed in the Intensive Care Unit at Cairo University Hospitals to take a survey to determine the knowledge base of the IABP and by direct observation of the nurse using the IABP (Rushdy et al., 2010). The research validated statistical significance to demonstrate that the registered nurses lacked the knowledge to safely care for the patient with the IABP in place (Rushdy et al., 2010). Rushdy et al. determined that nurses needed continuing education to keep current in caring for the patient with the IABP and with direct observation of the care to prove competency.

Evidence Generated for the Doctoral Project

Participants. The target population of the DNP project was critical care RNs who contribute to improved patient outcomes by delivering competent care to the patient. The RN was evaluated by taking a pretest, and then after completing the Impella education program, a post-test followed. The pre- and post-test included a brief survey that measured the RN's perception of confidence to care for the patient with the Impella device in place. The inclusion criteria included RNs who are currently employed in the CCU and RNs who regularly float to CCU. Exclusion criteria included all RNs that who do not work in the CCU. Delivering competent patient care is the focus of the DNP project by providing the educational component necessary to manage the patient with the

Impella device. Approximately 40 RNs were included in the project, based on the number of nurses who currently work or float to the CCU.

Procedures. Prior to initiation of the DNP project, approval was obtained from the Walden University Institutional Review Board and from the health system. The proposed timeline for the project was 3 weeks. The materials for the educational program were completed on paper for distribution to the RNs working in critical care. The pre- and post-test was identical and are based off of the educational program objectives, with clear and concise questions. To assure that the pre- and post-test were valid, the expert panel reviewed the test and marked any questions that were unclear or that could be argued to be correct in certain instances. The experts assessed the validity of the testing during the meeting prior to the implementation of the educational program. The pre- and post-tests were based on the educational information currently used at Abiomed to train clinical experts. The pretest was distributed in paper form the first week of the project, the educational program took place the second week, and the paper form posttest was distributed the third week. The pretest included RN demographics, questions about anatomy, the Impella device placement, console management, and responding to emergency situations. The educational program was 20 minutes in length and covered patient anatomy, the device function, troubleshooting the device, critical thinking skills, and emergency situations. The final week included the posttest that replicated the pretest, and an educational evaluation was included for the RNs to share any insights into the program.

Protections. To ensure that human subjects were protected, the DNP project was reviewed and approved by the Walden University Institutional Review Board prior to implementation. Permission from the health system was obtained to perform the Impella educational program on site. Informed consent was obtained from all RN participants before implementation of the practice initiative. The nurses had their demographic information protected by having a separate form that was not directly connected to the pre- or post-test forms. There was no interaction or inclusion of patients in this educational program. All pre- and post-tests were anonymous with voluntary demographic information that included the age of the nurse in ranges from 20 to 29 years old, 30 to 39 years old, 40 to 49 years old, and 50 and older. The other information requested of those who chose to participate in the educational program was the number of years practicing as an RN and how many years practicing in critical care. The pretests and posttests were securely stored in a locked office on the premises of the health system. The computer used to tabulate the tests and data was password protected, and all firewalls and antivirus software were kept current.

Analysis and Synthesis

Data analysis was conducted using a paired *t* test that compared the changes in the response for each question between the pretest and posttest data. Each response for the item was measured on both the pretest and posttest. The Impella education program addresses the gap-in-practice issue by providing the training required for the RN to deliver the appropriate care to the patient with the Impella device in place. The pre- and post-test (Appendix E) was based on a nominal scale using *yes* or *no* for possible answers

to 13 knowledge-based questions. The questions that were answered as no received a score of 0, and the answers that were answered *yes* were scored as 5 points. Engagement questions were asked at the end of the survey to determine the RN's belief if the Impella would positively impact patient outcomes and to determine the RN's confidence to care for a patient with the Impella device in place. The Likert scale was used for the engagement questions with a five-point rating scale with 1 point to represent *strongly disagree* and 5 points to represent *strongly agree* with the statement. To assure integrity of the evidence, any questions that were left blank or intentionally not answered were not included. All analysis was conducted using SPSS Statistics 25. Statistical significance was considered met with p values ≤ 0.05. I used the Microsoft Excel program for recording, tracking, organizing, and analyzing the evidence.

Summary

An important aspect of the implementation of the Impella educational program was to include the acquisition of knowledge, critical thinking, and psychomotor skills to safely provide care to the patient with the Impella device. The education of the critical care nurse on the management of the Impella device and controller was necessary to appropriately intervene on the unstable critical care patient. Acquiring knowledge and demonstrating competency was necessary to validate that the nurse demonstrated the capability to provide safe care for the complex patient with hemodynamic instability. Evaluation of the educational program was important to demonstrate program effectiveness to determine that the RN had gained knowledge about the Impella device.

Educating the critical care nursing staff on the management of the Impella device allowed for competent care for the critically ill patient.

Section 4: Findings and Recommendations

Introduction

Recently, the administration at the health system determined that the Impella device would be purchased and implemented, which brought attention to the needs of the RNs who would be managing the Impella device for the critical care patient. Due to lack of exposure, RNs had a limited understanding of the skills needed to actively respond to the required changes and properly manage the Impella controller. This knowledge and skill deficit represents a significant gap-in-practice because of the implementation of the Impella device. The practice-focused question for this DNP project was as follows: Will implementing an Impella educational program for critical care RNs at the health system allow nurses to deliver prepared and safe care of the adult patient who has an Impella device inserted? Developing an Impella educational program for RNs practicing in the CCU is the primary purpose of this doctoral project. Primary sources of evidence are the pre- and post-test provided on a voluntary basis to each RN who currently works in CCU. An educational program was conducted between the tests to determine if there was an increased understanding of the information concerning management of the Impella device. The analytical strategies used for the DNP project determined if there was a statistical significance found between the pre- and post-tests given to the RNs. A software program, SPSS (SPSS Inc., 2017) was used to analyze the collected data and determine statistical significance using the paired *t* test when comparing the pre- and post-test scores. Understanding the findings, recommendations, strengths, and limitations

to the Impella educational program was important to validate the learning accomplished by the CCU RN.

Findings and Implications

The goal of the DNP project was to increase the RNs' knowledge to safely manage the Impella device. A paired-samples *t* test was conducted using the SPSS (SPSS Inc., 2017) software program to compare CCU RN's knowledge of the Impella device, while comparing the pretest to the posttest results. There was a significant difference in the scores for the pretest (M = 15.63, SD = 10.14) and the posttest (M = 64.79, SD = 1.02); $t(14) = -24.17$, $p = .000$. The Sig. (2-tailed) value in the paired samples test is less than .05, and the results demonstrated that there was a significant statistical difference between the pre- and post-test scores by the CCU RNs. The mean number in the paired samples statistics results showed that the posttest had an increased score versus the pretest, which revealed that the RNs' posttest score after the Impella educational program demonstrated that the nurses had an improved knowledge base to manage the Impella device. The responses determined that nurses had an improved understanding of the Impella device by improved knowledge-based posttest scores. Reliability for the knowledge-based questions was established by the Kuder-Richardson 20 (KR-20) statistical test that uses binary variables to validate consistency of the results (El-Uri & Malas, 2013). The KR-20 was conducted using SPSS version 25 and demonstrated that the Cronbach's Alpha score was .717, which is considered acceptable for internal consistency reliability. Face and content validity for the pre- and post-test was established through a panel of experts, including a representative from Abiomed. The

pretest engagement questions demonstrated a decreased belief in the Impella device positively impacting patient outcomes and regarding RN confidence to care for the patient with the Impella device at 25%, where the value increased post Impella education to 90%. Increased RN confidence was demonstrated by $p = .000$, while a change in RN attitude towards the Impella indicated improvement by $p = .000$.

Unanticipated Limitations

There were 24 tests completed for each of the pre- and post-test evaluations from the CCU RNs. Respondents included 24 RNs for the pretest, and 24 RNs for the posttest. The data analyzed were found to be statistically significant, but there would have been the potential to improve the sampling size of the RNs if the pre- and post-tests had been distributed in proximity to the mandatory yearly RN validations. Attendance was limited for the Impella educational program, which included 28 RNs, when there would have been full compliance during the mandatory yearly validations at the health system. The Impella representative was only available to provide the Impella device and simulation controller for 1 day. The CCU is a busy environment that does not allow for nurses to leave the floor for trainings during their shift, therefore the RN would have scheduled availability to attend the trainings during the scheduled yearly validations.

Individuals, Communities, and Institutions

The implications of the project findings impact the individual RN because there is a need to provide professional development with initial and ongoing education for newly implemented device use in the CCU. Implementation of the Impella device will occur in the fourth quarter of 2017, and it is important to have the educational program completed

to assure that the RNs are ready to manage the Impella device. The Impella educational program will be included in the spring 2018 mandatory yearly validations that the CCU RNs are required to complete. Educational programs are driving forces in improving practice for nurses to further enhance patient outcomes during and after hospitalization (Savage, Fitzgerald, & Lee, 2015). Community members surrounding the health system require that appropriate treatments and procedures exist to support the needs of the community. Validated care provided by properly trained RNs is an asset to the local community. Community members choose to have their care provided at this local health system and expect to have safe and effective care delivered. Providing evolving education to RNs validates that the health system is committed to quality outcomes of their patients and recognizes that healthcare is never static.

Potential Implications to Positive Social Change

Potential implications to social change are demonstrated by an improved understanding of the Impella device to provide informed and safe care to the CCU patient. Another implication for social change is the possibility for RNs to have a cultural change in the health system by demonstrating support of the Impella device, expressing its usefulness and necessity to provide hemodynamic support to cardiac patients. RNs who expand their thinking by continuing education can approach the patient holistically to provide a heightened level of care, which can positively impact social change. Patients who require support from the Impella device will potentially experience social change by receiving improved care and improved patient lifestyle and overall patient outcomes.

Recommended Implementation and Evaluation Procedures

Implementation of the Impella education program allows for the RN to have appropriate training to manage the Impella controller and catheter. The RN has the opportunity to express his or her understanding of the Impella device prior to the Impella educational program by taking a pretest and then taking a posttest after the educational program. The evaluation of the Impella educational program is accomplished by demonstrating an improvement in the understanding of the management of the Impella controller and device. The educational program objectives include the nurse's necessary requirements to care for the CCU patient with the Impella device:

1. RN will demonstrate improved knowledge to care for the patient with the Impella device in place, and this will be demonstrated by an improved score on the posttest versus the pretest.
2. RN will demonstrate ability to make appropriate changes to the controller during the simulation portion of the educational program to validate that the RN has the necessary skills to manage the controller.
3. RN will demonstrate mastery of the basic anatomy of the heart and great vessels by return demonstration to identify the device placement during the simulation portion of the educational program.

The CCU RN had the opportunity to participate in the simulation of the Impella device by use of the controller in real time and make changes that would be necessary while caring for an actual patient. Education was provided to the nurse and the nurse would

appropriately respond to the requirements of the Impella device by the use of the policy and order set to guide the care of the patient.

Strengths and Limitations of the Project

Strengths

In this project, I used King's (1999) theory of goal attainment with the emphasis on the transaction process model. The transaction process model is a strength to the DNP project because it uses a feedback loop to evaluate the nurse-patient perception, judgment, and action required for controller changes in order for the nurse to provide the appropriate reaction, interaction, and transaction for the patient (King, 1999). Employing the appropriate model can provide a guideline to deliver care that is effective and safe.

An additional strength of this DNP project is when RNs lack experience and education of the Impella device prior to the implementation of the Impella device at the health system. The RNs demonstrate the need for the Impella educational program to be developed and implemented to meet the gap in practice. A strength of the Impella educational program is the detailed explanation of the Impella device with the return demonstration using the simulation controller and device on a simulation practice patient. The expanded role that nurses are required to fulfill demands that additional training be provided in order to deliver safe and prepared care.

In summary, the strengths of this DNP project are use of King's transaction process model and the provision of the Impella educational program. This DNP project also contributes to RN knowledge that expands the understanding of the Impella device and controller, which enhances patient safety. To understand further needs of the RN

when managing the Impella device the DNP project would need to be expanded to include RNs from multiple facilities with various backgrounds and experience levels.

Limitations

A limitation of this DNP project includes that the Impella device has not been implemented as of yet; therefore, there is not the opportunity to evaluate the RN's management of the Impella device and controller after the Impella implementation at the health system. There was no research in the literature review that specifically evaluated an educational program for the Impella device, so further research may be necessary to evaluate RN and facility needs on a larger scale regarding the Impella device. The project is designed as an initial and ongoing educational program for the yearly mandated validations, but there is no opportunity within the design of this DNP project to evaluate the RNs' function when caring for the patient or for determining improved patient outcomes after the Impella device is implemented at the health system.

A limitation of the project is that the Impella education program reviews the most common issues that may arise with the controller or catheter, but when rare issues arise with the device, the representatives for the Impella device will offer additional support for the CCU RNs. Future projects that require RNs to have advanced training and education would be beneficial to be delivered during the mandatory yearly validations to have the highest participation.

Another limitation is that there is not an opportunity to evaluate how the physicians interact with RNs after the Impella educational program to determine if the Impella order sets and education reflect the physician expectations after the health system

goes live with the device. During the planning stages of the Impella educational program, the multidisciplinary team may have predicted the physician needs for the order sets and management of the patient, but after the device is implemented at the health system, it will be important to have further evaluation by the multidisciplinary team to determine additional educational needs or changes to the program. Overall, these limitations suggest that additional research is needed to fully examine the benefits of an educational program for RNs caring the Impella device and the effectiveness on patient outcomes.

Section 5: Dissemination Plan

Dissemination Plan

This project will be disseminated to the health system by presentation at the quarterly cardiology meeting and inviting the RN CCU staff to participate. This meeting is well attended and is open to all health system employees. This meeting will provide an appropriate venue to discuss the findings and make appropriate suggestions to the ongoing educational needs regarding the Impella device. Disseminating the Impella educational program to RNs at a cardiology conference or continuing education event would also be appropriate. RNs who are not actively working in a cardiology specialty would find interest in the Impella device to further understand what supportive measures are available to patients post PCI and while the patient experiences cardiogenic shock. A poster presentation would also be applicable to disseminate the information to RNs at a nursing conference or event because the RNs would be able to look over the information and device at their leisure.

Self-Analysis

During the process of developing this educational program, I found that I had growth as a practitioner by enhancing my skills for program development, data collection, patient care coordination, and program evaluation to further understand the needs of the RN, patients, and health system administrators. I actively aimed to achieve improved leadership skills in the health system by forming a vision for the Impella educational program and by social networking to build relationships for multidisciplinary care. I also had to improve my organizational skills to coordinate meetings to set up the

educational program and distributions of the pre- and post-tests, which can be difficult when schedule demands are high for all stakeholders. The practitioner role overlapped with the project manager because I function effectively with my patients on a daily basis, but I was now required to not only think about the patient requirements but to determine how to plan for the RN educational requirement to manage the Impella device being used for a complex CCU patient requiring frequent intervention to support the patient's hemodynamic status. Project management required frequent meetings with department directors, physicians, and nursing management to assure that the RNs would receive the appropriate program to effectively support their educational needs in relation to the Impella device. Most CCU RNs employed by the health system had minimal to zero exposure to the Impella device in the past and demonstrated a need for education about the Impella device. The Impella educational program is designed to enhance the RNs' knowledge of the Impella device to develop the confidence to apply the knowledge and to improve psychomotor skills to manage the controller while caring for the patient with the Impella device in place.

Challenges, Solutions, and Insights

Completing the Impella educational program was a challenging endeavor due to the importance to properly educate and validate that the CCU RN was prepared to appropriately care for the patient with the Impella in place. There was a sense of urgency to deliver a well-developed Impella educational program because the health system had invested a large sum of capital into the implementation of the Impella program to expand the cardiology service provided to community members. Collaborating with the formed

expert panel and Impella representative was imperative to build a program that was well rounded and that satisfied each stakeholder. I found that developing and implementing this program helped to enhance my own networking skills and mentoring for the CCU RNs. Taking on an endeavor to develop and implement an educational program for CCU RNs is challenging, but it was also rewarding to observe the RNs' learning and processing of the information that allows for responsible and safe care of the CCU patient.

Summary

Heart disease continues to be the number one cause of death in the United States (AHA, 2014), and further supportive management of the cardiac patient will continue to be necessary to improve mortality and the quality of life for cardiac patients. Cardiac patients post PCI or with cardiogenic shock must be cared for by educated RNs to appropriately provide validated care and to manage supportive devices such as the Impella. The Impella device provides the hemodynamic support to limit intravenous vasopressor support and to significantly reduce major adverse events (death/stroke/MI; O'Neill et al., 2012). As healthcare continues to change and evolve, it is necessary to acknowledge gaps in practice in order to provide educational programs for nurses to impact patient outcomes for positive social change.

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Appendix A: John Hopkins Nursing Evidence-Based Practice Rating Scale

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

QUALITY of the Evidence			
A	High	Research	consistent results with sufficient sample size, adequate control, and definitive conclusions; consistent recommendations based on extensive literature review that includes thoughtful reference to scientific evidence.
		Summative reviews	well-defined, reproducible search strategies; consistent results with sufficient numbers of well defined studies; criteria-based evaluation of overall scientific strength and quality of included studies; definitive conclusions.
		Organizational	well-defined methods using a rigorous approach; consistent results with sufficient sample size; use of reliable **and** valid measures
		Expert Opinion	expertise is clearly evident
B	Good	Research	reasonably consistent results, sufficient sample size, some control, with fairly definitive conclusions; reasonably consistent recommendations based on fairly comprehensive literature review that includes some reference to scientific evidence
		Summative reviews	reasonably thorough and appropriate search; reasonably consistent results with sufficient numbers of well defined studies; evaluation of strengths and limitations of included studies; fairly definitive conclusions.
		Organizational	Well-defined methods; reasonably consistent results with sufficient numbers; use of **reliable and valid** measures; reasonably consistent recommendations
		Expert Opinion	expertise appears to be credible.
C	Low quality or major flaws	Research	little evidence with inconsistent results, insufficient sample size, conclusions cannot be drawn
		Summative reviews	undefined, poorly defined, or limited search strategies; insufficient evidence with inconsistent results; conclusions cannot be drawn
		Organizational	Undefined, **or** poorly defined methods; insufficient sample size; inconsistent results; undefined, poorly defined or measures that lack adequate reliability or validity
		Expert Opinion	expertise is not discernable or is dubious.

**A study rated an A would be of high quality, whereas, a study rated a C would have major flaws that raise serious questions about the believability of the findings and should be automatically eliminated from consideration.*

Appendix B: Permission for Use

Appendix C: Literature Review Table

Citation	Purpose	Design	JHNEBP rating scale	Findings
Burzotta et al., 2015	Summary of evidence-based Impella program initiation	Systematic Review	Strength: IV Quality: Good	Use of the Impella to mechanically support the patient effectively prior to and during PCI
Khera et al., 2015	Comparison of typical use of PVAD versus IABP	Retrospective Study Design	Strength: II Quality: High	Study demonstrated an increase in PVAD use versus the IABP There is a need for randomized clinical trials to determine the most appropriate practice
Venugopal et al., 2015	Using a single center registry to demonstrate the use of the Impella as safe and feasible	Quasi-experimental Study Design	Strength: II Quality: Low	Study demonstrated effective use of the Impella device with high-risk PCI, cardiogenic shock, transplanted hearts in acute rejection, and use with aortic stenosis.
Perera et al., (2010)	Determine if IABP prior to PCI reduces major complications	Prospective, randomized controlled trial Study Design	Strength: I Quality: High	Patients did not have reduced adverse complications if the IABP was inserted prior to PCI
Rushdy, Morsy, Elfeky, (2010)	Assessment of nurse knowledge of the IABP and assess nurses choice of intervention of the patient with the IABP	Descriptive Exploratory Study Design	Strength: III Quality: Low	Study results demonstrated inadequate knowledge base of the IABP and inappropriate interventions Recommendation to implement an educational program to improved knowledge and prove competency

Appendix D: RN Demographic Data

General Demographics RN Post-test (n = 24; frequency)				
RN age	20-30 (3; 12.5%)	31-40 (12; 50%)	41-50 (8; 33.3%)	>50 (1; 4.2%)
Years practicing as an RN	<5 years (8; 33.3%)	5-10 (12; 50%)	11-20 (2; 8.3%)	>21 (2; 8.3%)
Critical care experience	<5 years (10; 41.7%)	5-10 (10; 41.7%)	11-20 (3; 12.5%)	>21 (1; 4.2%)

Appendix E: RN Survey

Impella Pre/Post Test	**YES**	**NO**
1. Echocardiogram is necessary when Impella catheter migration is suspected or when the device requires repositioning		
2. The speed of the Impella must be decreased to P2 prior to the physician repositioning the catheter		
3. A suction alarm requires the P-level to be reduced by 1 or 2 levels to break the suction		
4. A risk of having the Impella in place is hemolysis		
5. The patient with the Impella device in place has the controller values documented hourly		
6. Assess the groin site for bleeding and hematoma hourly and document		
7. A major complication of having the Impella in place is decreased blood flow to the extremity		
8. The head of the bed must not be higher than a 30-degree angle		
9. It is important to assess for signs of right heart failure, such as leg and ankle swelling requiring an order for diuretics		
10. A benefit to using the Impella is decreased use of vasopressors to hemodynamically support the patient		
11. The patient with the Impella device in place is assigned as a 1:1		
12. When CPR is necessary reduce the P-level to P-2		
13. After CPR if the patient has restored cardiac function the Impella placement must be verified by echocardiogram		

Impella Survey Item	Strongly Disagree	Disagree	Neutral	Agree	Strongly Disagree
1. I think that the Impella will improve patient outcomes					
2. I have confidence in my ability to manage the Impella device and the necessary patient care required while the Impella device is in place					

Thank you for considering being part of the survey.

Appendix F: SPSS Paired t-test

Paired t-test: Knowledge-based Questions

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	RN Pre Test	15.6250	24	10.14166	2.07016
	RN Post Test	64.7917	24	1.02062	.20833

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	RN Pre Test & RN Post Test	24	.223	.295

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	RN Pre Test - RN Post Test	-49.16667	9.96370	2.03383	-53.37397	-44.95936	-24.174	23	.000

Paired t-test: Engagement Questions

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PreTestConfidence	40.6250	24	25.33740	5.17197
	PostTestConfidence	90.6250	24	12.36338	2.52367

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	PreTestConfidence & PostTestConfidence	24	.748	.000

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	PreTestConfidence - PostTestConfidence	-50.00000	18.05788	3.68605	-57.62517	-42.37483	-13.565	23	.000

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PreTestPtOutcomes	33.3333	24	24.07717	4.91473
	PostTestPtOutcomes	90.6250	24	12.36338	2.52367

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	PreTestPtOutcomes & PostTestPtOutcomes	24	.730	.000

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	PreTestPtOutcomes - PostTestPtOutcomes	-57.29167	17.25633	3.52243	-64.57837	-50.00496	-16.265	23	.000

Appendix G: KR-20 Reliability

Case Processing Summary

		N	%
Cases	Valid	24	100.0
	Excluded[a]	0	.0
	Total	24	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.717	.721	11

Item Statistics

	Mean	Std. Deviation	N
Pre Test Ques 1	.4167	.50361	24
Post Test Ques 1	.9583	.20412	24
Pre Test Ques 2	.0833	.28233	24
Pre Test Ques 3	.1250	.33783	24
Pre Test Ques 4	.0833	.28233	24
Pre Test Ques 5	.8333	.38069	24
Pre Test Ques 6	.1250	.33783	24
Pre Test Ques 8	.2917	.46431	24
Pre Test Ques 10	.1250	.33783	24
Pre Test Ques 11	.9167	.28233	24
Pre Test Ques 13	.0833	.28233	24

Inter-Item Correlation Matrix

	Pre Test Ques 1	Post Test Ques 1	Pre Test Ques 2	Pre Test Ques 3	Pre Test Ques 4	Pre Test Ques 5	Pre Test Ques 6	Pre Test Ques 8	Pre Test Ques 10	Pre Test Ques 11	Pre Test Ques 13
Pre Test Ques 1	1.000	.176	.357	.192	.357	.378	.447	.015	.447	.255	.051
Post Test Ques 1	.176	1.000	.063	.079	.063	.466	.079	.134	.079	-.063	.063
Pre Test Ques 2	.357	.063	1.000	.342	.455	.135	.342	.470	.342	.091	-.091
Pre Test Ques 3	.192	.079	.342	1.000	.798	-.169	.619	.035	.238	.114	-.114
Pre Test Ques 4	.357	.063	.455	.798	1.000	.135	.798	.138	.342	.091	-.091
Pre Test Ques 5	.378	.466	.135	-.169	.135	1.000	.169	.287	.169	-.135	.135
Pre Test Ques 6	.447	.079	.342	.619	.798	.169	1.000	.035	.238	.114	.342
Pre Test Ques 8	.015	.134	.470	.035	.138	.287	.035	1.000	.035	.193	.138
Pre Test Ques 10	.447	.079	.342	.238	.342	.169	.238	.035	1.000	.114	-.114
Pre Test Ques 11	.255	-.063	.091	.114	.091	-.135	.114	.193	.114	1.000	.091
Pre Test Ques 13	.051	.063	-.091	-.114	-.091	.135	.342	.138	-.114	.091	1.000

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Pre Test Ques 1	3.6250	2.679	.514	.	.670
Post Test Ques 1	3.0833	3.558	.235	.	.713
Pre Test Ques 2	3.9583	3.172	.526	.	.678
Pre Test Ques 3	3.9167	3.210	.377	.	.695
Pre Test Ques 4	3.9583	3.085	.621	.	.665
Pre Test Ques 5	3.2083	3.216	.308	.	.706
Pre Test Ques 6	3.9167	2.949	.618	.	.658
Pre Test Ques 8	3.7500	3.152	.251	.	.723
Pre Test Ques 10	3.9167	3.210	.377	.	.695
Pre Test Ques 11	3.1250	3.505	.185	.	.719
Pre Test Ques 13	3.9583	3.607	.088	.	.730

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
4.0417	3.781	1.94443	11

Appendix H: IRB Approval

06-28-17-0631968