Preemptive Advanced Clinical Management to Decrease 30-Day Hospital Readmissions in the Mechanical Circulatory Support Population

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Capstone

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"On my honor as a student, I have neither given nor received aid on this assignment."

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Abstract

Background: The mechanical circulatory support (MCS) population consists of patients with advanced heart failure (HF) who receive a mechanical implanted pump to insure adequate blood flow to prolong life regardless if a transplant will be performed (Jessup et al., 2009). Due to the complexities of the devices and required medical therapy, 79% - 82% of patients receiving MCS are readmitted to the hospital during their time on mechanical support and unplanned hospital readmission is associated with increased mortality in this population.

Purpose: The purpose of this project was to provide preemptive advanced clinical management for MCS patients following hospital discharge to decrease the 30-day readmission rate. This management includes intensive telephone follow-up, education and referrals.

Methods: MCS patients discharged between August 15 and October 15, 2014, participated in this IRB-approved performance improvement project. Patients received telephone follow-up calls 24 to 48 hours after discharge and thereafter on day seven, fourteen, twenty-one, and twenty-eight. A standardized question list based on common reasons for readmission guided the telephone follow-up. Data regarding telephone follow-up issues was recorded. Hospital readmission rates were compared to the same time period in 2013.

Results: Three readmissions occurred with eleven patients (27.2%) in the preemptive group versus five readmissions with thirteen patients (38.5%) in the comparative group. In the preemptive group, ten of the eleven patients reported symptoms during their follow up phone calls. Five of the eleven reported shortness of breath, three weight gain, three bleeding, three driveline drainage, one equipment problem, one with visual disturbance and one with an unsteady gait. All patients received education specific to their reported symptoms and symptoms were reported to the Ventricular Assist Device (VAD) coordinators facilitating interdisciplinary

collaboration. Although patients in the preemptive group had similar symptoms to the comparative group, none were admitted for heart failure or cardiac symptoms as in the comparative group and were treated in the outpatient setting. Two of the three readmitted patients were for worsening conditions of their original discharge diagnosis. One patient developed a driveline infection not present on the initial admission.

Implications: Preemptive follow-up in this complex, advanced heart failure population was well received by patients and caregivers to promote self-care. Managing heart failure symptoms and device complications with a collaborative interdisciplinary team decreases hospital readmission which has been shown to correlate with increased mortality in this population.

Keywords: mechanical circulatory support, hospital readmission, nursing interventions

Preemptive Advanced Clinical Management to Decrease 30-Day Hospital Readmission in the Mechanical Circulatory Assist Population

Introduction

Overview of Mechanical Circulatory Support

The mechanical circulatory support (MCS) population consists of patients with advanced heart failure (HF) who received extraordinary measures by receiving a pump to facilitate blood flow through their heart to delay death and improve quality of life (Jessup et al., 2009). MCS devices including the Heart Mate II (Thoratec, Pleasonton, CA) and HeartWare (HeartWare, Inc., Sydney, Australia) are implanted to assist the left ventricle of the heart in providing adequate blood flow to the body. Due to the complexities of the devices and required medical therapy, 79% - 82% of patients receiving MCS will be readmitted to the hospital during their time on mechanical support (Hasin et al., 2013; Smedira et al., 2013; Patel, Cowger & Zuckermann, 2014; Khazanie et al., 2014). Khazanie et al. (2014) discovered one year readmission rates had not changed between 2006 (81.8%) and 2011 (81.1%) in 2,507 Medicare patients with MCS. An association has been observed between unplanned hospital readmissions and increased mortality in the MCS population. Survival at 30 days post device implant was reported at 99% with no readmissions to 87% with two readmissions (Smedira et al., 2013). Comorbidities, age, and indication for MCS also contribute to overall mortality (Kirkland et al., 2014).

The cost to Medicare for hospitalization for device implantation in 2010 was $201, 026 (SD: $81, 461). The mean cost to Medicare for inpatient acute care follow-up in the year following MCS implant per patient was $40,217 (SD: $57,242) (Khazanie et al., 2014). Prevention of hospital readmission in this specialized patient population will decrease additional

economic burdens for patients, families, and health systems. Prevention of readmissions for patients with HF is a goal in the United States. Healthy People 2020 is a national campaign to improve healthcare outcomes over a ten-year period. One goal of Healthy People 2020 is to reduce hospitalizations of patients age 65 and older for HF. This was also a goal for Healthy People 2010. In 2007, the rate of hospitalization for patients with Medicare Part A between the age of 65 and 74 years was 9.8 per 1,000 people. The goal for Healthy People 2020 is a one percentage point decrease to 8.8 per 1,000 people with a primary diagnosis of heart failure (U.S. Department of Health and Human Services, 2010). Patients who receive MCS are patients with advanced heart failure. Evidence-Based interventions are needed to meet this objective.

The Affordable Care Act, Hospital Readmission Reduction Program was implemented in October, 2012 to reduce readmissions from acute myocardial infarction, pneumonia and HF within 30 days of discharge. In 2014, the criteria were expanded to include Chronic Obstructive Pulmonary Disease and surgical repair of the hip or knee. Payments to hospitals are reduced based on calculated excess 30-day readmission numbers. Readmission rates for hospitals and performance data is publicly reported on www.medicare.gov/hospitalcompare. The national Medicare readmission rate for HF patients within 30 days is 23.0% (Centers for Medicare and Medicaid, 2013). A readmission rate of 55.6% for Medicare patients was noted by Hasin et al. (2013) at 6 months for their cohort of 115 MCS patients. Khazanie et al. (2014) discovered one year readmission rates had not changed between 2006 (81.8%) and 2011 (81.1%) in 2,507 Medicare patients with MCS.

The Role of the Clinical Nurse Specialist

The role of the Clinical Nurse Specialist (CNS) as an Advanced Practice Registered Nurse (APRN) encompasses the relationship domains of patient, nursing practice and

organization (Figure 1). "Core Practice Doctorate Clinical Nurse Specialist Competencies" were developed in December of 2009 by the National Association of Clinical Nurse Specialists (NACNS) in collaboration with other stakeholders. These competencies focus on providing a thorough assessment of patient needs. Additional skills include facilitation of interdisciplinary collaboration to develop a comprehensive plan of care. Evidenced-based interventions guide necessary changes of organizational processes to meet the needs of complex patient populations (NACNS, 2009). This project incorporates the CNS Practice Doctorate Competencies (Figure 1).

The Clinical Nurse Specialist practicing at the doctorate level develops interventions using an evidenced-based assessment of patient needs. An analysis of patient needs for this project was obtained from Transplant Team data, participation in Transplant Rounds, direct interactions with patients and families and the Hopeful Hearts Support Group. Interventions were developed based on complications observed and documented in the literature for patients with mechanical circulatory support. On the cardiothoracic surgery unit, the CNS rounds several times a week on mechanical circulatory support patients. The objective of the rounding is to identify individualized goals of patient care, provide support, and assist with coping skills during acute hospitalization. Collaboration with the interdisciplinary team allows for a comprehensive plan of care to be developed for the patient.

Education of staff throughout the hospital environment is developed and facilitated by the CNSs to ensure competency in caring for this complex population. This includes educating staff on units caring for MCS patients: the Cardiothoracic Surgery Intensive Care Unit, Cardiothoracic Surgery Progressive Care, inpatient rehabilitation, emergency department, dialysis, endoscopy, cardiac catheterization and electrophysiology lab and non-invasive cardiology. Participants include physicians, nurse practitioners, registered nurses, care partners,

physical/speech/occupational therapists, exercise physiologists and transporters. Support of the care environment also includes expert consultation on complex patient needs with the interdisciplinary care team to achieve optimal patient outcomes.

Organizational support of the device program is another key component to success. The CNS obtained grant funding for the Hopeful Hearts Support Group for device patients and their families. Diversional activities are funding through the grant which was obtained through the hospital auxiliary. Facilitated by the CNS, this group provides support for patients and families including developing coping skills to deal with acute on chronic illness during prolonged hospitalization.

It was identified that staff nurses were required to leave the unit to transport patients to testing. Patient Safety Net adverse event reporting for transportation was reviewed to identify potential safety issues for this complex population. Other organizations were contacted to obtain Best Practices. Literature was reviewed for Evidence-Based safe transport. The CNS developed and facilitated classes for transporters to promote safe transitions for patients to procedural/testing locations. Funding for additional Automated External Defibrillators was obtained and transport staff was trained on their use. The process is currently being implemented and safety, efficiency and effectiveness will be evaluated.

Project Purpose

The purpose of the present project was to decrease overall 30-day hospital readmission rates for patients with mechanical circulatory support during a 90-day trial of an evidence-based APRN-led post-discharge follow-up project. This was accomplished through intensive post-discharge phone follow-up using a standardized questionnaire addressing the most common reasons for readmission, including bleeding, infection, medication adherence and comorbidity

management (Hasin et al., 2013, Smedira et al., 2013, Patel, Cowger & Zuckermann, 2014, Khazanie et al., 2014). Intensive post-discharge follow-up has been shown to decrease readmissions in the HF population (Brown & Gottleib, 2012). Identified needs were addressed through education or referral to appropriate resources. A systematic review of randomized control trials in HF patients by Boyde, Turner, Thompson & Stewart in 2011 identified patient education by nurses to be an effective intervention in the HF population to decrease hospital readmissions and improve quality of life. The primary desired outcome, namely reduced readmissions for MCS patients, as well as, lessons learned were evaluated by an analysis of the 30-day readmission rates for MCS patients as well as through evaluation of the intensive telephone follow-up process.

Review of the Literature

A literature review was completed using PubMed, Ovid Medline and CINAHL using the search terms "hospital readmission", "readmission", "ventricular assist devices", "mechanical circulatory support" and "heart assist devices". Criteria included articles published within ten years, in English for human, adult subjects. PubMed revealed 12 articles relevant to the search criteria. Six articles were identified from CINHAL. Of those, two were duplicates and three did not apply. Ovid Medline revealed seven articles, all of which were duplicates of PubMed articles (Table 1).

Heart Failure

Heart Failure patients are a population increasing in number (Yancy et al., 2013). Approximately 5.1 million people in the United States are affected by HF (Go et al., 2014). HF is experienced with increasing prevalence in advancing age (Hall, Levant & DeFrancis, 2012). In HF, the ability to meet the physiologic demands of the body diminishes due to impaired pumping

of the ventricle resulting in symptoms such as shortness of breath, edema, weight gain, and fatigue (Yancy et al., 2013). The medications and treatments for HF may result in side effects that have a negative impact on Health Related Quality of Life (HRQOL) (O'Loughlin et al., 2010). As a result, patients may become non-adherent to their prescribed medical therapies, increasing the risk of hospitalization (Ryan et al., 2013).

Heart failure is a progressive disease. The severity of the disease is rated using the "Development of Heart Failure/Recommended Treatment Algorithm" developed by the American Association of Cardiology Foundation/American Heart Association (AACF/AHA) in 2005. Stages begin with categories A and B which are at risk for HF and progress to Stage D which is advanced HF (Hunt et al., 2005). "Classification of Functional Capacity" was developed by the New York Heart Association (NYHA) in 1928 to standardize reporting of symptoms. It is used to categorize symptoms using a scale of I – IV. The ninth version of this tool is in current use. While the "Stages of Heart Failure" progress from A to D, patients may move between classes I – IV as their symptom change (Table 2). According to the 2009 ACCF/AHA "Guidelines for the Diagnosis and Management of Heart Failure in Adults" patients classified as "Stage D," which is considered end stage, can be considered for palliative or hospice care or "extraordinary care" including advanced therapies such as cardiac transplant or MCS which assists with the pumping of the heart (Figure 4) (Jessup et al., 2009).

Cardiac Transplant

Cardiac transplant is the "gold standard" treatment for advanced refractory HF which is not responding to optimal treatment. Availability of donor organs is limited. Mechanical circulatory support is indicated as a "bridge to transplant" (BTT) to optimize organ function prior to transplant. The wait time for cardiac transplant can be extensive based on blood type, body

size, and antibodies in the recipient. Patients may not have adequate cardiac function to support life while waiting for a direct transplant (Table 3) (Colvin-Adams et al., 2014). An increasing number of patients have MCS prior to transplant (Figure 5). Mechanical circulatory support provides improved survival and outcomes while waiting for a transplant.

The time a patient is on a device is dependent on goals for treatment. The patient awaiting transplant as highlighted in Table 3, will have a variable time to achieve the goal of transplantation based on blood type, body habitus, and antibodies present.

Mechanical Circulatory Support

Mechanics of mechanical circulatory support devices. The Heart Mate II (Figure 2) and HeartWare (Figure 3) assist devices use a pump to move blood from the weakened left ventricle of the heart to the ascending aorta where the oxygenated blood is distributed to the body. The blood is pulled from the left ventricle as a result of a spinning rotor for the Left Ventricular Assist Device (LVAD) and rotating impeller for the HeartWare Ventricular Assist Device (HVAD). The result is a normal cardiac output of up to 10 liters/minute. The use of anticoagulation is required to prevent thrombosis which is a blood clot in the pump. (Thoratec Incorporated, 2013; HeartWare Incorporated, 2013). The use of anticoagulation can lead to bleeding, strokes or thrombosis from sub-therapeutic anticoagulation (Forest et al., 2013; Hasin et al., 2013; Raasch et al., 2012; Smidera et al., 2013).

The devices are powered by electricity carried from an external source (batteries, alternating current or car power) to the pump via a driveline. A pair of LVAD batteries lasts 6-10 hours and HVAD batteries last 4-6 hours each. The driveline exits the skin through a small incision in the abdomen which predisposes the patient to infection. Daily to weekly driveline care is performed by the patient or family using aseptic technique using chlorhexidine or other

cleanser if the patient is sensitive to chlorhexidine (Thoratec Corporation, 2013; HeartWare, Incorporated, 2013). Deviation from the recommended techniques or frequency can increase the potential for infection. Kirklin et al. (2014) reported a 15% driveline infection rate at one year increasing to 33% at three years. Gordon et al. (2013) noted a 22% infection rate with peak risk eighteen days after surgery and remaining consistent after 60 day post implant.

The driveline connects to a system controller which is the computer that controls the speed of the pump and gathers data for analysis on the performance of the pump. The system controller will alarm if attention is needed as a result of mechanical failure of the device, patient hemodynamic changes, or monitoring parameters that are out of range (Thoratec Corporation, 2013; HeartWare, Incorporated, 2013) . Patients and caregivers are trained on care and maintenance of the equipment in addition to driveline care. Classes are attended prior to a scheduled device implant when possible. When the patient is transferred to the Cardiothoracic Surgery Progressive Care Unit, classes are resumed in a group setting two to three times a week. Education is reinforced by nurses providing care on a daily basis. Patients and caregivers must pass a written and demonstrative test that covers daily care and emergency procedures prior to discharge to home.

Destination therapy. Mechanical circulatory support may also be used as destination therapy (DT) for patients who are not candidates for transplant such as those with advanced age, history of cancer, increased body mass index, or otherwise ineligible. Patients receiving MCS for DT live the rest of their days with the device (Yancy et al., 2013). Medicare has provided coverage for MCS devices as DT since 2003. Patients must meet qualifications including: (a) failure to improve on optimized medical therapy for 45 of the last 60 days, or treatment with an intra-aortic balloon pump (IABP), or inotropic therapy for greater than seven days; and (b) an

ejection fraction of less than 25% (normal is 55% or greater); and (c) a peak oxygen consumption level of $\leq$ 14 ml/kg/min unless on an IABP or inotropic therapy or unable to physically perform the test (Centers for Medicare and Medicaid, 2013).

Patients with advanced HF are increasingly choosing to live longer through mechanical support. Survival data of patients with currently available continuous flow left ventricular assist devices is limited. The Food and Drug Administration (FDA) approved the Heart Mate II as a BTT therapy six years ago in April, 2008 and as DT in January, 2010 (Thoratec Incorporated, 2013). The Heart Ware Ventricular Assist Device was FDA approved in November, 2012 and is currently in clinical trials for destination therapy approval (HeartWare Incorporated, 2013). The Interagency Registry for Mechanically Assisted Circulatory Support (INTERMACS) is sponsored by the National Heart, Lung, and Blood Institute in partnership with the FDA, and CMS. Prospective data collection began on June 23, 2006, and outcome data is published providing foci for future research and identification of device complications (Kirklin et al., 2013).

Over 9,300 patients received MCS from 2008 to 2013. Overall survival is reported at 80% at one year, 69% at two years, 59% at three years and 47% at four years. Patients receiving mechanical circulatory support for destination therapy had slightly lower survival with one year survival 75% and 50% at three years (Kirklin et al., 2014).

Implications related to mechanical circulatory support decisions. Heart failure is a chronic disease. Mechanical circulatory support may provide some relief from symptoms however it is not without risk. The cost is more than financial. It can be stressful emotionally as families are dealing with acute illness, prolonged hospitalizations and significant life changes. Extensive time is required in managing the technology and medical management. Hallas,

Banner, and Wray (2009) in their qualitative study, identified perceived control as a theme for all mechanical circulatory support patients. Subcategories of normality, uncertainty and emotional state were also noted. Patients were constantly working to control their uncertain environment to find a state of normality.

"Success" for the device population is very individualized. While one patient may be content with being alive to see a grandchild graduate even though they are wheelchair bound, another patient may expect they will exceed their previous level of exercise and return to work full-time. The expectations of patients and their caregivers will ultimately define "success". The process and time from HF to mechanical circulatory support may occur rapidly as a result of an acute myocardial infarction and loss of heart function or over an extended period of time as in chronic HF.

Heart Failure Readmission

Patients are living longer on mechanical circulatory support increasing the chance of developing complications. Readmissions among HF patients including mechanical circulatory support patients have been show to increase mortality (Figure 6) (Yancy et al., 2013; Smedira et al., 2013). Hospital readmissions cost Medicare $17.4 billion a year of which HF patients have the highest readmission rate (Jencks et al., 2009). Greater than 50% of patients admitted with a HF diagnosis will be readmitted within six months of discharge. Approximately 24% will be readmitted within 30 days (Desai & Stevenson, 2012). A goal of Healthy People 2020 is to reduce hospitalizations of patients age 65 and older for HF (U.S. Department of Health and Human Services, 2010). This is also a national priority as part of the Affordable Care Act Hospital Readmission Reduction Program to reduce readmissions from Acute Myocardial Infarction, Pneumonia and Heart Failure which was implemented in October, 2012, (Centers for

Medicare and Medicaid, 2013). Heart failure patients are frequently readmitted to the hospital for (a) medical complications such as hypervolemia, arrhythmias and infections; (b) environmental situations such as absent caregiver support; and (c) behavioral components such as non-adherence to prescribed therapies and dietary indiscretions (Hodges, 2009). An analysis of hospital readmissions for HF determined 20% – 30% as preventable (Ryan et al., 2013).

In the mechanical circulatory support population, re-hospitalization has been found to occur most frequently for (a) co-morbid and cardiovascular disease management; (b) psychosocial support; (c) infection (d) device malfunction; (e) sub-therapeutic anticoagulation; and (e) bleeding (Forest et al., 2013; Hasin et al., 2013; Raasch et al., 2012; Smidera et al., 2013). Common readmission factors for heart failure are experienced in addition to issues related to the device or required anticoagulation.

Interventions to decrease frequency of readmissions that have been successful in the HF population include telephonic follow-up post hospital discharge. Dungan et al., (2005) showed follow-up three days post discharge and weekly for two weeks had an effect lasting six months but not one year. Murray et al. (2009) used a multidisciplinary approach with a Clinical Nurse Specialist (CNS) meeting with patients to provide education prior to implant, during hospital stay and called the patient at home, however the frequency was not stated. A 7 % readmission rate was noted in the multidisciplinary approach versus 17% who received usual care (Murray et al., 2009). Stone (2009) in her doctoral dissertation used weekly telephone calls to HF patients for six weeks with statistically significant improvement in management and awareness of symptoms. However, Stamp (2011) performed a literature review more specific to women and HF education to find no strong evidence that nurse-led education improved outcomes for women.

There are limited articles related to interventions specifically in the mechanical circulatory support population for decreasing readmissions. Only two of the twelve articles described interventions which included telephone follow-up and an interdisciplinary approach. Although there are articles related to HF and mechanical circulatory support patients have HF, there are individualized needs of the mechanical circulatory support patient related to device infection and malfunction potential.

Another area requiring additional research includes the psychosocial factors affecting readmission and relationship to HRQOL. Rosenberger, Fox, DiMartini and Dew (2012) also identified the need for intervention focused research to be done in this population related to psychosocial factors. Kugler, et al. (2011) reviewed factors affecting HRQOL in 27 mechanical circulatory support patients but larger studies are needed. Caregiver role and quality of life is another area identified for further study.

Summary

In summary, the literature suggests that the HF population including patients with mechanical circulatory support is at high risk for hospital readmission (Forest et al., 2013; Hasin et al., 2013; Raasch et al., 2012; Smidera et al., 2013). Nursing interventions specific to the mechanical circulatory support population require additional investigation to determine which methods will prove to be effective to decrease the readmission rate.

Methods

Project Question

Does preemptive advanced clinical management through telephone follow-up of the mechanical circulatory support population with a left ventricular assist device for bridge to

transplant or destination therapy decrease the 30-day hospital readmission rate compared to the same time period in 2013?

Theoretical Framework

The Situation-Specific Theory of HF Self-Care will be applied to this project (Figure 9). As stated previously, Hallas, Banner and Wray (2009), identified perceived control as a universal theme for all the mechanical circulatory support patients interviewed. Self-care promotes autonomy leading to a sense of control over health status and wellbeing. Nurse guidance provided through partnering with patients to assist them in monitoring for signs and symptoms of adverse events and promoting wellness by taking an active role in medication and disease management is within the scope of the CNS Doctorate CNS Competencies.

For example, a patient who noticed increased shortness of breath would recognize the inability to complete tasks previously accomplished without symptoms. Next, a comparison of weight this morning and earlier in the week would identify a weight gain of five pounds compared to a week ago. As previously instructed, a call would be made to the provider/APRN for guidance on treatment. After being instructed to take an extra dose of furosemide, the effectiveness of the treatment would be evaluated by continued weight and symptom monitoring. The patient during this process would be building self confidence to maintain and manage their heart failure.

Patients in the mechanical circulatory support population frequently are readmitted to the hospital. Empowering patients to recognize a change in their health condition may prevent these readmissions. This can only be accomplished through education of their condition by an expert. Patients with HF need multiple components to be successful in self-care. Previous experience with HF contributes to better management. According to Riegel & Vaughan Dickson, (2008),

patients acquire this skill after approximately two months. This may contribute to the high readmission rate within 30-days of a hospital discharge. Without the previous experience it can be difficult to recognize symptoms. Patients without adequate knowledge were shown to have less ability to manage their symptoms. Patients must also value the choices they are making to be beneficial to their ultimate goals. Negative perceptions were associated with lower self-care. Confidence in the ability for self-care was also associated with lower inpatient hospital costs (Riegel & Vaughan Dickson, 2008). Formal evaluation of self-confidence was not evaluated however,

This project relied on self-reporting of patient symptoms to provide education and referral. The Situation-Specific Theory of HF Self-Care was utilized to optimize patient outcomes through CNS mentoring of patients to promote self-care.

Hypothesis

The hypothesis is intense intervention through phone follow-up post inpatient mechanical circulatory support discharge will have a measurable effect on the 30-day readmission rate. Early identification of risk factors for readmission, if addressed quickly, is expected to promote outpatient treatment.

Definition of Terms

Days to readmission or death. For all mechanical circulatory support patients discharged after August 15, 2014, and followed until November 15, 2014, days to readmission or death were tracked using the electronic health record (EHR) during the 30-day period following their discharge. For patients discharged and readmitted within the August 15 through November 15 timeframe, the second discharge date began another 30-day monitoring period. Patients

readmitted during the designated time frame for heart transplant from mechanical circulatory support device were excluded.

30-day readmission rate. A 30-day readmission rate for the 90-day period was calculated by dividing the number of mechanical circulatory support patients readmitted within 30-days of discharge by the total number of mechanical circulatory support patients discharged during the 90-day period.

Interventions. The number and type of interventions/referrals identified from the phone calls were recorded using an Excel database. Interventions include, patient education on topics related to frequent causes of readmissions such as anticoagulation, signs and symptoms of bleeding, HF and stroke symptoms and device malfunction (Appendix A). Telephone interaction was documented as a clinical communication in the electronic medical record.

Hopeful Hearts Support Group. Hopeful Hearts is a support group for mechanical circulatory support/cardiac transplant patients that gathers weekly for one hour on the Cardiothoracic Surgical Progressive Care unit. Patients after discharge were invited to participate, providing an additional opportunity for face-to-face contact. This was analyzed to identify potential confounding effects of the telephone intervention as well as to encourage participation in the group.

Description of the Population

The sample eligible to participate in this performance improvement project included advanced HF patients managed at a large, urban, academic medical center in the mid-Atlantic region with a Heart Mate II or HeartWare and discharged August 15 to October 15, 2014. Patients with a Total Artificial Heart (TAH) were excluded in this project due to the unique characteristics of biventricular versus left ventricular support. TAH patients do not have a native

heart and therefore do not experience arrhythmias, myocardial infarction and right sided heart failure that LVAD/HVAD patient's experience which may affect accuracy of results.

As of August, 2014, there were 77 patients being following with mechanical circulatory support.

Protection of Human Subjects

Institutional Review Board (IRB) approval was obtained from the organization. Follow-up phone calls were implemented as the standard of care for this performance improvement requirement. A waiver of consent was obtained through the IRB. An information sheet was provided to patients explaining the project and providing them an option to decline participation in the performance improvement project (Appendix B).

Setting

A large urban, academic medical center in the mid-Atlantic region was the site for data collection. Patients discharged from Cardiothoracic Surgery Progressive Care (CSPCU) or Cardiothoracic Surgery Intensive Care Unit (CSICU) participated in this performance improvement project. The organization averages approximately 50 Heart Mate II/HeartWare devices annually (VCUMC, 2014).

Procedures

Information on patients scheduled for implant was obtained from the Heart Failure/Transplant Team. Patients were followed using the electronic medical record and communication with the team for anticipated discharge date. Data was collected using a secure data based. The patient was informed of the follow-up calls in addition to clinic appointments (Appendix B). Per standard of care, patients continued to call the VAD coordinator on call for any medical questions or concerns. Patients were contacted in person prior to discharge to provide notification of enhanced follow-up through a combination of modalities. Telephone

contact occurred on days 1-2, 7, 14, 21 and 28. Early intervention of identified issues was referred to the appropriate provider and/or education provided to decrease unplanned hospital readmission. Patients were offered the opportunity to participate in the Hopeful Heart Support Group for mechanical circulatory support/transplant patients/families which meets weekly. Education on anticoagulation or drive-line care or other identified needs were addressed and documented in the Cerner Electronic Medical Record along with results from the call (Figure 9).

In addition, understanding of device and maintenance; medications including anticoagulation; and worsening of HF symptoms was assessed (Appendix A).

Measures

Demographics. Demographic data collected and analyzed included age, gender, device implanted, date of device implant, indication for device implant and BTT or DT indication.

Days to readmission or death. Data was obtained from biweekly transplant team rounds, VAD coordinators, CSICU and CSPCU unit census and review of the EMR. Results were evaluated and analyzed.

Interventions and referrals. The number and type of interventions and referrals identified from the phone calls were recorded in an Excel database at each phone call in addition to the EMR.

Participation in Hopeful Hearts support group. Assessment during each telephone call was documented and marked as a simple yes/no in the Excel database. Patients were asked to identify barriers to attendance to assist with facilitation of program development.

Reliability. The data from the Electronic Medical Record (EMR) was extracted by an expert in EMR data management. Data was analyzed and verified by the project director to ensure reliable data for calculated readmission rates.

Reliability may be biased based on patients self-report in response to questions as well as possible interviewer bias. There is a potential for inaccuracy if the questions are not followed in a structured procedure. To minimize this bias, the telephone protocol was followed as closely as possible and any deviation from the protocol was noted in the Excel database. The telephone call protocol was tested at least twice (project director and other nurse expert) before the first call to a patient was made.

Results

Readmission results

The 30-day readmission rate for the sample was calculated by taking the total number of mechanical circulatory support patient readmissions within 30 days during the study timeframe and dividing this number by the total number of mechanical circulatory support patients discharged during the study timeframe. The readmission rate for the study timeframe was 27%.

Telephone Follow-Up Results

Ten out of eleven patients reported symptoms during their calls. In the preemptive group, ten of the eleven patients reported symptoms during the follow up phone calls. Five of the eleven reported shortness of breath, three reported weight gain, three reported bleeding, another three described driveline drainage, one had equipment problems with the battery charger, one with had visual disturbances, and one reported an unsteady gait. All patients received education specific to their reported symptoms and the symptoms were reported to the VAD coordinators. As a result of the interventions, an INR goal was changed and aspirin discontinued based on reported bleeding in one patient and coordination with the team of care provided by several specialists was facilitated. Three patients had their wives also participate and one patient had her daughter participate with the calls allowing for their caregivers to express concerns and ask questions. One

patient was sent a form to request medical records be sent to an outside specialist and another patient was mailed a symptom log to promote self-care maintenance.

Patients comments in response to the calls included, "I feel loved and you care", "enjoyed the calls", "very helpful". "very informative", "felt supported", "I don't mind if you keep calling to check in on me" and "helpful".

Discussion

Impact on Readmissions

Avoiding preventable hospitalizations is a national goal. Various initiatives have been implemented through national organizations including the Institute of Healthcare Improvement (IHI) - State Action of Avoidable Readmissions (STAAR), American College of Cardiology - Health to Home (H2H), and Medicare to decrease preventable hospitalizations. Up to 76% of Medicare rehospitalizations have been reported as being potentially avoidable. (Hackbarth, Reischauer & Miller, 2007).

The sooner a potential health issue is identified, the sooner it can be treated therefore decreasing the likelihood an acute hospital stay will be required. Collaboration with an interdisciplinary team and patient and family/caregiver engagement is critical. This project provided support for the transition between hospital and home. Standardization of the process to follow-up patients can contribute to a highly reliable system. This project supported the goal of a telephone call within 48 hours as identified by IHI for all patients discharged regardless of risk of being readmitted (Sevin et al., 2013). Heart failure patients with mechanical circulatory support are at high risk for readmissions based on the complexities of their chronic disease and comorbities. Outcomes from this project included preemptive identification of symptoms to be addressed and managed in the outpatient setting versus rehospitalization. Over the last year, care of the mechanical circulatory support patients was transitioned after the initial surgery to the

heart failure cardiology team in collaboration with the cardiac surgery team with a focus on managing HF and other symptoms. Potential issues identified such as weight gain were addressed by the VAD coordinators and interdisciplinary team quickly allowing changes in treatment and follow-up as necessary.

Hasin et al. (2013) reported association between time on device and readmission. Forest et al. (2013) had a similar finding except for a lack of correlation with the 30-day readmission. The preemptive group had been on their devices longer however did not get readmitted more frequently. The comparative group was exclusively readmitted for heart failure/cardiac symptoms while the preemptive group was readmitted for infection and device thrombosis (Hasin et al., 2013, Smedira et al., 2013, Patel, Cowger & Zuckermann, 2014, Khazanie et al., 2014). In the preemptive group, two of the three patients were readmitted for a worsening of their original admitting diagnosis – pump thrombosis and chronic infection. These conditions were being treated medically and were not related to patient non-adherence. The final patient was readmitted for a driveline infection and had not shown symptoms during the previous hospitalization or at home until the day of admission.

Impact on Self-Care

Telephonic follow-up provided interactive encounters to promote collaboration with the patient/family and self-care. Support provided by the CNS in collaboration with the interdisciplinary team was an intricate part of this project. A systematic review of qualitative healthcare literature related to professional interaction and self-care in heart failure patients identified critical components including accessibility, listening, respect and collaboration as essential in the success of patient self-care (Currie et al., 2014). This project fostered the essential components for successful support of self-care. Facilitation of self-care begins with the

relationship between the health professional and patient/caregiver. An active partnership was developed through these interactions and began in the hospital setting therefore enhancing the continuity of care. Patients received frequent calls with a structured approach focusing on frequent reasons for readmission in the mechanical circulatory support population. Education was provided on identification of potential complications in addition to actions necessary. Active listening of patient concerns and information sharing with the interdisciplinary team contributed to promotion of self-care. The patient was reminded a VAD coordinator was on call 24 hours a day and accessible day or night to address concerns. Patients were reminded not to delay care or concerns based on "office hours".

Strengths and Limitations

Strengths

Strengths include an accessible population of mechanical circulatory support patients for intervention. Patients are known to the project manager who is the Nurse Clinician on the Cardiothoracic Surgery Progressive Care Unit where the mechanical circulatory support patients are cared for. This project provided psychosocial support for patients and their family members with a minimal cost. Support was given for this project by the interdisciplinary cardiac transplant team (Appendix C). Interventions identified were shown effective in the HF population.

Limitations

Limitations include the complexities of mechanical circulatory support patients and vast reasons for readmission, some of which are unavoided such as cardiac arrhythmias or device malfunction. Self-bias from patient reporting may provide inaccurate results for analyzing the need for further intervention. Samartzis et al., (2013), identified face-to-face interactions improved quality of life more than telephone interactions. In this project telephone interventions

were used in addition to usual care of clinic visits therefore enhancing the face-to-face interactions during clinic visits.

A formalized tool to evaluate self-care was not used and may be an area for future study in this population.

Patients in the preemptive group were offered additional support by attending the Hopeful Hearts Support Group held at the hospital on a weekly basis. Face-to-face interactions were noted as more efficacious than telephonic follow-up as previously discussed. None of the patients returned for the support group with reasoning of time, distance and transportation influencing their decision not to come. This information will used to enhance the program with consideration of a quarterly group meeting outside the hospital for outpatient support.

Nursing Practice Implications

Hospital readmission of patients with HF and mechanical circulatory support, increases mortality and causes financial burden to patients and healthcare systems (Smedira et al., 2013, Khazanie et al., 2014). Patient education by nurses has been shown to decrease hospital readmissions (Boyde, Turner, Thompson & Stewart ,2011). Nurses are capable of providing comprehensive care to this population including identification of risk factors for readmission and early interventions. Intensive post discharge follow-up has been show to decrease readmissions in the heart failure population (Brown & Gottleib, 2012).

The mean cost to Medicare for inpatient acute care follow-up in the year following mechanic circulatory support implant per patient was $40,217 (SD: $57,242) (Khazanie et al., 2014). The cost savings for even one hospitalization would account for the program utilization. An average telephonic follow-up call lasted twenty minutes. The approximate cost per phone call is $15.00. Each patient required five phone calls in the current model totaling $75.00.

Extrapolated out to approximately 50 patients a year would total $3,750 a year. Utilization of resources to provide preemptive advanced clinical management through telephone contact is a positive return on investment.

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Table 1.

Review of the Literature

Author	Device	Number	Results	Recommendations/ Interventions/Conclusion
Drews et al., 2011	First generation (pulsatile) Second generation (non-pulsatile) Third generation (non-pulsatile) 12 devices	87 first generation 43 second generation 68 third generation 198 total	Re-hospitalizations occurred in all groups of patients. Coagulation disorder (INR not in range) 0.39 readmissions/patient/year 0.1 patients/year gastrointestinal bleeding 0.021 epistaxis patients/year Wound Infection (driveline site) 0.33 readmissions/patient/year 62% in 1 year post implant Technical Failure (thrombus, device failure, cannula damage, broken	2.8 re-hospitalizations/patient/year were needed to manage coagulation disorders (bleeding and embolic), driveline infections and technical failures.

			driveline) 0.22 readmissions/patient/year 32% with technical failure Cerebral Embolism 0.17 readmissions/patient/year 10% stroke 1% ischemic neurologic deficit 14% transient ischemic attack	
Drews, Stepanenko, Dandel, Buz, Lehmkuhl & Hetzer, 2010	First generation (pulsatile) Second generation (non-pulsatile)	64 first generation 110 second generation Over age 60	Readmission comparable between pulsatile and non-pulsatile. 2.8 per patient per year, 3.6 per patient per year respectively. Reasons: anticoagulation disorders, infections, non-cardiac management.	
Forest et al., 2013	Continuous flow devices	71 patients Heart Mate II (n=58) HeartWare	155 readmissions for 56 patients (79%) Readmission rate 2.46 per LVAD year	Decrease readmission in HF for outpatient HF clinics, dedicated nurse educators and telephone follow-up. Time on device predictive of readmission except 30-day readmission

		(n=9) Ventrassist (n=4)	Average length of stay for first readmission is 5 days. 41% for bleeding and infection. Few related to device malfunction.	
Hasin et al., 2013	Heart Mate II	115 patients 42 transplanted	83 patients with 224 readmissions Follow-up1.4 $\pm$ 0.9 years Rate 1.64 $\pm$ 1.97 per patient-year of follow-up Initial 6 months 2.0 $\pm$ 2.3 to 1.2 $\pm$ 2.1 per patient-year of follow-up after 6 months. Bleeding (66 readmissions in 34 patients) Gastrointestinal bleeding (51 readmissions in 27 patients) Cardiac - HF or arrhythmia (51readmissions in 36) 6 pump related	Fewer readmissions noted with higher B-type natriuretic peptide on admission and higher hemoglobin pre-device implant. Follow-up post device: monthly clinic visits for first 3 months then every 3 months for the first year. Second year visits are every 4 months, and 6 months thereafter. Telephone support 24/7 from VAD coordinator. Occasional staff initiated follow-up calls. Lower readmission associated with shorter time on device, younger, non-ischemic cardiomyopathy and bridge to transplant. Living further away from implanting center was associated with more readmissions.

			Thrombosis (20 readmissions in 15 patients) Hemolysis – 13 readmissions 28% not readmitted 29% 1 readmission 15% 2 readmissions 29% > 2 readmissions Medicare readmissions 55.6% in 6 months 22% readmission at 1 month 65% readmission at 6 months	
Khazanie et al., 2014	Not specified	2507 Medicare patients	1 year readmission rates not changed between 2006 (81.8%) and 2011 (81.1%). Cardiovascular readmissions 2006 (51.0%) and 2011 (42.6%) Mean readmissions the year following VAD implant 2.0 days (SD: 2.1 days)	Center volume correlates with mortality but not readmissions.

			Readmission reasons, infection (pump pocket and driveline), bleeding, thrombosis, HF, arrhythmias and bleeding. Mean cost inpatient care at 1 year post VAD $38, 469 (SD: $57,258)	
Kirklin et al., 2013	Continuous Flow Intracorporeal LVAD Pump Pulsatile Flow Intracorporeal TAH Pulsatile Flow Intracorporeal LVAD Pump Pulsatile Flow Paracorporeal LVAD Pump	6,885 patients	Adverse Events Neurologic Events 11% at 1 year, 17% at 2 years Device malfunction leading to replacement or death , 5% at 1 yr, 10% at 2 years. MCS complications (stroke, bleeding, driveline infection, device malfunction) 70% at 1 year 1 year survival 80% and 70% at 2 year. 30% of patients transplanted off of VADs	

			Improved Quality of Life using EQ5D in Self Care, Usual Activities and Visual Analog Scale compared to pre-device implant. Improvement increased at 3, 6 and maintained at 12 months.	
Milano & Simeone, 2013	Heart Mate XVE Heart Mate II Micromed DeBakey HeartAssist 5 LVAD HeartWare DuraHeart Syncardia TAH	Review of devices	Complications of devices: Infections – Estimated 15-20%. Increases mortality. Bleeding – HeartMate II postoperative (15.6%), gastrointestinal (25-55%), gingival and nasal bleeding Thrombotic events – ischemic stroke Heart Mate II (6-8%) HeartWare (7.2%) Pump thrombosis HeartMate II (4%) HeartWare (4.4%) Hemolysis – considered rare.	Review of complications. No readmission data available.

			Right ventricular failure post device implant HeartMate II (24%), HeartWare (20%) Tricuspid regurgitation if not corrected can increase right ventricular support. Aortic regurgitation may increase with time on device. Ventricular arrhythmias affect right side of the heart and possible internal defibrillation firing.	
Murray et al., 2008	HeartMate XVE Thoratec P-VAD MicroMed Debakey LVAS	20 patients n=7 traditional group n=13 multidisciplinary team	Randomized to 2 groups: traditional single service and multidisciplinary teams. Preoperative teaching prior to implant if able. Rounding occurred 3 times a week with multidisciplinary team Traditional preoperative	Shorter length of stay did not increase readmissions.

			length of stay (LOS) longer than multidisciplinary team 21 versus 2 days. Education started day 1. Using 1:1 education, binder and CD-ROM. Continued as outpatient. Call from CNS to local hospital and local emergency response of anticipated discharge date. Referral to physical therapy and cardiac rehabilitation starting post operative day 1. Cardiac rehabilitation started prior to discharge for 1 to 2 visits. Nutritional assessment starting on post operative day 1. Post discharge stay in local hotel if greater than 30 minutes from the hospital. Traditional stay	

			up to 2 weeks. Multidisciplinary, less than 1 week. CNS call to patient when home to answer questions and assess patient status. 30-day readmission for traditional 71% (5/7) Multidisciplinary 7% (1/13) Reason for readmission Traditional - driveline infection, sepsis, right ventricular failure, dehydration, malnutrition and electrolyte management Multidisciplinary – driveline infection	
Smedira et al., 2013	Heart Mate II	48 patients	87 non-LVAD readmissions medical management (n=48) psychosocial (n=22) infections (n=17) 90 LVAD readmissions Device/driveline infection (n=51) Non-therapeutic	Pre-device evaluation of psychosocial factors, support, home. Device teaching and self-care education prior to implant. Weekly clinic visits with echocardiography, labs, examination and social work visit. Cardiac rehabilitation Contact via telephone for anticoagulation follow-up. Progression to monthly and bimonthly visits.

			anticoagulation/device malfunction (n=22) Bleeding (n=15) Increased readmission = increased mortality	

Table 2

Comparison of ACCF/AHA Stages of HF and NYHA Functional Classifications.

ACCF/AHA Stages of HF (38)		NYHA Functional Classification (46)	
A	At high risk for HF but without structural heart disease or symptoms of HF	None	
B	Structural heart disease but without signs or symptoms of HF	I	No limitation of physical activity. Ordinary physical activity does not cause symptoms of HF.
C	Structural heart disease with prior or current symptoms of HF	I	No limitation of physical activity. Ordinary physical activity does not cause symptoms of HF.
		II	Slight limitation of physical activity. Comfortable at rest, but ordinary physical activity results in symptoms of HF.
		III	Marked limitation of physical activity. Comfortable at rest, but less than ordinary activity causes symptoms of HF.
		IV	Unable to carry on any physical activity without symptoms of HF, or symptoms of HF at rest.
D	Refractory HF requiring specialized interventions	IV	Unable to carry on any physical activity without symptoms of HF, or symptoms of HF at rest.

ACCF indicates American College of Cardiology Foundation; AHA, American Heart Association; HF, heart failure; and NYHA, New York Heart Association.

Yancy, C. W., Jessup, M., Bozkurt, B., Butler, J., Casey Jr., D. E., Drazner, M. H., . . . Wilkoff, B. L. (2013). 2013 ACCF/AHA guideline for the management of heart failure: A report of the American College of Cardiology Foundation/American Heart Association Task Force on practice guidelines. *Journal of the American College of Cardiology, 62*(16), e147-e239. doi:http://dx.doi.org.proxy.its.virginia.edu/10.1016/j.jacc.2013.05.019 . Used with permission.

Table 3

Wait time for cardiac transplant based on blood type in the United States and Virginia.

		All ABO	O	A	B	AB
Heart	All Time	3,912	2,123	1,271	429	89
	< 30 Days	348	149	142	43	14
	30 to < 90 Days	531	260	193	61	17
	90 Days to < 6 Months	508	274	154	68	12
	6 Months to < 1 Year	739	392	241	80	26
	1 Year to < 2 Years	783	448	233	91	11
	2 Years to < 3 Years	364	229	104	28	3
	3 Years to < 5 Years	379	214	132	31	2
	5 or More Years	270	163	76	27	4
	Virginia	All ABO O A B AB	O	A	B	AB
Heart	All Time	182	108	54	18	2
	< 30 Days	9	4	4	1	0
	30 to < 90 Days	23	9	10	2	2
	90 Days to < 6 Months	14	8	4	2	0
	6 Months to < 1 Year	34	20	10	4	0
	1 Year to < 2 Years	44	26	13	5	0
	2 Years to < 3 Years	26	19	4	3	0
	3 Years to < 5 Years	26	17	8	1	0

Colvin-Adams, M., Smithy, J. M., Heubner, B. M., Skeans, M. A., Edwards, L. B., Waller, C., . . . Kasiske, B. L. (2014). OPTN/SRTR 2012 annual data report: Heart. *American Journal of Transplantation, 14*(S1), 113-138. doi:10.1111/ajt.12583

Table 4
Comparative Versus Preemptive Group Descriptions

Data elements LVAD/HVAD	08/15-10/15/2013 Comparative Group N = 64		08/15-10/15/2014 Preemptive Group N = 77	
	n	%	*n*	%
Number discharged within date	13	20	11	14
Index admission	2	15	2	18
Gender				
Male		54	6	55
Female		46		45
Age in years				
Average	49.07692		59.54545	
Median	51		59	
Standard Deviation	14.49978		11.26378	
Device	*n*	%	*n*	%
Heart Mate II	12	92	9	82
HeartWare	1	8	2	18
Indication				
Bridge to transplant	7	54	9	82
Destination therapy	6	46	2	18
Readmissions	5	38.5	3	27.2
Reason for readmission				
Abdominal pain/driveline infection	0	0	1	33
Fever/infection	0	0	1	33
HF symptoms/cardiac	5	100	0	0
Pump thrombosis	0	0	1	33
Days from Discharge to Readmission				
Average	13.6		15.7	
Range	1-21		10-24	

Table 4. Data of comparative group versus preemptive group. From Virginia Commonwealth University data, 2014.

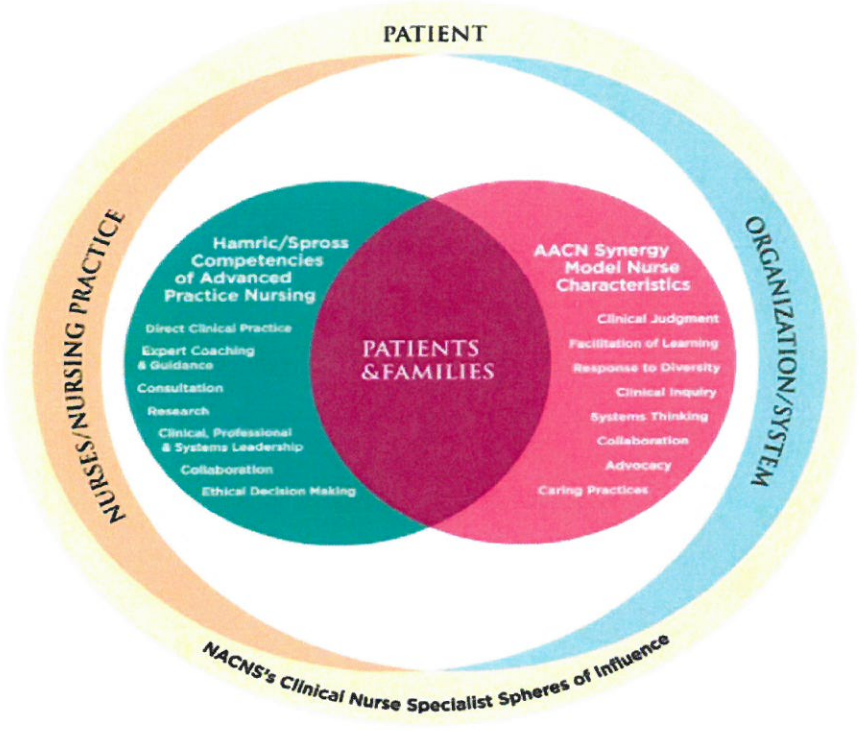


Figure 1. Model depicting organizational framework for Clinical Nurse Specialist competencies. From "Clinical Nurse Specialist Core Competencies: Executive Summary". National Association of Clinical Nurse Specialists." 2010, Copyright 2010 by the National CNS Competency Task Force.

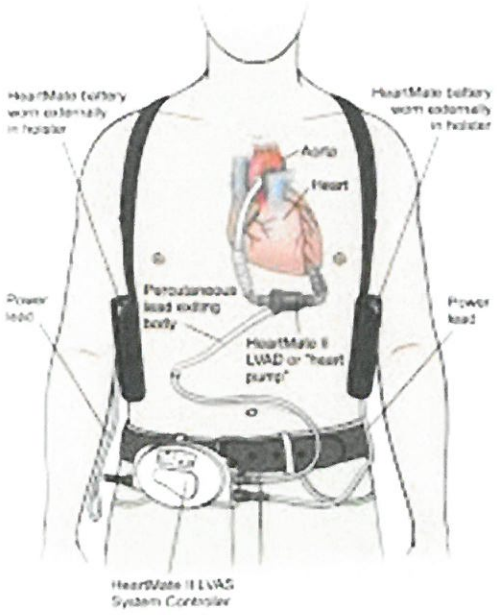


Figure 2. Heart Mate II system components. "Instructions for use." Thoratec Corporation (2013). Retrieved from http://www.thoratec.com/_assets/download-tracker/106020_E_-_HeartMate_II_Pocket_IFU_NA.pdf

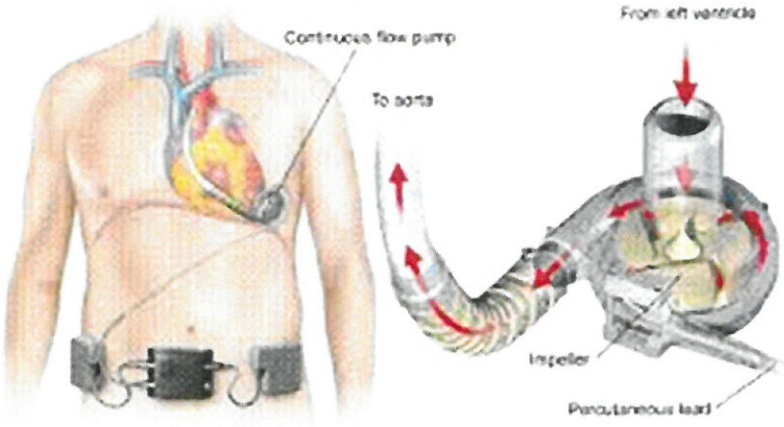


Figure 3. HeartWare assist device components. "HeartWare Ventricular Assist Device instructions for use". HeartWare Incorporated (2013). Retrieved from http://www.worldheart.com/sites/default/files/uploads/resources/ifu00001_rev17_hvasinstructionsforuse_us.pdf/

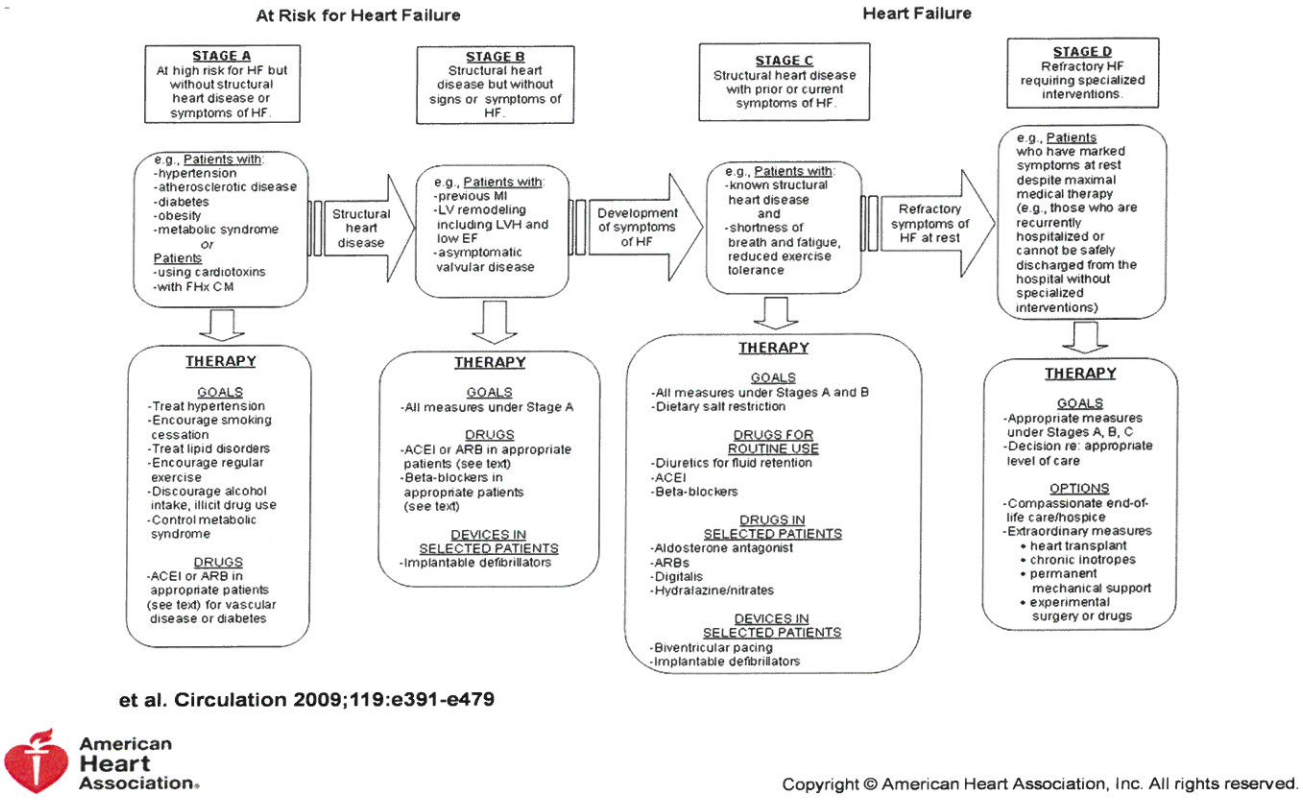
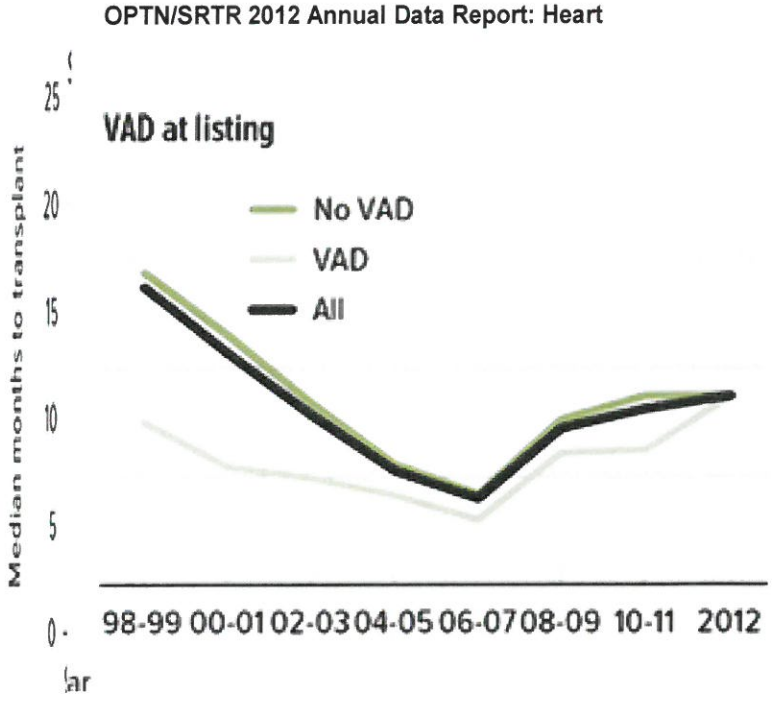


Figure 4. Jessup, M., Abraham, W. T., Casey, D. E., Feldman, A. M., Francis, G. S., Ganiats, T. G., . . . Yancy, C. W. (2009). 2009 focused update: ACCF/AHA guidelines for the diagnosis and management of heart failure in adults: A report of the American College of Cardiology Foundation/American Heart Association task force on practice guidelines developed in collaboration with the International Society for Heart and Lung Transplantation. *Journal of the American College of Cardiology, 53*(15), 1343-1382. doi:http://dx.doi.org.proxy.library.vcu.edu/10.1016/j.jacc.2008.11.009. Used with permission.



American Journal of Transplantation
pages 113-138, 28 DEC 2013 DOI: 10.1111/ajt.12583

Figure . Patients with Ventricular Assist Devices at time of cardiac transplant listing. From OPTN/SRTR. (2013). VAD at Listing. *American Journal of Transplantion, 14*(S1), 113-138. doi:10.1111/ajt.12583http://onlinelibrarywiley.com/doi/10.1111/alt.12583.10-00008

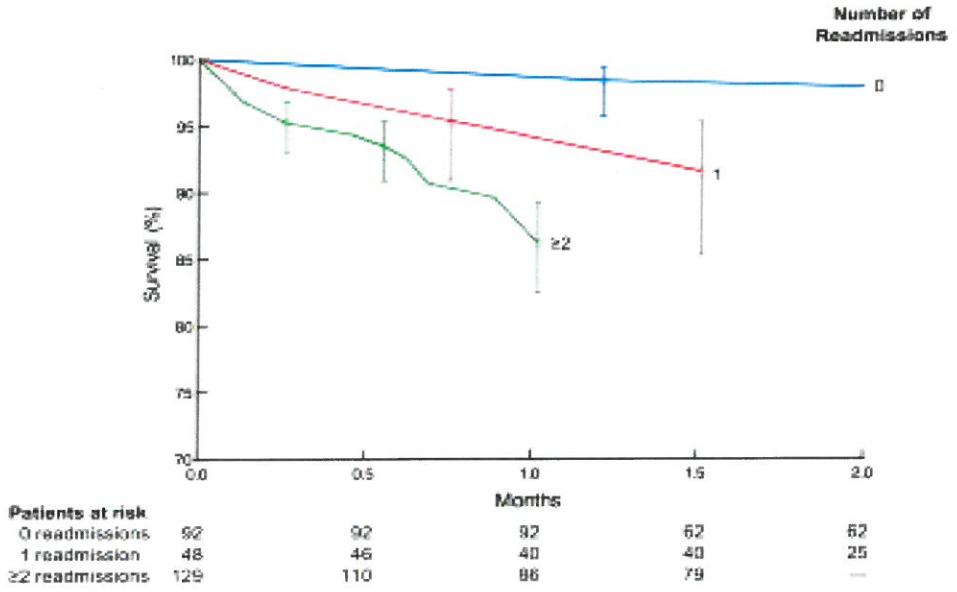


Figure 6. Conditional Survival After Each Unplanned Hospital Readmission.

From "Unplanned Hospital Readmissions After HeartMate II Implantation : Frequency, Risk Factors, and Impact on Resource Use and Survival" Smedria et al., 2013, *JACC,* Copyright 2013 by the American College of Cardiology Foundation. Reprinted with permission.

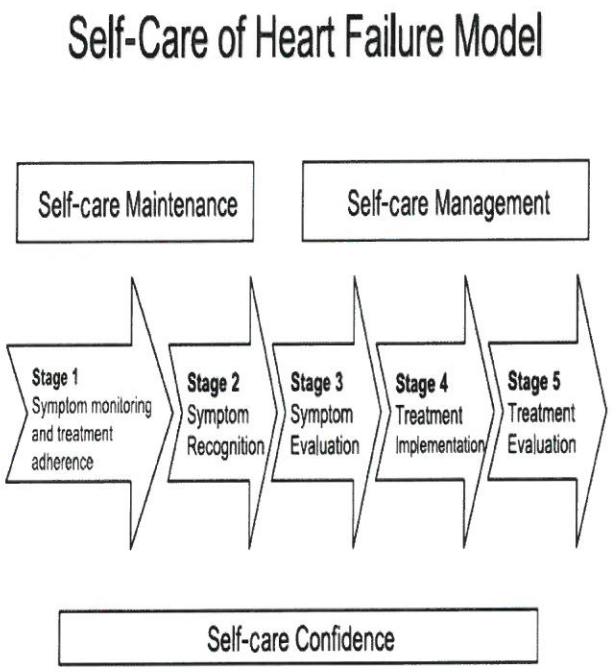


Figure 7. Self-Care of Heart Failure Model. From "A Situation-Specific Theory of Heart Failure Self-Care." Riegel, B., & Dickson, V. V. (2008). *The Journal of Cardiovascular Nursing, 23*(3), 190-196. doi:10.1097/01.JCN.0000305091.35259.85 [doi]

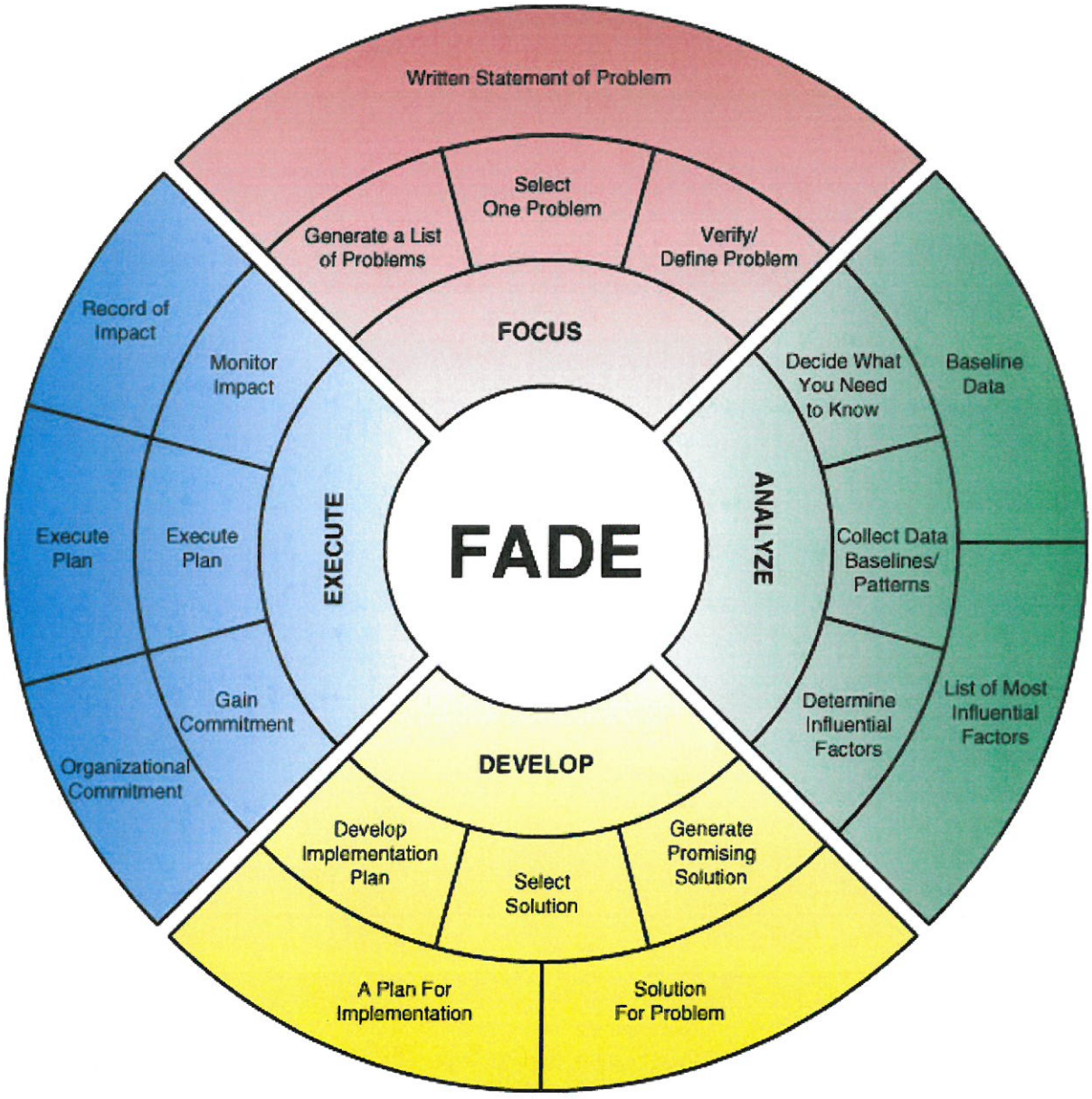


Figure 8. FADE Model of Quality Improvement. From "Methods of Quality Improvement." Retrieved from http://patientsafetyed.duhs.duke.edu/module_a/methods/fade.html.

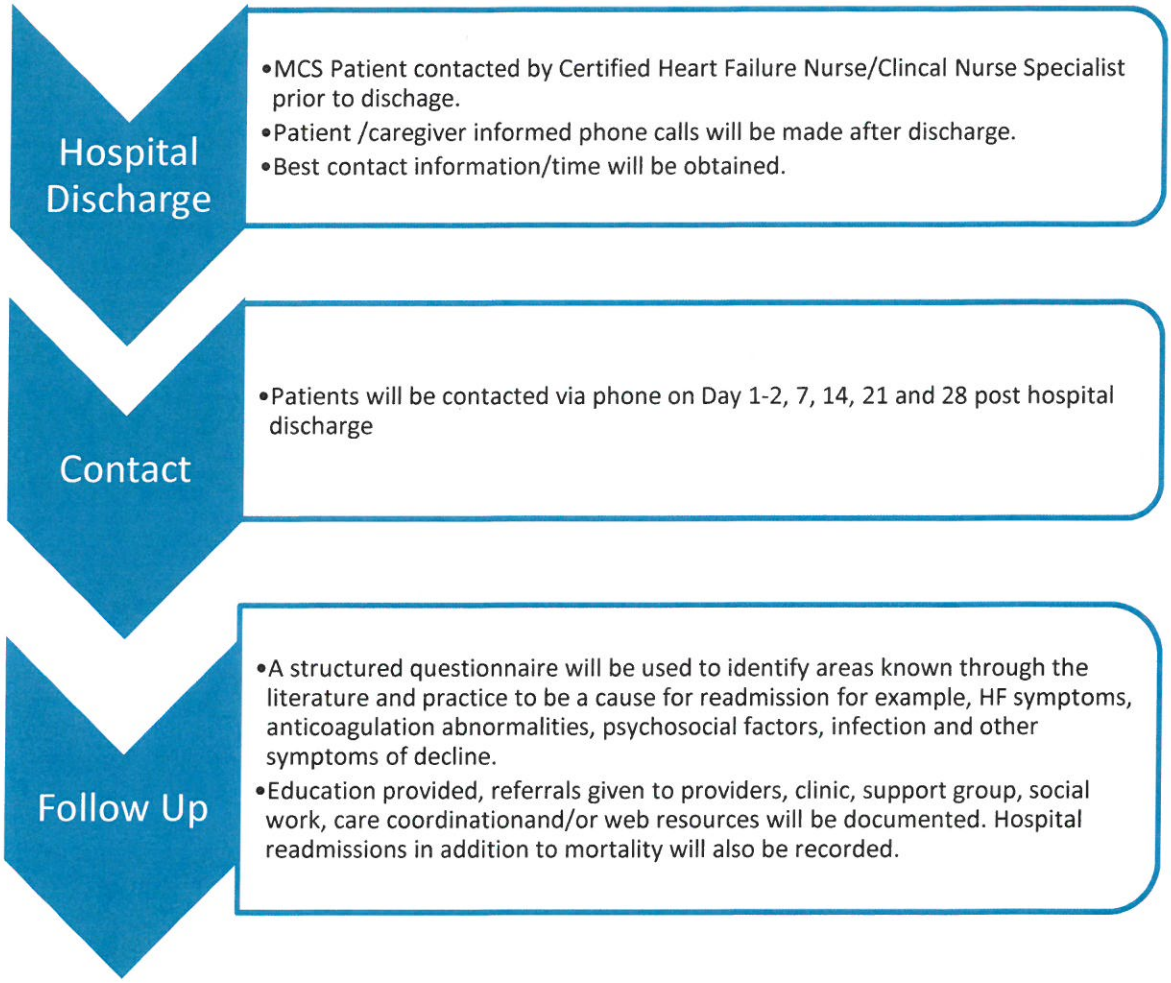


Figure 9. Preemptive advanced clinical management plan.

Appendix A

Preemptive Advanced Clinical Management of the MCS Patient

Name_____ Contact Number_____

Discharge Date_____ Interviewer ☐ Kimberly Nelson MSN, RN-BC, ACNS-BC ☐ Other_____

Device ☐ Heart Mate 2 ☐ Heart Ware

Date	Question	Response
Date_____ ☐ Day 1-2 ☐ Day 7 ☐ Day 14 ☐ Day 21 ☐ Day 28	• Have you had any Emergency Department visits or hospital admissions since your discharge on _____? • Are you experiencing any symptoms such as shortness of breath, chest pain or dizziness? If so which symptoms? • How often do you weight yourself? • What type of diet do you follow? • Do you have any signs of bleeding – bleeding gums, nose bleeds, blood in your urine or black stool? • When did you last have blood work done to check your INR? • Have you had any problems or alarms with your equipment?	☐ No ☐ Yes_____ ☐ No ☐ Yes__ _____ ☐ daily ☐ every other day ☐ weekly ☐ don't ☐ other_____ ☐ low sodium ☐ heart healthy ☐ diabetic ☐ renal ☐ none ☐ other_____ ☐ No ☐ Yes _____ ☐ No ☐ Yes_____ ☐ daily ☐ weekly ☐ Other_____

Preemptive Advanced Clinical Management of the MCS Patient

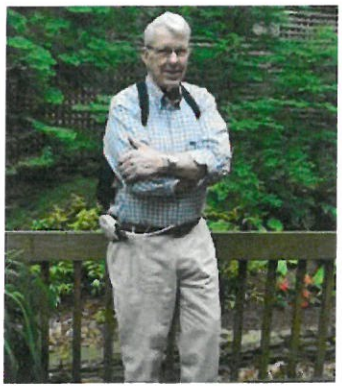
	• How frequently do you change your driveline dressing? • When was the last time you changed your driveline dressing? • Did you notice any redness, swelling, discharge or odor? • Have you had any signs of illness such as fever, cough, or other symptoms? • Are there any concerns I can address or questions I can answer for you? • Our Hopeful Hearts Support group meets weekly on Thursdays at 1:00 or other dates as scheduled. It is open to patients and their families who have been discharged from the hospital. Have you participated in the group?	_____ ☐ No ☐ Yes_____ ☐ No ☐ Yes_____ ☐ No ☐ Yes_____ _____ _____ ☐ Yes When_____ ☐ No Why not?_____ _____ _____

Preemptive Advanced Clinical Management of the MCS Patient

Referral/Education		Education Provided
	☐ VAD Coordinator ☐ Primary Care Provider ☐ Social Worker ☐ Other_____	_____ _____ _____ _____ ☐ anticoagulation ☐ signs and symptoms of infection ☐ signs and symptoms of driveline infection ☐ device education ☐ signs and symptoms of bleeding

Appendix B

VCU Pauley Heart Center



Your health is important to us!

A nurse will call you when you go home to:

- answer questions
- provide you with information
- assist you with other concerns

You will be invited to participate in our Hopeful Hearts support group.

When you go home from the hospital, you can expect the nurse to call you:

- 24-48 hours after you go home
- Once a week for 4 weeks

Please let us know when the best time to reach you is.

These calls do not replace calling 9-1-1 for an emergency, your scheduled clinic visits or calling the VAD Coordinator (804-828-0951 pager 4248) if you have a concern.

The purpose of these follow up phone calls is a performance improvement project to decrease hospital readmissions. You may choose not to participate. If you have any questions, Please call Kim Nelson MSN, RN-BC, ACNS-BC at 804-828-2131 or Jeanne Salyer PhD, RN, FNAP 804-828-3373.

Appendix C

VCU
Virginia Commonwealth University
Medical Center
In the tradition of the Medical College of Virginia

Division of Cardiology
Advanced Heart Failure Program
VCU Pauley Heart Center

West Hospital, 5th Floor, South Wing
1200 East Broad Street
P.O. Box 980204
Richmond, Virginia 23298-0204

804 828-4571
Fax: 804 828-7710
TDC: 1-800-828-1120

April 24, 2014

RE: Kimberly Nelson DNP candidate

To Whom It May Concern:

Kimberly Nelson's project as noted below is important work for our Mechanical Circulatory Assist Program. She brings a unique perspective from her current role as the Nurse Clinician for our cardiothoracic surgery team and the nursing units where these patients are cared for.

The purpose of the present project is to decrease overall 30-day hospital readmission rates for patients with MCS. The primary ways this will be done include intensive phone follow up using a standardized questionnaire addressing the most common reasons for readmission which include bleeding, infection, medication adherence and stroke (Hasin et al., 2103, Smedira et al., 2013, Patel, Cowger & Zuckermann, 2014, Khazanie et al., 2014). Identified needs will be addressed through education and/or referral to appropriate resources. Nursing education has been shown to be an effective intervention in the heart failure (HF) population to decrease hospital readmissions and improve quality of life (Kutzleb & Reiner, 2006). The desired outcomes/lessons learned will be evaluated by an analysis of the 30-day readmission rates for MCS patients as well as through an evaluation of the intensive telephone follow-up process. Intensive post discharge follow up has been show to decrease readmissions in the heart failure population (Brown & Gottleib, 2012).

Kim will be able to work with our enterprise analytics team to review data as well as validation from our electronic medical record. As the program manager for Heart Failure and Transplant I fully support her endeavors and look forward to reaping the benefits of positive outcomes.

Sincerely,

Laura Kreisa MS FNP-BC CPHQ
Program Manager, Heart Failure and Transplant
Pauley Heart Center, VCU Health System
P.O. Box 980204
West Hospital, 5th floor, South Wing, Rm 304C
Richmond, VA 23298-0204
804-828-4527

Appendix D

Author Guidelines for CriticalCareNurse

CRITICAL CARE NURSE is an official publication of the American Association of Critical-Care Nurses (AACN). Authors are invited to submit manuscripts for consideration and peer review. Clinical topics must apply directly to the care of critically and acutely ill patients and/or progressive care, telemetry, and stepdown unit patients and their families, with case presentations and clinical tips especially welcome.

Manuscripts should be submitted online via the *CCN* online manuscript submission and review system at http://www.editorialmanager.com/ccn. At the time of submission, complete contact information (postal/mail address, e-mail address, telephone and fax numbers) for the corresponding author is required. First and last names, e-mail addresses, and institutional affiliations of all coauthors also are required. (Print copies of the journal will be sent only to coauthors who provide their physical address.) Manuscripts submitted through the online system should not be submitted by mail or e-mail.

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Cover Letter—Please include a cover letter with the name, address, telephone numbers (home and work), fax number, and e-mail address of the author to whom all correspondence should be addressed.

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Manuscript Content

Title Page—The title page of a manuscript should contain the following:

- Title, which should be concise yet informative
- Authors' full names, with degrees, credentials, ranks, affiliations, and work and home addresses of all authors
- Brief (1 to 2 sentences) biography of each author
- Funding and financial disclosure
- Acknowledgments or any other statements that identify people or places related to the manuscript
- Three to 5 key words for indexing

Abstract—Abstracts must be written in the third person. Abstract categories vary as follows:

- Research or quality improvement project reports—must have structured abstracts of no more than 180 words. These abstracts should have the following subheadings: Background, Objectives, Methods, Results, Conclusions.
- All other papers, such as case reports or review papers—must have an unstructured abstract of no more than 150 words.

Articles—Feature articles are papers devoted to the mainstays of clinical practice and of interest to nearly all readers. Articles should generally not exceed 15 double-spaced typed pages, excluding abstract, references, tables, and figures.

Columns are shorter papers devoted to clinical subspecialty areas (eg, pediatrics, neonatal, transplantation) or functional areas (eg, ethics, legal, staff development). Articles should have a maximum length of 2000 words (excluding abstract, references, tables, and figures).

Use of such visual elements as tables and figures, as well as sidebars and bibliography to convey additional information, is strongly encouraged in both features and columns; these elements should augment, not duplicate, information in the text.

- Submit the paper without any information that may identify the author(s).
- Add continuous line numbering, a function in Microsoft Word, to the paper: Format/Document/Layout/Line Numbers. In the Line Numbers dialogue box, select both Add Line Numbering and Continuous. Although not visible in Normal view, line numbering can be seen in Print Preview or Print Layout.

References—References should be double-spaced and should be located after the last page of text and before any Tables and Figures. Number them consecutively by their order of appearance in the text and designate reference numbers as superscripts in the text. References in tables and figures are numbered sequentially as if they are cited where the table or figure is first cited in the text. *Do not use a word processing footnote function.* If a source lists more than 6 authors, list only the first 3, followed by "et al." Follow the *American Medical Association Manual of Style*, 10th edition, for format and punctuation, shown below.

For Journals: Last name and initials (no periods) of authors, title of article (capitalize only the first word, proper names, and abbreviations normally capitalized; no quotation marks), journal title (italicize and use Index Medicus abbreviations), year of publication, volume, issue, inclusive page numbers. Example: 1. Pun BT, Gordon SM, Peterson JF, et al. Large-scale implementation of sedation and delirium monitoring in the intensive care unit: a report from two medical centers. *Crit Care Med.* 2005;33(6):1199-1205.

For Books: Last name and initials of authors; title of book (italicize and capitalize all significant words); edition number (if after first edition); last name and initials of editor if any; city and state of publication; publisher; year of publication; page numbers (only if specifically cited). Example: 2. Munhall PL, Boyd CO. *Nursing Research: A Qualitative Perspective*. 2nd ed. New York, NY: National League for Nursing; 1998.

For Book Chapters: Last name and initials of authors; title of chapter; "In:" followed by last name and initials of editors, "ed."; title of book, etc, as above. Example: 3. Lewinsohn P. Depression in adolescents. In: Gottlib IH, Hammen CL, eds. *Handbook of Depression*. New York, NY: Guilford Press; 2002:541-553.

For Online References: Author(s), if given; title of the specific item cited (if none is given, use the name of the organization responsible for the site); name of the website; full URL; published (date); date the website was accessed. Example: International Society for Infectious Diseases. ProMED-mail website. http://www.promedmail.org. Accessed April 29, 2006.

Tables—Submit each table as a separate Word file. Each table must be numbered (consecutively in the order mentioned in the text) and titled. Each column within a table should have a heading. Abbreviations must be explained in a footnote.

Figures—Submit scanned black-and-white or color images at a resolution of at least 300 dpi. Do not send files downloaded from the Internet, as these are low-resolution and will reproduce poorly in print. The preferred file formats are TIFF and EPS. Do not submit any art in Microsoft applications; for printing purposes, the original art that was placed into these applications is required. Include signed consent/release from owner of photo or artist if different from author. Include signed consent/release forms from all identifiable individuals. If permission from subjects is not obtained, photographs will be cropped appropriately. For figures such as graphs, data points should be provided in a separate text file. Figure legends should be typed double-spaced in consecutive order on a new manuscript page. Contact the editorial office for further information (800-394-5995, ext 241, ccnhelp@aacn.org).

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Abbreviations and Symbols—Avoid nonstandard abbreviations and those included in The Commission's "Do Not Use" list of abbreviations (available at http://www.jointcommission.org/PatientSafety/DoNotUseList). Use the full term for an abbreviation or symbol on first reference, unless it is a standard unit of measure.

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❑ Title page (include title of manuscript; name(s), professional credential(s), affiliation(s), addresses of all authors in the order intended for publication; brief [1 to 2 sentences] biography of each author; funding and financial disclosure; acknowledgments; and 3 to 5 key words for indexing)

❑ Text of manuscript (do not include authors' names or institutions in the running head or in the manuscript)

❑ Abstract (include as numbered page; double-spaced on separate page)

❑ References (include as numbered pages; double-spaced on separate page; follow reference style described in these guidelines)

❑ Tables (double-spaced, 1 per page; numbered consecutively; include title for each)

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