Heart Failure 30-Day Readmissions: Causes, Prediction, Prevention in a Rural Hospital

Susan Gray

East Carolina University

Abstract

Readmissions of heart failure (HF) patients are a costly and potentially avoidable expenditure for our healthcare systems. In 2015, acute care facilities who exceed pre-determined benchmarks for 30-day HF readmission rates set by the Centers for Medicare and Medicaid Services (CMS) will see substantial penalties resulting in reductions in all Medicare reimbursement (Centers for Medicare and Medicaid Services [CMS], 2014). In an attempt to mitigate the financial burden associated with heart failure 30-day readmission rates, new techniques must be developed to identify the risk factors associated with this condition. The risk-standardized readmission rates (RSRRs) for heart failure have decreased from 23.4 % in July 2010 to 21.9% in June 2013 (CMS, 2013). Despite this decline, reducing readmission rates is a national priority in an effort to reduce rising healthcare costs (CMS, 2014). The purpose of this project was to identify trends of 30-day heart failure readmissions and evaluate the efficacy and feasibility of a discharge risk assessment implemented to stratify those at highest risk for 30-day readmission for heart failure. This discharge risk assessment for readmission was implemented at a North Carolina rural community hospital and targets an acute care population with a 30-day readmission rate higher than the current national median. The project design was a retrospective data analysis of all patients readmitted to the hospital within the first 30-days post discharge for treatment of heart failure as a primary diagnosis. Rogers' Diffusion of Innovation provided the theoretical foundation for the project. Results of the retrospective chart review showed that neither age, nor time of follow up visits, nor medication regimens were predicting factors of 30-day heart failure readmissions. Heart failure 30-day readmissions are due to multiple factors. The prediction and prevention of 30-day heart failure readmissions requires an interprofessional approach to create robust strategies to address this issue.

Keywords: heart failure, 30-day readmission, prevention, prediction

Acknowledgments

I wish to thank my committee including Dr. Candace Harrington, Dr. Carolyn Horne and Cindy Worthy who have encouraged me and kept me on task. I also wish to thank my husband, children, and parents who have been invaluable during the process. I will be forever grateful for my newfound friends and colleagues including Jennifer Bizuneh, Ann Marie Hunt, Chrissy Rowland, Amelia Ross, Alisa Starbuck, Veronica Stevens, and Rachel Zimmer.

TABLE OF CONTENTS

CHAPTER 1: INTRODUCTION

The Center for Disease Control and Prevention (CDC) estimates that five million people in the US are diagnosed with heart failure (HF) each year (CDC, 2013). The CDC estimates that HF costs the United States 32 billion dollars per year. One half of HF patients die within 5 years of initial diagnosis (CDC, 2013). An estimated 20% of HF Medicare beneficiaries are readmitted within 30 days of discharge (Medicare Payment Advisory Commission [MedPAC], 2007). Readmissions are costly and potentially avoidable. The risk-standardized readmission rates (RSRRs) for HF have decreased from 23.4 % in July 2010 to 21.9% in June 2013 (CMS, 2013). Despite this decline, reducing readmission rates is a national priority.

In 2015, acute care facilities who exceed CMS pre-determined benchmarks for 30-day HF readmission rates set by CMS will lose up to 3% of Medicare reimbursement (CMS, 2014). In order to mitigate the financial burden associated with HF 30-day readmission rates, new techniques must be developed to identify the risk factors associated with HF readmissions and create strategies to prevent their occurrence.

Statement of Purpose

The purpose of this project was to 1) identify causes for 30-day heart failure readmissions in a rural community hospital, 2) identify trends of readmission predictors in order to stratify those at highest risk for 30-day readmissions, and 3) suggest strategies to reduce 30-day HF readmissions for the most common cause of readmissions. The project was implemented in a North Carolina rural community hospital that targeted an acute care population whose rate of heart failure 30-day readmission is higher than the current national median.

Background of the Problem

Heart failure is a complex clinical syndrome resulting from functional or structural impairment of the cardiac pump. Classic symptoms include shortness of breath, fatigue, and ankle swelling. Classic signs include elevated jugular vein distention, pulmonary crackles, and displaced apical pulse (McMurray et al., 2012). Evidence shows diagnosis in the elderly is challenging due to existing co-morbidities and atypical symptomology (Oudejans et al., 2011). In order to classify the severity of HF patients, providers use either the American College of Cardiology /American Heart Association (ACC/AHA) stages, based on structural changes and clinical presentation, or the New York Heart Association (NYHA) classification system, based on symptom related functional debility (American Heart Association, 2015). The ACC/AHA stages determine the progression of the disease; whereas, the NYHA functional classification emphasizes the activity level and associated severity of symptoms (American Heart Association, 2015).

The prevalence of individuals with HF is an estimated 5 million people ≥ 20 years old (Go et al., 2013). The prevalence of HF is expected to increase by 46% resulting in greater than 8 million people ≥ 18 years old who are diagnosed with HF by 2030 (Go et al., 2013). The incidence of HF is 825,000 new cases annually (American Heart Association, 2015). According to the American Heart Association (2015), HF incidence approaches 10/1000 after 65 years of age. Between the ages of 60-79, 7.8% of men and 4.5% of women are diagnosed with HF. After 80 years old, 8.6% of men and 11.5% of women are diagnosed with HF (American Heart Association, 2015). The current cost of treating HF is 30 million dollars per year. However, the projected cost by 2030 is estimated at 69.7 billion dollars per year, an increase of 127% (Go et al., 2013; Godfrey et al., 2013).

The national readmission rate for Medicare HF patients averages 24.7% with direct and indirect costs of $37.2 billion annually (Godfrey et al., 2013). Since the introduction of the Patient Protection Affordable Care Act in 2010, a national priority has been to reduce hospital readmissions in order to reduce healthcare costs (CMS, 2013). In 2012, CMS initiated the Readmission Reduction Program. However, RSRRs for heart failure have only decreased by 1.5% over a three-year period extending from 2010 to 2013 (CMS, 2013). The purpose in implementing this program was to reduce payments to inpatient prospective payment system hospitals with excessive readmissions. Hospitals across the country are continuing to be faced with the challenge of reducing readmissions rates for heart failure patients.

Significance of the Problem

The etiology of HF 30-day readmissions is as diverse as the patients who suffer from the disease. Advanced Practice Registered Nurses (APRNs) must ascertain the etiology of 30-day HF readmissions in order to develop strategies to prevent their occurrence. APRNs must ameliorate processes to ensure seamless care between the hospital and community. A multidisciplinary approach including optimal medical treatment, adequate follow up, access to healthcare, patient education, and psychological support must be in place to improve the quality of life for HF patients and reduce 30-day readmissions (Black, 2014).

Identifying HF patients at high risk for readmission provides essential information to develop target strategies and maximize outcomes. Prediction models have been created to stratify patients at risk. However, efforts to date have yielded inconsistent findings and no prediction model has been universally accepted as the gold standard. A study of

2,536,439 HF hospitalizations conducted by Aggarwal and Gupta (2014) revealed that 30-day HF readmissions were attributed to varying demographic parameters such as age, payer source, and/or gender. They suggested that strategies tailored to specific causes for certain populations need to be implemented to reduce 30-day HF readmissions (Aggarwal & Gupta, 2014).

Practice Setting

This scholarly project was conducted in a rural 280-bed, county owned, not-for-profit acute care facility. The facility employs 1500 people and serves two counties. In 2014, the facility reported a $17 million deficit, partly due to Medicare penalties attributed to 30-day readmissions. In order to offset the deficit, the stakeholders invested in a readmission predictor tool in order to prevent future penalties.

CHAPTER 2: RESEARCH BASED EVIDENCE

Synthesis of Evidence

A comprehensive review of the literature was conducted using the key words: heart failure, 30-day readmission, readmission prevention, and prediction model. PubMed, Cumulative Index to Nursing and Allied Health Literature (CINAHL), and ProQuest Nursing and Allied Health Source databases were searched. Inclusion criteria was articles from the past five years, those written in English, peer review journals consisting of randomized control trials, systematic reviews, meta analyses, and clinical practice guidelines. Hand searches of reference lists were completed to identify additional resources. Exclusion criteria included duplicate articles and articles that did not address solutions to 30-day heart failure readmissions.

The initial literature search for heart failure resulted in more than 35,000 articles. Thirty-day heart failure readmission literature search produced 3876 articles. Thirty-day heart failure readmission causes, prevention and prediction model resulted in 185 articles. The abstracts of these articles were reviewed. For the purpose of this scholarly project, 50 articles including clinical guidelines were chosen as pertinent to the objective of identifying trends and readmission prevention strategies.

The literature review included four main categories including heart failure, 30-day heart failure readmissions, heart failure readmission prediction models, and heart failure readmission prevention strategies.

Heart Failure

The European Society of Cardiology (ESC) guidelines for the diagnosis and treatment of acute and chronic heart failure and the American College of Cardiology Foundation (ACCF)/American Heart Association (AHA) guidelines for the management of heart failure provided evidence-based guidelines (McMurray et al., 2012; Yancy et al., 2013). Both of these guidelines used findings from numerous randomized controlled trials with the highest level of evidence to develop the guidelines. The clinical evidence for medication management for HF patients from these guidelines was incorporated in the chart review tool utilized in this scholarly project.

Thirty-Day HF Readmissions

Understanding 30-day readmission trends discussed in the literature increases the likelihood of implementing target interventions (Eastwood et al., 2014). Schell stated, “the etiology of hospital readmissions for HF is as diverse as individuals who have the disease” (2014, p. 232). A literature review conducted by Giamouzis et al. (2011) stated that several studies associate HF 30-day readmissions with increased age, non-white race, lower socioeconomic status, increased cardiac ischemia, and presence of comorbidities.

Eastwood et al. (2014) studied 18,590 patients who were readmitted between seven and 30 days after hospitalization. Logistic regression was used in their study to identify factors contributing to readmissions. The study identified the following contributing factors for readmission: 1) readmission that included discharge with the need for additional home health services, 2) discharged against medical advice, 3) kidney disease and 4) discharged from hospitals without specialized HF services. Limitations of the study included failure of notation of medication history, documented severity of cardiac disease and uncertainty if patients followed up post discharge.

Sherer, Crane, Abel, and Efird (2014) conducted a retrospective cohort study of 245 HF inpatients to examine the effects of socio-demographic and clinical factors on HF readmissions. Using Cox regression, the results suggested that the number and type of comorbidities including renal insufficiency, atrial fibrillation, cardiomyopathy, and history of myocardial/infarction were predictors of HF readmissions. The authors concluded that knowledge of certain comorbidities identified in this study could help target those patients at higher risk for readmission. Limitations of the study were uncertainty of accurate recording of the data and missing data in the reviewed charts.

Readmission Prediction Models

Prediction models for readmission are complex due to the myriad of unique clinical data, administrative data, and social factors of each patient (Aggarwal and Gupta, 2014; Amarasingham et al., 2010). Reed, Bokovoy, and Doram (2013) investigated five logistic regression models for 30-day readmission after HF hospitalizations based on administrative data including the CMS Readmission Model, the LACE Index, the Hanson Score, the PARR score, and the AH Model. The results of their study showed the Hansan, PARR, and AH Model were the strongest predictors of unplanned 30-day HF readmissions. Au et al. (2012) concluded that none of the administrative database models were sufficiently accurate to predict HF 30-day readmission. However, Au et al. (2012) stated that the LACE Index is superior to other CMS models for risk of death or readmissions since it incorporates length of hospital stay.

Hebert et al. (2014) performed a retrospective cohort study in order to create a readmission risk model through their electronic health record. They developed readmission-risk models for acute myocardial infarction, pneumonia, and congestive heart failure. The congestive heart failure readmission-risk model performed poorly due to emphasis on social and behavioral variables in the chronic heart failure patients, thus complicating the ability to predict heart failure readmissions.

Readmission Prevention Strategies

Strategies implemented to address 30-day HF readmissions were heavily cited. Bradley et al., (2013) used a linear regression model to determine readmission prevention strategies. According to their findings, the following were associated with lower RSRRs: 1) partnering with community physicians, 2) partner with local hospitals, 3) nurses responsible for medication reconciliation, 4) follow-up appointments made before discharge, 5) seamless process to have inpatient medical records transferred to primary care provider, and 6) assign staff to follow up on test results that are available after the patient is discharged. Delgado-Passler and McCaffrey (2006) determined through their literature review that APRN directed heart failure post discharge management reduces readmissions. A study conducted by David, Britting, and Dalton (2014) went further to state patients receiving care from a medical team that included APRNs were 50% less often to be readmitted.

A new initiative introduced by the American College of Cardiology (ACC) known as the Patient Navigator program is aimed at preventing heart failure readmissions (Schell, 2014). The ACC recruits hospitals that already participate in the Hospital to Home Initiative and provides a team to assist patients in the challenges of heart failure management post discharge when they are most vulnerable (Schell, 2014).

Definitions and Concepts

Heart Failure

Heart failure is a complex clinical syndrome defined as impairment of the systolic ventricular filling and ejection of blood by the cardiac pump to deliver oxygen to meet metabolic requirements (Yancy et al., 2013; McMurray et al., 2012). An overview of the different types of heart failure follows including left ventricle failure, right ventricle failure, systolic heart failure, and diastolic heart failure.

Left ventricle failure. Left ventricle failure is defined as a dysfunction of the contractile function of the left ventricle, resulting in a low cardiac output (Urden, Stacy & Lough, 2014). This leads to vasoconstriction of the arterial bed that raises systemic vascular resistance. The increased resistance creates congestion and edema in the pulmonary circulation and alveoli (Urden et al., 2014). Patients presenting with left ventricular failure may present with decreased exercise tolerance or fluid retention (Urden et al., 2014). Over time the increased pulmonary congestion and edema can lead to right ventricle dysfunction.

Right ventricle failure. Right ventricle failure is defined as the dysfunction of the contractile function of the right ventricle (Urden et al., 2014). Associated symptoms of right ventricular failure include jugular venous distention, weakness, peripheral or sacral edema, hepatomegaly, jaundice, and liver tenderness. Gastrointestinal symptoms include poor appetite, anorexia, nausea, and an uncomfortable feeling of fullness (Urden et al., 2014).

Systolic heart failure. Systolic heart failure is defined as the marked decrease of contractility of the heart muscle during systole, resulting in low cardiac output and ejection fraction below 50% (Urden et al., 2014). Associated symptoms of systolic heart failure include dyspnea, exercise intolerance, and fluid volume overload. As systolic dysfunction progresses, the left ventricular end-diastolic pressure rises. The blood flowing through the pulmonary vascular bed meets resistance against the congested heart, therefore causing a backup of fluid and pressure. The fluid ultimately leaks through the walls of the alveoli causing pulmonary edema (Urden et al., 2014). . Elevated left heart pressures lead eventually to right heart pressure.

Diastolic heart failure. Diastolic heart failure is defined as the inability of the heart muscle to relax, stretch or fill during diastole (Urden et al., 2014). Cardiac muscle and cardiovascular vessels stiffen during the aging process causing impaired relaxation (Urden et al., 2014). Associated symptoms include exercise intolerance, dyspnea, fatigue, and pulmonary edema (Urden et al., 2014). Studies have shown that patients with diastolic heart failure have a preserved ejection fraction defined as 45% or greater. An ejection fraction above the range of 40% to 50% is considered normal for this population (Urden et al., 2014).

Ejection Fraction

Ejection fraction (EF) is defined as the ratio of the volume of blood emptied during systole to the volume of blood that remains in the heart at the end of diastole and is the measurement of left ventricular function (Ejection Fraction, 2014). Heart failure with an EF ≤ 40% is referred to as HF with a reduced EF (HF*r*EF), historically known as systolic HF. Heart failure with an EF ≥ 40% is referred to as HF with a preserved EF (HF*p*EF), historically known as diastolic HF (McMurray et al., 2012). The majority of randomized control trials to determine treatment modalities for HF have only studied HF*r*EF and the treatment modalities have proven efficacious in only this group to date (Yancy et al., 2013).

Echocardiogram

Although a clinical diagnosis, doppler echocardiography assists the clinician in identifying the cause and type of heart failure is made using (Urden et al., 2014). Doppler flow studies coupled with ultrasound determine whether abnormalities of the myocardium, heart valves, or pericardium are present and which chambers are involved in heart failure.

E/A Ratio

Two waves are seen during echocardiogram with measures recorded during flow across the mitral valve (Ashley & Niebauer, 2004). The early (E) wave represents passive filling of the ventricle. The atrial (A) wave represents active filling during atrial systole. In a healthy heart, the E-wave velocity is slightly greater than that of the A-wave. However, in diastolic heart failure a reversal is noted in which the A wave is greater than the E wave. This indicates impaired relaxation and slow filling, known as E/A reversal

(Ashley & Niebauer, 2004).

Pulmonary Hypertension

The Pulmonary Hypertension Association defines pulmonary hypertension as an increased pressure in the lungs (2015). The World Health Organization (WHO) first defined classifications of pulmonary hypertension in 1973 (Pulmonary Hypertension Association, 2015). Pulmonary hypertension due to left sided heart failure is classified as Group 2. WHO Group 2 pulmonary hypertension is defined as mean pulmonary artery pressure (mPAP) ≥ 25 mm Hg and left ventricular (LV) filling pressure ≥ 15 mmHg. Diastolic heart failure is frequently the cause of pulmonary hypertension (Pulmonary Hypertension Association, 2015).

30-day Readmission

Patients identified with ICD-9 heart failure codes returning to the hospital ≤ 30 days from date of discharge (CMS, 2015).

Medication management

Although there are numerous evidence-based pharmacological agents utilized in the management of heart failure, this author will concentrate on three medications considered to be key agents in the management of heart failure and considered to be benchmarks for standard care for heart failure management within the acute care setting.

Beta-antagonists (beta-blockers). Beta antagonists is defined as a class of drugs that counteract the sympathetic nervous system and Renin-Angiotensin-Aldosterone-System (RAAS), which decreases preload and afterload and inhibits ventricular remodeling (Maron & Rocco, 2011). A meta-analysis involving 22 trials and over 10,000 patients concluded that beta-blocker therapy is associated with clinically meaningful reduction in mortality and morbidity (Brophy & Rouleau, 2001). Three randomized controlled trials including Cardiac Insufficiency Bisoprolol Study II (CIBISII), Carvedilol Prospective Randomized Cumulative Survival (COPERNICUS), and Metoprolol controlled release/extended release Randomized Intervention Trial in Congestive Heart Failure (MERIT-HF) showed that beta-blocker therapy reduced mortality by 34% and hospitalization by 28-36% within one year of initiation of therapy (McMurray et al., 2012). The beta-blockers shown to reduce morbidity and mortality include bisoprolol, carvedilol, and metoprolol (Maron & Rocco, 2011). Bisprolol and Metoprolol are cardioselective beta-blockers that have a greater affinity for beta1-adrenergic receptors. Carvedilol has a greater affinity for beta1-adrenergic receptors, beta 2-adrenergic receptors and alpha 1-adrenergic receptors (Maron & Rocco, 2011).

Angiotensin converting enzyme inhibitors (ACE-I). ACE-Is are defined as a class of drugs that inhibit the ACE from converting angiotensin I to angiotensin II and is a mainstay in ameliorating heart failure morbidity and mortality (Colucci, Gottieg, & Yeon, 2014). In a failing myocardium, there is an increase in ACE binding sites. ACE is a vasoconstrictor causing increased blood pressure and myocardial hypertrophy (Colucci, Gottieb, & Yeon, 2014). ACE inhibitors also have a role in blocking the RAAS in HF patients. The RAAS is a hormonal cascade that maintains homeostatic control of blood pressure by regulating tissue perfusion and extracellular volume. In HF, the RAAS is accelerated (Bissessor & White, 2007).

Angiotensin II receptor blocker (ARB). ARBs are defined as a class of drugs that block the binding of angiotensin II to AT1 receptor. ARBs are used when HF patients are not able to tolerate ACE inhibitors (Colucci, Gottieb, & Yeon, 2014). The Eperenone in Mild Patients Hospitalization and Survival Study in Heart Failure (EMPHASIS-HF) trial and Randomized Aldactone Evaluation Study (RALES) trials showed that ARB add-on therapy did not reduce all-cause mortality (McMurray et al., 2012). The ACCF/AHA guidelines state that the combination of an ACE inhibitor, ARB, and aldosterone antagonist has the potential for harm in patients with HF*r*EF (Yancy et al., 2013).

Risk for Readmission Prediction Score (RRPS)

RRPS is the score generated by the Risk for Readmission Prediction tool utilized at the facility where this project was conducted. A systematic review of prediction models for hospital readmission risk show they perform poorly (average C-statistic of 0.66) (Choudhry et al., 2013). However, the prediction tool purchased by the facility where this project was conducted demonstrates modest discrimination ability during derivation, internal and external validation post-recalibration (C-statistics of 0.78) and reasonable mode fit during external validation for utility in heterogeneous populations (Choudhry et al., 2013). The discharge risk for readmission prediction model includes 58 independent predictors such as demographics, hospital utilization, medications, labs, history and physical, procedures, length of stay, and discharge disposition. In order to create a highly predictive model, the quality and accessibility of the data is important. Patients were given a score generated by the prediction model according to their risk stratification: 0-40 low risk, 41-49 moderate risk, and 60-100 high risk.

Theoretical Framework

Roger's Diffusion of Innovation (DOI) theory provided a theoretical framework for the implementation of readmission predictor assessment. A risk for 30-day HF readmission model supported innovation and uptake of new care modalities. Rogers (2003) defined diffusion as “the process by which an innovation is communicated through certain channels over time among the members of a social system” (p.35). Conceptualized ideas were innovations communicated through channels over time in a social system (Rogers, 2003). The ultimate goal of understanding the etiology of 30-day HF readmissions was to propose a quality improvement plan for readmission prevention. The clinical innovation of risk for readmission predictors based on evidence has the potential for significant organizational improvement. Bucknall (2012) emphasized the importance of the translation of knowledge into action and behavior changes. The DOI theory bridged the know-do gap between identified trends and the implementation of a prevention plan.

Elements of Diffusion of Innovation

The four elements of Roger’s theory included innovation, communication channels, time, and social system. .

Innovation. Innovation, according to Rogers (2003) was an idea perceived as “new”. The adopters must understand the advantages, disadvantages, and consequences of the innovation. Stakeholders of the facility invested in new technology to identify heart failure patients that were at high risk for readmission. The goal became to educate the adopters on the importance of the new technology. The employees were informed of the financial penalty the facility endured due to the reoccurrence of 30-day HF readmissions. The employees understood that action needed to be taken to prevent reoccurrence in order to avoid future penalties.

Communication channels. Communication channels were the second element of the diffusion of innovation process. Rogers (2003) defined communication as the process of mutual understanding through information sharing. Two communication channels were mass media or interpersonal communication (Rogers, 2003). Rogers (2003) stated that interpersonal communication is most effective when strong opinions prevail. To ensure the adopters were well informed, town hall meetings were utilized to inform the employees of the urgency in addressing the readmission rate. Committee meetings were held monthly to tailor the readmission predictor tool unique to the facility's needs.

Time. Time is the third element of the diffusion of innovation process. There was a sense of urgency in creating an action plan for the prevention of readmissions. The proposed timeline for launching the readmission predictor tool was seven months. However, 11 months lapsed from time of purchase to the launch. To ensure that the readmission tool was complete, the launch was delayed three months.

Social system. The fourth element of the diffusion of innovation process was the social system. Social system, as defined by Rogers (2003), was "a set of interrelated units engaged in joint problem solving to accomplish a common goal" (p.23). The organization's social system consisted of a Chief Medical Officer (CMO), a Chief Executive Officer (CEO), a Chief Operating Officer (COO), a Chief Nursing Officer (CNO), a Board of Trustees, department heads, unit managers, and staff. The emphasis of the leadership was teamwork. Ideas were welcomed in this social system. However, due to the magnitude of the financial commitment to purchase a risk for readmission tool, the decision was made by the CMO, CEO, COO, CNO, and Board of Trustees. A team of informatics technology nurses, case managers, social workers, and nurses executed the implementation.

Innovation-Decision Process

According to Rogers (2003), five steps in the innovation-decision process included knowledge, persuasion, decision, implementation, and confirmation.

Knowledge. The first step of the innovation-decision process was knowledge. Adopters gathered information about the innovation. Questions asked during the cognitive knowledge step seek to answer “what”, “how”, and “why”. The adopters sought knowledge on factors the readmission predictor assessment included, how it was to be implemented, and the rationale behind the implementation.

Persuasion. Persuasion was the second step of the innovation-decision process. Once knowledge was obtained, adopters form an opinion, favorable or unfavorable. Opinions and beliefs about the innovation were affected by peers’ views and the uncertainty of the innovation (Rogers, 2003). The stakeholders were persuaded through peer influence to purchase the readmission predictor tool. The stakeholders were in turn able to persuade managers and staff that the innovation would be beneficial.

Decision. The third step was the decision stage when the individual or group chose to accept or reject the innovation. Rogers (2003) described two types of rejection including active rejection or passive rejection. Rogers (2003) suggested that active rejection exists when an individual rejects an innovation after trying it. Further, he suggested that passive rejection exists when an individual rejects an innovation without consideration of adopting it.

The decision makers at the organization where this scholarly project was implemented chose to accept the innovation despite risks and uncertainty. The administrators were assured that the benefits of the innovation outweighed the risk.

Implementation. The implementation phase occurred when the innovation was put into practice. Months of planning went into the implementation phase of the risk for readmission predictor tool once the decision to move forward was made. The risk assessment tool involved several variables that required input from physicians, nurses, lab, case managers, and demographic data. The organization continued to plan for implementation but, due to the complexity and barriers, implementation did not occur during the scholarly project timeframe.. The author created an alternate readmission risk assessment tool in order to assess suspected factors in 30-day HF readmissions based on the body of evidence.

Confirmation. The fifth step in the innovation-decision process was confirmation. Adopters looked for support that they made the right decision. Despite conflicting messages, adopters surround themselves with supporters (Rogers, 2003). The facility networked with other facilities that had purchased the same risk for readmission predictor tool. They sought support in their decision and ongoing use.

Characteristics of Innovation

DOI theory identified factors that can enhance process of change and indicated whether an innovation will be accepted. Rogers' innovation characteristics included observability, relative advantage, compatibility, trialability, and complexity (Rogers, 2003).

Observability. Observability referred to how visible the innovation is to potential adopters. Providers were more apt to accept an innovation if they are able to observe it (Rogers, 2003). The electronic medical record displayed an easily accessible risk for readmission score. However, few staff were aware of its meaning. Inservices were ongoing so staff could observe the utility of readmission risk assessment tools.

Relative advantage. Relative advantage referred to the degree to which an innovation was perceived to be superior to the current practice. Current practice did not have in place a specific plan targeting 30-day HF readmissions. Employees were made aware of the importance of implementing robust readmission prevention program in order to avoid future financial penalty and meeting the organization's strategic mission.

Compatibility. Compatibility referred the degree to which innovation was perceived to be consistent with socio-cultural values, previous ideas, or perceived needs (Rogers, 2003). The mission of the employees was to focus on superior quality health care services and to improve the health of the community in a caring, efficient and financially sound manner. The implementation of a 30-day HF readmission prevention initiative was compatible with their mission.

Trialability. Trialability referred to how much the innovation can be experienced. New ideas that can be tried will generally be adopted more quickly (Rogers, 2003). Rogers (2003) pointed out that reinvention often takes place during the trial of innovation. Reinvention frequently occurred as planners tailored the assessment to the unique needs of the patients in their community.

Complexity. Complexity was defined according to level of difficulty. A complex innovation is difficult to embrace (Rogers, 2003). The goal was to make the recommended process change user-friendly and easily accessible. However, the creation of the tool was complex. Committee meetings, conference calls with the vendor, and data gathering were time consuming. The timeline has extended longer than expected.

Adopters of change

In addition to understanding the five stages of DOI and the innovation characteristics that led to the successful implementation of a proposed innovation, the author needed to identify the individuals likely to accept or reject the innovation. Rogers referred to these individuals as adopters. Rogers set forth five categories of adopters including innovators, early adopters, early majority, late majority, and laggards.

Innovators. Innovators venturesome and change agents. They are risk takers as well as gatekeepers of new innovation (Rogers, 2003). They make up 2.5% of the social system (Rogers, 2003). The stakeholders, representing a small group of decision-makers, researched readmission prevention models and were willing to take the risk to make the investment.

Early adopters. Early adopters are visionaries. They are the trendsetters and role models. Early adopters make up 13.5% of the social system. Early adopters set the tone for acceptance amongst the social system (Rogers, 2003). Rogers (2003) points out that innovators and early adopters are usually well-educated and open to new ideas.

Early majority. Early majority are the pragmatists. They are conservative, prudent, and do not like complexity. This group represents 34% of the social system.

Late majority. Late majority are skeptical. They are cautious and succumb to peer pressure. Late majority represents 34% of the social system. This group waits until most of the social system has accepted the new idea.

Laggards. Laggards are the last group to accept change. They prefer the status quo and their point of reference is the past. They are suspicious of change. Laggards represent 16% of the social system. This group often waits to see if the change is successfully implemented.

The innovators of the implementation facility were comprised of a small group of decision-makers. The innovators included the CEO, CMO, and CNO and the nurse leader for the readmission prevention task force. The early adopters included a team of case managers, nurses, and an IT team. The innovators and early adopters were the driving force of the implementation of the new innovation. They were forward thinking and progressive and set the tone for acceptance. The early majority included the case managers and staff nurses. The tool was created to be user-friendly in order for acceptance and implementation. Since the launch was recent, it was too early to evaluate the late majority or laggard reaction to the implantation.

In summary, Roger's diffusion of innovation theory offered a plausible explanation for why some innovations are adopted rapidly and others with difficulty, despite strong evidence of the potential benefits. The implementation of change involved a complex interplay between social systems, communication style, adopter characteristics, and the decision-making process. DOI provided the theoretical framework for the implementation of the risk for readmission predictor tool in a rural community hospital.

CHAPTER 3: METHODOLOGY

Needs Assessment

The questions explored for this project were: 1) Is there a difference between age and 30-day readmissions? 2) Is there a relationship between days until follow up visit and 30-day readmissions? and 3) Is there a correlation between patients not on the appropriate medication regimen and 30-day readmissions? The implementation facility explored ways to predict and prevent 30-day readmissions in HF patients after being penalized by regulatory agencies.

Despite best efforts, HF readmissions continued to be a problem. The stakeholders invested in a prediction readmission model from the electronic health record (EHR) provider. However, even with a team meeting weekly with the representatives from the EHR provider to tailor the prediction model to the unique needs of the population served by the facility, launch of the tool has not occurred.

Project Design

In this quantitative study using descriptive statistics, the outcome was to better understand the causes of 30-day heart failure readmissions in order to predict and prevent their occurrence. Formal presentation of the proposed scholarly project was made in January 2015 at the facility in which this study was completed. Organizational institutional review committee (IRC) approval was obtained March 4, 12015 (see Appendix A). University Medical Center Institutional Review Board (UMCIRB) approval was obtained May 7, 2015 (See Appendix B).

A retrospective chart review was conducted over 6 months following IRB approval. Data were collected on charts identified by ICD-9 codes for HF with readmissions within 30 days of discharge between January 2013 to March 2015. Data were accessed using an encounter number with an individual access code specific to the principal investigator. Electronic data was stored in a password-protected document in a password-protected computer in a locked location. The principal investigator (PI) had the password and encryption codes with sole access to the data. The PI did not collect protected health information (PHI) identifying data. The electronic file will be shared with the IRC at the facility where the project took place on completion of the project. The data will then be subsequently stored on the encrypted hospital R drive for six years.

A chart review tool with a code legend was utilized for data collection (see Appendix C). The tool consisted of variables including age, gender, tobacco use, Ace Inhibitor or ARB, Beta-blockers, ejection fraction, days between discharge and follow up visits, and days between discharge and readmission. Data were not collected on individuals greater than 89 years old since this is considered a personal identifier. The data were entered into a spreadsheet. There were 52 heart failure readmissions in 2013 and 73 heart failure readmissions in 2014; therefore the sample size was estimated to be no greater than 150 encounters.

This quality improvement project evaluated possible factors that might predict readmissions of high-risk heart failure patients.

Failure Mode Effects Analysis (FMEA), as defined by the Institute for Healthcare Improvement is, “a systematic proactive method for evaluating a process to identify where and how it might fail and to assess the relative impact of different failures, in order to identify the parts of the process that are in the most need of change” (Institute for Healthcare Improvement, 2015). The ultimate goal of FMEA is to redesign systems to optimize patient outcomes (Reams, 2011). Latino and Fernandes (2013) stated the organization must identify the latent root causes that contribute to 30-day readmissions. Latent root causes are the systemic or organization deficiencies that can mislead decision makers. Once the root cause analysis (RCA) is done and latent root causes are identified, FMEA can be implemented. The identified problem is given a score depending on severity, probability, and detectability. The resulting score of these factors is known as the risk priority number (RPN). A high RPN indicates a high priority problem. Once a failure mode is identified, an individual or team implements action(s). Once the action is complete a new RPN is calculated which will determine if there has been improvement (Reams, 2011). The results from this quality improvement scholarly project identified potential factors of 30-day readmissions heart failure patients and provided focused areas for prevention.

Resources used/cost analysis

Resources utilized were the IT department at the study facility. The liaison between EHR and the hospital provided the list of HF 30-day readmissions encounter numbers for the chart review. Travel and indiscriminate costs totaling $500 were incurred with this scholarly project. A timeline was kept during the duration of the DNP project (See Appendix D).

CHAPTER 4: RESULTS

One hundred forty-five subjects met 30-day HF readmission criteria, with fifteen not meeting inclusion criteria based on advanced age of greater than 89 years of age. The final sample (n=130) included 52 males (35.9%) and 78 females (53.8%). The sample ranged in age from 38-89 years (mean [SD], 71.8 [11.8] years) (see Figure 1). Of the sample, 27 (18.6%%) were smokers, 62 (42.8%) were not smokers, and smoking history was not documented on 41 (28.3%) (See Table 1).

Results revealed that 45 (31%) were on an ACE -I, 8 (5.5%) were on an ARB, and 77 (53.1%) were on neither an ACE-I nor ARB. Those on beta-blockers were: Bisprolol 4 (2.8%), Carvedilol 50 (34.5%), Metoprolol 47 (32.4%) and none of the above 29 (20%). Cross tabulation revealed that 45 (34.6%) were on both ACE-I or ARB and a Beta-

Blocker. Cross tabulation revealed that 21 (16%) were not on any medication including and ACE-I, ARB, or beta-blocker (see Table 2).

Ejection fraction (EF) ranged from 8-70% (*M* 42.2, *SD*16). Frequency studies revealed the most frequent EF was 55% (32, 22.1%), then 30% (17, 11.7%), and next 60% (15, 10.3%). The results showed 8 (6.2%) had an EF ≥ 50% with no echocardiogram abnormalities. Ejection fractions ≥ 50% with abnormalities was 53 (40.7%). Noted abnormalities included pulmonary hypertension, E/A reversal, hypokinesis, impaired ventricular relaxation, and aortic stenosis. Ejection fractions ≤ 50% were 69 (53.1%).

Days between discharge and follow up visit ranged from 0-28 days, (*M* 8.5, *SD* 5.95). Frequency studies revealed the most frequent days between discharge and follow up visit was 7 days (28, 19.3%), then 2 days (18, 12.4%), and next 10 days (12, 8.3%).

Days between discharge and readmission ranged from 0-30, (*M* 14.3, *SD* 8.3). Frequency studies revealed the most frequent days between discharge and readmission was 6 days (12, 8.3%), then 5 days (11, 7.6%), and next 12 days (8, 5.5%).

Risk for readmission scores could not be obtained due to the delay in launch of the program at the facility. Relationship between days to follow up and days to readmission showed that 36 (27.7%) were readmitted before follow up visit and 89 (68.5) were readmitted after follow up visit, and 5 (3.8%) were readmitted the same day as their follow up visit. Results showed an average of 5.42 days existed before readmission for those readmitted before follow up visits and 10.7 days before readmission for those readmitted after follow up visit. Pearson's correlation showed there was a weak, negative correlation not statistically significant between the two variables, $r = -.29$, $n = 130$, $p > 0.05$ (see Table 3). Descriptive statistics showed there was an average of 14.85 days to readmission for those < 70 years of age and 14.01 days to readmission for those ≥ 70 years of age. In addition, data show that there was an average of 13 days between discharge and readmission for those on both an ACE-I or ARB and a beta blocker and those on neither (See Table 4).

Failure Mode Effects Analysis

The first step for performing a FMEA analysis is to identify the process to be addressed and create a flow chart. All potential failure modes, causes, and effects associated with the process are identified. A Risk Priority Number (RPN) is then calculated including severity, occurrence, and detection of the problem. Once the RPN is calculated, actions are identified to address the failure modes. Next, the actions are re-assessed to evaluate their impact and a new RPN is calculated. The new RPN will determine if further action needs to be taken (Reams, 2011). The ultimate goal of FMEA is to redesign systems to optimize patient outcomes (Reams, 2011). The RPN for 30-day heart failure readmission is 10 (severity) x 10 (occurrence) x 10 (detection) =1000. The severity score is a 10 due to significant financial penalties. The occurrence score is a 10 since the readmission rate of the facility is higher than the national average. The detection score is a 10 since 30-day HF readmissions are difficult to detect. The high score reiterates that 30-day heart failure readmissions are a priority that needs attention in order to improve patient outcomes. Root causes of 30-day heart failure readmissions include timely follow up visits, discharge medication regimen, transportation barriers, insurance barriers, and co-morbidities, to mention a few. Strategies that address the identified root causes can then be implemented. FMEA involves several steps with an interprofessional team that can take months. It is beyond the scope of this DNP project and outside the timeline to conduct a formal FMEA analysis**.**

CHAPTER 5: DISCUSSION

Significance

This aim of this DNP project was to determine if 30-day heart failure readmissions could be prevented or predicted by identifying patterns and trends. The author sought to answer three questions: 1) Is there a relationship between age and 30-day heart failure readmissions? 2) Is there a relationship between days to follow-up and 30-day heart failure readmissions? and 3) Is there a difference between patients not on appropriate medication regimen and 30-day heart failure readmissions? The empirical findings from the chart review of 130 patient encounters showed no relationship between age and 30-day readmissions. Second, the data suggested there was no relationship between days to follow up and 30-day readmissions. In fact, 68.5% of heart failure readmissions occurred after the scheduled follow-up visit within the 30-day window post discharge. Last, findings suggested there was no relationship between medication regimen and readmission. A relevant finding was that patients were on medication regimens that did not align with the evidence-based guidelines.

Implications

The implications of the findings suggested that 30-day heart failure readmissions are multifactorial. Physical, social, and psychosocial issues were contributory factors confounding the ability to predict and prevent their occurrence. In addition, co-morbidities of heart failure patients clouded the predictability of readmission. The literature revealed that one prediction model for heart failure readmission does not fit all.

In addition, the evidence-based guidelines do not fit all heart failure patients regardless of age.

Recommendations

The scale of heart failure 30-day readmissions is extensive and multifaceted at both small and large facilities. In order to further address the issue of 30-day heart failure readmissions, the following recommendations were made. A formal FMEA analysis would identify the root causes specific to the facility and enable the creation of strategies for prevention A discharge nurse specific to heart failure patients was recommended to ensure adequate discharge instruction, schedule the follow up appointment within seven days, and assess accessibility and affordability of discharge medication regimen may ameliorate some of the psychosocial and socioeconomic factors of readmission. This author recommended an outpatient heart failure clinic with an appointed APRN to evaluate and manage the patients with heart failure post discharge within seven days and continue to follow them weekly and as needed until the 30-day post discharge window passes. In addition, palliative care or hospice for those who have recurrent advanced heart failure should be considered as best practice. Further quality improvement cycles were recommended to examine the facility's readmission predictor tool in identifying high-risk patients for readmission.

Limitations of the project

The initial goal of this project was to analyze the implementation of an initiative using a risk for readmission score in order to stratify high-risk patients for 30-day readmissions. Due to a delay in the institution's launch date, this DNP project was amended to enable evaluation of 30-day heart failure readmissions using a chart review tool created by the author. The chart review tool measured eight variables based on application of best evidence for heart failure management, which was substantially less detailed than the planned prediction tool, but captured current CMS heart failure performance measures and evidence-based recommendations.

Another limitation was that data were limited within the encounters to identify if patients had taken the medications as prescribed. In addition, data were limited with regards to the ability to follow-up in the recommended window with the patient's healthcare provider.

CHAPTER 6: CONCLUSIONS

Prediction and prevention of heart failure readmissions is complex. This DNP project contributes to the body of knowledge by reiterating the importance of strategies targeted at the root causes of heart failure readmissions. The data suggested that causes of 30-day readmissions were not correlated with age, time of follow up visit, or a specific medication regimen.

Dissemination of the project included a formal presentation to DNP faculty and colleagues, presentation to the readmission team at the implementation facility, and journal submission to *Clinical Scholars Review*. The facility is exploring an outpatient clinic for recently discharged patients as recommended. As suspected at the onset, potential strong predictors for 30-day readmission including physical, social, or psychosocial factors need to be addressed in order to predict and prevent 30-day heart failure readmissions. A formal FMEA analysis will assist facilities in identifying causes of 30-day heart failure readmissions unique to their community. APRNs could play a pivotal role in providing follow up care for recently discharged heart failure patients in both small and large facilities. The findings of this scholarly project are generalizable to rural community hospitals.

References

Aggarwal, S., & Gupta, V. (2014). Demographic parameters related to 30-day readmission of patients with congestive heart failure: Analysis of 2,536,439 hospitalizations. *International Journal of Cardiology*. doi:10.1016/j.ijcard2014.07.140

Amarasingham, R., Moore, B., Tabak, Y., Drazner, M., Clark, C., Zhang, S., ... Halm, E. (2010, November). An automated model to identify heart failure patients at risk for 30-day readmission or death using electronic medical record data. *Medical Care*, *48*, 981-988. Retrieved from www.lww-medicalcare.com

American Heart Association, 2015. Heart and stroke statistics. Retrieved from http://www.heart.org/HEARTORG/Conditions/HeartFailure/AboutHeartFailure/Classes-of-Heart-Failure_ucm_306328_Article.jsp

Ashley, E. & Niebauer, J. (2004). *Cardiology explained*. London:Remedica. Retrieved from http://www.ncbi.nlm.nih.gov/books/NBK2215/

Au, A., McAlister, F., Bakal, J., Ezekowitz, J., Kaul, P., & Walraven, C. (2012, September). Predicting the risk of unplanned readmission or death within 30 days of discharge after a heart failure hospitalization. *American Heart Journal*, 365-372. doi.10.1016/j.ahj.2012.06.010

Black, J. (2014). Learning about 30-day readmissions from patients with repeated hospitalizations. *American Journal of Managed Care. 20*(6). e200-207.

Bissessor, N., & White, H. (2007, August 3). Valsartan in the treatment of heart failure or left ventricular dysfunction after myocardial infarction. *Vascular Health Risk Management*, *4*, 425-430.

Bradley, E., Curry, L., Horwitz, L., Sipsma, H., Wang, Y., Walsh, M., ... Krumholz, H. (2013). Hospital strategies associated with 30-day readmission rates for patients with heart failure. *Circulation: Cardiovascular Quality Outcomes*, *6*, 444-450. doi:10.1161/CIRCOUTCOMES.111.000101

Brophy, J. M., & Rouleau, J. K. (2001). Beta-blockers in congestive heart failure. A Bayesian meta-analysis. *Annals of Internal Medicine*, *134(7)*, 550.

Bucknall, T. (2012). Bridging the know-do gap in health care through integrated knowledge translation. *Worldviews on Evidenced-Based Nursing, 9,* 193-194. doi:10.1111/j.1741-6787.2012.00263x

Centers for Disease Control and Prevention. (2013). Heart failure fact sheet. Retrieved from http://www.cdc.gov/dhdsp/data_statistics/fact_sheets/fs_heart_failure.htm

Centers for Medicare and Medicaid Services. (2014). *Payment policy for inpatient readmissions*. Retrieved from CMS.gov: http://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/AcuteInpatientPPS/Readmissions-Reduction-Program.html

Centers for Medicare and Medicaid Services. (2015). Readmissions reduction program. Retrieved from http://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/AcuteInpatientPPS/Readmissions-Reduction-Program.html

Choudhry, S., Li, J., Davis, D., Erdmann, C., Sikka, R., & Sutariya, B. (2013). A public-private partnership develops and externally validates a 30-day hospital readmission risk prediction model. *Online Journal of Public Health Information*, *5*(2), 1-17. Retrieved from http://oljphi.org

Colucci, W., Gottieb, S., & Yeon, S. (2014). Angiotensin converting enzyme inhibitors and receptor blockers in heart failure: Mechanism of action. . Retrieved from http://www.uptodate.com/contents/angiotensin-converting-enzyme-inhibitors-and-receptor-blockers-in-heart-failure-mechanisms-of-action?source=see_link

David, D., Britting, L., & Dalton, J. (2014). Cardiac acute care nurse practitioner and 30-day readmission. *Journal of Cardiovascular Nursing*, 1-8. doi:10.1097/JCN0000000000000147

Delgado-Passler, P., & McCaffrey, R. (2006). The influence of post discharge management by nurse practitioners on hospital readmission for heart failure. *Journal of American Academy of Nurse Practitioners*, *18*, 154-160, doi:10.1111/j.1745-7599.2006.00113.x

Eastwood, C., Howlett, J., King-Shier, K., McAlister, F., Ezekowitz, J., & Quan, H. (2014). Determinants of early readmission after hospitalization for heart failure. *Canadian Journal of Cardiology*, *30*, 612-618, doi:10.1016/j.cjca.2014.02.017

Ejection fraction. (2014). In *Merriam-Webster online dictionary*. Retrieved from http://www.merriam-webster.com/medical/ejection%20fraction

Giamouzis, G., Kalogeropoulos, A., Georgiopoulou, V., Laskar, S., Smith, A., Dunbar, S., ... Butler, J. (2011). Hospitalization epidemic in patients with heart failure: Risk factors, risk prediction, knowledge gaps, and future directions. *Journal of Cardiac Failure*, *17*, 54-75. doi:10.1016/j.cardfail.2010.08.010

Go, A. S., Mozaffarian, D., Roger, V. L., Benjamin, E. J., Berry, J. D., Borden, W. B., & Bravata, D. M. (2013). Heart disease and stroke statistics-2013 update: A report from the American Heart Association. *Circulation*, *127*, 6-245. doi:10.1161/CIR.0b013e31828124ad

Godfrey, A. S., Mozaffarian, D., Roger, V. L., Benjamin, E. J., Berry, J. D., Bravata, D. M., & Ford, E. S. (2013). Heart disease and stroke statistics-2013 ubdate. A report from the American Heart Association []. *Circulation*, *127*(1), 6-245. doi:10.1161/CIRCULATIONAHA.112.125435

Hebert, C., Shivade, C., Foraker, R., Wasserman, J., Roth, C., Mekhjian, H., ... Embi, P. (2014). Diagnosis-specific readmission risk prediction using electronic health data: A retrospective cohort study. *BMC Medical Informatics and Decision Making*, 14(14:65), 1-9. Retrieved from http://www.biomedcentral.com/1472-6947/14/65

Institute for Healthcare Improvement, 2015. Retrieved from http://www.ihi.org/resources/Pages/Tools/FailureModesandEffectsAnalysisTool.aspx

Latino, R., & Fernandes, K. (2013, May). Getting a grip on readmissions using root cause analysis and FMEA. Retrieved from www.ReadmissionNews.com

Maron BA, Rocco TP. Pharmacotherapy of congestive heart failure. In: Brunton LL, Chabner BA, Knollmann BC, eds. Goodman & Gilman's The Pharmacological Basis of Therapeutics. New York: McGraw-Hill; 2011:789–814.

McMurray, J. V., Adamopoulos, A., Anker, S. D., Auricchio, A., Bohm, M., Dickstein, K., ... Fonseca, C. (2012). ESC guidelines for the diagnosis and treatment of acute and chronic heart failure 2012. *European Heart Journal*, *33*, 1787-1847. doi:10.1093/eorheart/ehs104

Medicare Payment Advisory Commission. (2007). Report to Congress: Promoting greater efficiency in Medicare. Retrieved from http://www.medpac.gov/documents/reports/chapter-3-measuring-quality-of-care-in-medicare-(june-2014-report).pdf?sfvrsn=2

Oudejans, I., Mosterd, A., Bloemen, J., Valk, M., van Velzen, E., Wielders, J.,…Hoes, A. (2011). Clinical evaluation of geriatric outpatients with suspected heart failure: value of symptoms, signs, and additional tests. *European Journal of Heart Failure*. 13, 518-527. doi:10.1093/eurjhf/hfro21.

Pulmonary Hypertension Association (2015). WHO Group 2: PH due to Left Heart Disease. Retrieved from http://www.phassociation.org/MedicalProfessionals.

Reams, J. (2011, May). Making FMEA work for you. *Nursing Management*, 18-20. doi:10.1097/01.NUMA.0000396500.05462.6e

Reed, J. F., Bokovoy, J. L., & Doram, K. R. (2013). Unplanned readmissions after hospital discharge among heart failure patients at risk for 30-day readmission using an administrative dataset and "off the shelf" readmission model. *The Internet Journal of Cardiovascular Research*, *9*(1). Retrieved from https://ispub.com/IJCVR/9/1/14837

Rogers, E. M. (2003). *Diffusion of innovations*. New York: Free Press.

Schell, W. (2014). A Review: Discharge navigation and its effect on heart failure readmissions. *Professional Case Management*, *19*, 224-234. doi:10.1097/NCM.0000000000000040

Sherer, A., Crane, P., Abel, W. M., & Efird, J. (2014). Predicting heart failure readmissions. *Journal of Cardiovascular Nursing*, 1-7. doi:10.1097/JCN0000000000000225

Urden, L. D., Stacy, K. M., & Lough, M. E. (2014). *Critical care nursing: Diagnosis and management*. St. Louis, Mo: Saunders/Elsevier.

Yancy, C., Jessup, M., Bozkurt, B., Butler, J., Casey, D., Drazner, M., ... Wilkoff, B. (2013). 2013 ACCF/AHA guideline for the management of heart failure. *Journal of American College of Cardiology*, *62*, e147-e239. doi:10.1016/j.jacc.2013.05.019.

Table 1

Gender, Smoker Frequency Data

Variable	Encounters (n=130)	
	N	%
Sex		
Male	52	40%
Female	78	60%
Smoker		
Yes	27	18.6%
No	62	42.8%
Not Documented	41	28.3%

Table 2

Medication Regimens

Medication	ACE-I	ARB	Neither	Total
Bisprolol	0	1	3	4
Carvedilol	19	3	28	50
Metoprolol	20	2	25	47
No BB	6	2	21	29
Total	45	8	77	130

Table 3

Pearson's Correlation between Age and 30-Day HF Readmissions

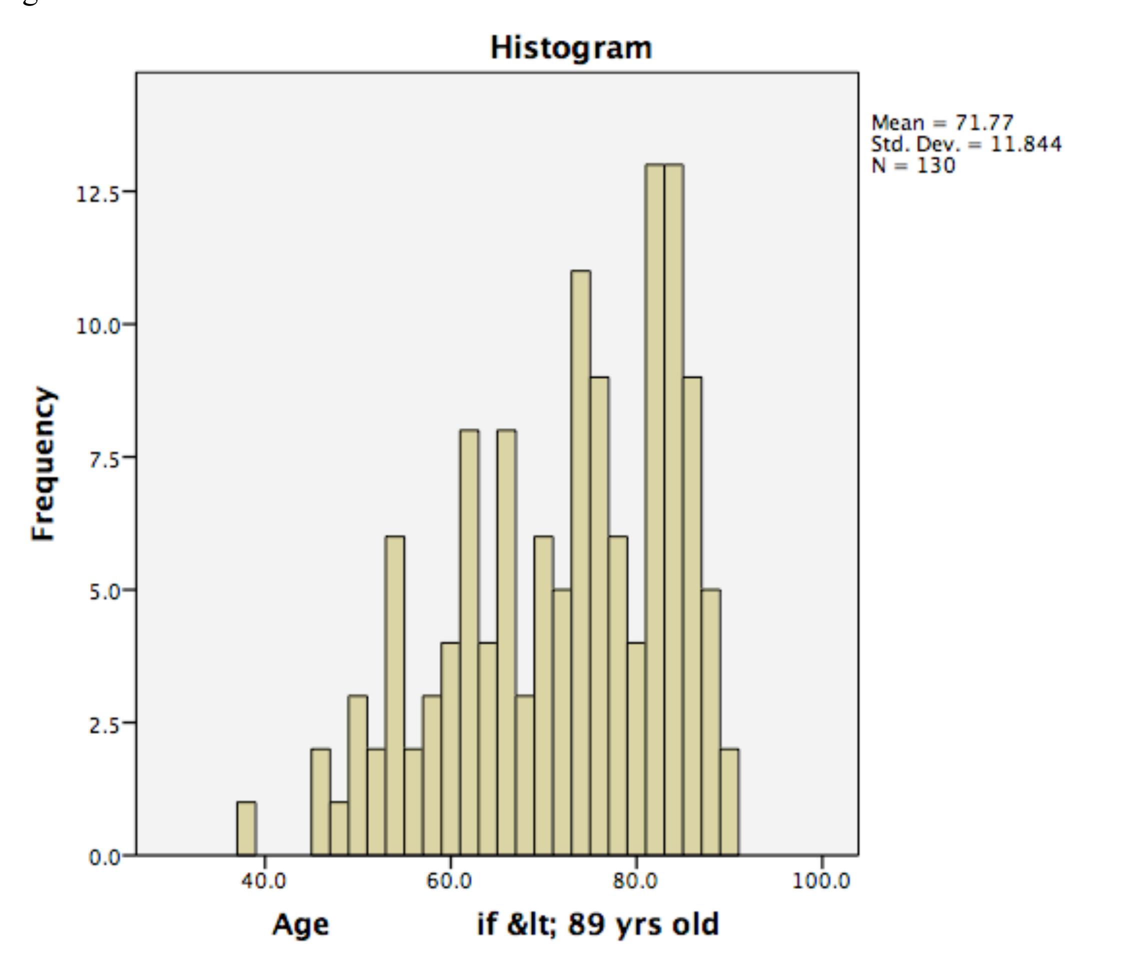
		Age	Days to Readmission
Age	Pearson's Correlation	1	-0.29
	Sig (2 tailed)		.740
	N	130	130
Days to Readmit	Pearson's Correlation	-.029	1
	Sig (2 tailed)	.740	
	N	130	130

Table 4

Cross Tabulation between Medication Regimen and 30-Day HF Readmissions

Medications	N, %	Days between discharge and readmission
Both ACE-I/ARB and BB	45, 34.6%	13.53
Neither	21,16%	13.38

Figure 1


Histogram
Mean = 71.77
Std. Dev. = 11.844
N = 130
Frequency
12.5
10.0
7.5
5.0
2.5
0.0
40.0
60.0
80.0
100.0
Age if < 89 yrs old

Appendix A

NASH
UNC HEALTH CARE

2460 Curtis Ellis Drive, Rocky Mount, NC 27804
252 962-8000 / www.nhcs.org

March 4, 2015

Dear Ms. Gray,

Thank you for your recent submission to the Nash Institutional Review Committee for your study, *Utility and efficacy of discharge Risk Assessment for Reduction in heart failure 30-day readmissions in a Rural Community Facility.* I am happy to inform you that your research study has been approved by the committee. We look forward to participating in this important collaborative project.

If you have any further questions related to this, please feel free to contact Chris Wood, Director of the Nash Comprehensive Cancer Program at 252-962-8978 or by email at clwood@nhcs.org.

Thank you for this opportunity to participate in this study at Nash Health Care.

Sincerely yours,

Dr. Gordon Mathes

Chairman, Nash Health Care Institutional Review Committee (IRC)

Appendix B

EAST CAROLINA UNIVERSITY
University & Medical Center Institutional Review Board Office
4N-70 Brody Medical Sciences Building· Mail Stop 682
600 Moye Boulevard · Greenville, NC 27834
Office **252-744-2914** · Fax **252-744-2284** · **www.ecu.edu/irb**

Notification of Exempt Certification

From: Biomedical IRB
To: Susan Gray
CC: Candace Harrington
Date: 5/7/2015
Re: UMCIRB 14-002137
Evaluation of Prediction Tool for Heart Failure Readmissions

I am pleased to inform you that your research submission has been certified as exempt on 5/7/2015. This study is eligible for Exempt Certification under category #4.

It is your responsibility to ensure that this research is conducted in the manner reported in your application and/or protocol, as well as being consistent with the ethical principles of the Belmont Report and your profession.

This research study does not require any additional interaction with the UMCIRB unless there are proposed changes to this study. Any change, prior to implementing that change, must be submitted to the UMCIRB for review and approval. The UMCIRB will determine if the change impacts the eligibility of the research for exempt status. If more substantive review is required, you will be notified within five business days.

The UMCIRB office will hold your exemption application for a period of five years from the date of this letter. If you wish to continue this protocol beyond this period, you will need to submit an Exemption Certification request at least 30 days before the end of the five year period.

The Chairperson (or designee) does not have a potential for conflict of interest on this study.

IRB00000705 East Carolina U IRB #1 (Biomedical) IORG0000418
IRB00003781 East Carolina U IRB #2 (Behavioral/SS) IORG0000418

Appendix C

	Ace/Arb	Beta Blocker	Smoker	EF %	Age if < 89 yrs old	Gender	# of Days between Discharge and Follow up visit	# of Days between discharge and readmission	Risk for Readmission Prediction Score if available
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
.									
130									

Code Legend

Ace/ARB
1. Ace Inhibitor
2. ARB
3. None of the Above

Beta Blocker
1. Bisoprolol
2. Carvediolol
3. Metoprolol
4. None of the above

Smoker
1. Yes
2. No
3. Not documented

Gender
1. Male
2. Female

Appendix D

Timeline

1/26/15	DNP power point presentation
2/02/15	Initial meeting with Jill Steward, Nursing Research Council
2/03/15	Established secure R drive with IT representative
2/11/15	Formal presentation to Nursing Research Council
3/04/15	Letter of approval obtained from Institutional Review Committee of NHCS
3/13/15	IRB application submitted
3/24/15	IRB revisions complete
5/07/15	ECU IRB Approval
6/20/15	Chart Review Data Collection Completed
9/09/15	Presentation of DNP project to committee with approval
9/16/15	Presentation of DNP at intensives
12/1/15	Final Paper Approval
12/1/15	Journal Submission

Appendix E

Project Title: Heart Failure Readmissions: Causes, Prediction, Prevention in a Rural Hospital

Private Defense Completed on 9/9/2015

Public Defense Completed on 9/16/2015

Final Project/Final Paper Approval:

As the Chair of this student's Doctor of Nursing Practice Scholarly Project Committee, I have reviewed and approved this student's project and final paper and agree that he/she has met the project expectations, including the DNP Essentials, and has completed the project.

DNP Committee Chair Signature________________ Date 10/24/2015

06/2015 cak