EVALUATING THE EFFECTS OF HEART FAILURE CLINIC ENROLLMENT ON HOSPITAL ADMISSION AND READMISSION RATES: A RETROSPECTIVE DATA ANALYSIS

by

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As members of the DNP Project Committee, we certify that we have read the DNP Project prepared by Patricia M. Veleta entitled "Evaluating the Effects of Heart Failure Clinic Enrollment on Hospital Admission and Readmission Rates: A Retrospective Data Analysis" and recommend that it be accepted as fulfilling the DNP Project requirement for the Degree of Doctor of Nursing Practice.

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Final approval and acceptance of this DNP Project is contingent upon the candidate's submission of the final copies of the DNP Project to the Graduate College.

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STATEMENT BY AUTHOR

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DEDICATION

I would like to dedicate this research project to my friends and family for their unconditional love and support throughout my academic endeavors. I especially would like to thank my Mom, Step-Dad and my two sisters, Paloma and Laura, who have helped care for my children more times than I can count (let alone remember) as I completed my Masters of Science in Nursing and now my Doctorate of Nursing Practice. I would have never been able to complete my graduate school coursework or my clinical rotations without their help. For this, I will be forever thankful. I would also like to thank and dedicate this project to my children Kristopher and Greyson. Thank you for your unconditional love and understanding of the demands of my coursework throughout this rigorous process. May you grow up not to follow in my footsteps but instead take the path next to me and go further than I could have ever dreamt possible.

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ABSTRACT

Heart failure (HF) is a clinical syndrome associated with high morbidity and mortality with a large economic burden, and is the leading cause of hospitalizations among Medicare beneficiaries in the United States. Healthcare reform has focused on strategies to reduce HF readmissions, including outpatient HF clinics.

Purpose: The purpose of this DNP Project was to answer the following question: *In adult patients diagnosed with HF, how does enrollment in the HF clinic, compared to non-enrollment affect hospital admission and readmission rates?*

Methods: A retrospective analysis of 767 unique patients and their 1,014 respective admissions and readmissions was conducted. Continuous and categorical data was analyzed and presented as a mean (M), standard deviation (SD), absolute number (N) and percentage (%). A Pearson Chi Square test was used for categorical variables and Analysis of Variance was used for age and ejection fraction (EF).

Results: Study sample demographics (N=767); age (M=79.72, *SD*=7.48); gender (57.6 % male) and EF (M=0.43, *SD*=0.16) were evaluated. The No HF clinic (No HFC) and HF clinic (HFC) enrollment groups (N=573) were compared for age (M=79.49, SD=7.65) (M=80.39, SD=6.94), male gender (54.6%, 66.5%) and EF (M= 0.44, *SD*=0.17) (M=0.42, *SD*=0.15), respectively. Each sample patient had at least one admission for HF during 2015; of which 573 (46.2%) were in the No HFC group and 194 (8.4%) were in the HFC group ($p< 0.001$). There was no difference in all-cause readmissions between the No HFC group [n=95(14.5%)] and the HFC group [n=37(16.2%)] ($p=0.534$) and no difference in HF-related readmissions between the No HFC group [n=72(11.0%)] and the HFC group [n=23(10.0%)] ($p=0.700$).

Conclusions: This DNP project demonstrated a significant difference in HF admission rates in favor of the HFC group. While no differences were found in all-cause or HF-related readmission rates in No HFC and HFC groups, the rates are less than the national average. Unintended findings were that datasets can be very poorly constructed and populated, resulting in large amounts of unusable data. Recommendations are for more rigor in the organization of datasets to assure accurate comparisons between admission and readmission rates based on enrollment in HF clinics.

CHAPTER 1: INTRODUCTION

Heart failure (HF) has become a major public health problem that currently affects approximately 5.1 million Americans and more than 23 million people worldwide. Despite advancements in clinical management, the morbidity, mortality and hospital readmission rate remains high, imposing a large economic burden (Caboral-Stevens, 2014; Go et al., 2013). As a result of the significant impact of HF on the individual and society, there is an urge toward prevention, early identification, and control through medical regimen adherence. Currently, HF quality improvement initiatives aimed at reducing HF hospital readmissions have included evaluating measures such as timely follow-up visits, tele-monitoring, and to some degree HF clinics. However, paucity in the literature currently exists with respect to multi-disciplinary nurse-run HF clinics and their effects on hospital readmission rates.

Background Knowledge

Heart failure is a complex clinical syndrome occurring from any structural or functional abnormalities in ventricular filling or ejection of blood that can cause cardinal symptoms of dyspnea and fatigue, which may limit physical activity and cause fluid retention in turn causing congestion and edema (Caboral-Stevens, 2014). Because of this complex nature, an official HF diagnosis requires a clinical evaluation incorporating clinical history, physical examination findings, and diagnostic testing results.

Heart Failure Definitions

According to the American College of Cardiology Foundation (ACCF) and the American Heart Association (AHA), heart failure can have various definitions as it occurs from structural and functional abnormalities in ventricular filling or ventricular ejection (Yancy et al., 2013).

The ejection fraction (EF) is often used to differentiate between systolic and diastolic dysfunction and is the percentage of blood pumped out of the left ventricle per minute. It is easily measured by an echocardiogram with normal ranges from 50-85%. However, the current guidelines use the terms *HF with reduced EF* (HFrEF) and *HF with preserved EF* (HFpEF), *HF with preserved EF borderline* (HFpEF-borderline), and *HF with preserved EF improved* (HFpEF-improved) to distinguish between systolic and diastolic HF based on EF measurements (Yancy et al., 2013).

As shown in Table 1 the definitions of heart failure are largely guided by the measured EF. *Heart failure with reduced EF* (HFrEF) is also referred to as systolic HF and is defined as the presence of a clinical HF diagnosis combined with an EF of 40% or less. *Heart failure with preserved EF* (HFpEF) is also referred to as diastolic HF and is defined as the presence of clinical signs and symptoms of HF with evidence of preserved or normal EF and evidence of abnormal LV diastolic dysfunction on an echocardiogram or left heart catheterization. *Heart failure with preserved EF-borderline* (HFpEF-borderline) is defined as the presence of clinical signs and symptoms of HF with an EF between 41-49%. *Heart failure with preserved EF-improved* (HFpEF-improved) is defined as a previously documented reduced EF that has now improved or recovered completely (Yancy et al., 2013).

Knowledge of a patient's EF, ACCF/AHA stage of HF, along with NYHA functional class, is of particular importance as they provide useful and complementary information about the presence and severity of HF. Ejection fraction (EF) can be a useful prognostic indicator of mortality risk. A recent meta-analysis compared survival rates between patients diagnosed with HFrEF and those diagnosed with HFpEF and found that patients diagnosed with HFrEF are at a

higher risk of death when compared to those diagnosed with HFpEF even after adjustments for age, gender, etiology, history of hypertension, diabetes and atrial fibrillation were made (Meta-Analysis Global Group in Chronic Heart Failure [MAGGIC], 2012). Furthermore, the risk of death increased notably when the EF fell below 40% (MAGGIC, 2012).

TABLE 1. *2013 ACCF/AHA Heart Failure Definitions of HFrEF and HFpEF.*

Classification	**EF (%)**	**Description**
HF with reduced ejection fraction (HFrEF)	</= 40%	-Systolic HF -Defined as the presence of a clinical HF diagnosis combined with an EF of 40% or less
HF with preserved ejection fraction (HFpEF)	>/=50%	-Diastolic HF -Defined as the presence of clinical signs and symptoms of HF -Evidence of preserved or normal EF -Evidence of abnormal LV diastolic dysfunction on an echocardiogram or left heart catheterization
HFpEF, borderline	41-49%	-presence of clinical signs and symptoms of HF with an EF between 41-49%
HFpEF, improved	>40%	-Previously documented reduced EF that has now improved or completely resolved

Note. Adapted from "2013 ACCF/AHA guidelines for the management of heart failure: executive summary: a report of the American College of Cardiology Foundation/American Heart Association Task Force on practice guidelines" by Yancy, C. W., Jessup, M., Bozkurt, B., Butler, J., Casey, D. E., Drazner, M. H., ... & Johnson, M. R., 2013, *Journal of the American College of Cardiology*, *62*(16), 1495-1539.

According to Yancy et al. (2013), the ACCF/AHA stages of HF and the NYHA functional classifications provide beneficial and complementary information regarding the presence and severity of HF. The ACCF/AHA stages of HF focus on the development and progression of HF and can be used to describe both individuals and populations. The New York Heart Association Functional Classification (NYHA-FC) is often used to describe exercise capacity and symptomatic status of the disease (Yancy et al., 2013).

As seen in Table 2, the ACCF and AHA classify HF into four stages that depict the progressive nature of the disease (Yancy et al., 2013). *Stage A* includes patients who are at high

risk for HF but without structural heart disease or symptoms of HF. *Stage B* includes patients with structural heart disease but without signs or symptoms of HF. *Stage C* includes patients with structural heart disease who have previously had or currently have symptoms of HF. *Stage D* includes patients with refractory HF signs and symptoms requiring specialized interventions (Yancy et al., 2013).

TABLE 2. *ACCF/AHA Stages of Heart Failure.*

Stage	Description
A	Patients who are at high risk for HF but without structure heart disease or symptoms of HF
B	Patients with structural heart disease but without signs or symptoms of HF
C	Patients with structural heart disease who have previously had or currently have symptoms of HF.
D	Patients with refractory HF signs and symptoms requiring specialized interventions

Note. Adapted from "2013 ACCF/AHA guidelines for the management of heart failure: executive summary: a report of the American College of Cardiology Foundation/American Heart Association Task Force on practice guidelines" by Yancy, C. W., Jessup, M., Bozkurt, B., Butler, J., Casey, D. E., Drazner, M. H., ... & Johnson, M. R., 2013, *Journal of the American College of Cardiology*, *62*(16), 1495-1539.

The New York Heart Association Functional Classification (NYHA-FC) is a widely used tool to evaluate the functional capacity of individuals with clinical diagnosis of HF (Caboral-Stevens, 2014; Yancy et al., 2013). As seen in Table 3, NYHA Class I includes patients who have no limitations of physical activity and ordinary physical activity does not cause symptoms of HF. NYHA Class II includes patients who have slight limitation of physical activity. These patients are comfortable at rest but ordinary physical activity results in symptoms of HF. NYHA Class III includes patients who have a marked limitation of physical activity. These patients are comfortable at rest but less than ordinary activity causes symptoms of HF. Finally, NYHA Class IV includes patients who are unable to carry on any physical activity without symptoms of HF and/or have symptoms of HF even at rest (Yancy et al., 2013).

TABLE 3. *NYHA Functional Classifications.*

Class	Description
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.

Note. Adapted from "2013 ACCF/AHA guidelines for the management of heart failure: executive summary: a report of the American College of Cardiology Foundation/American Heart Association Task Force on practice guidelines" by Yancy, C. W., Jessup, M., Bozkurt, B., Butler, J., Casey, D. E., Drazner, M. H., ... & Johnson, M. R., 2013, *Journal of the American College of Cardiology*, *62*(16), 1495-1539.

As a result of the complex nature of HF, a clinical evaluation with a history, physical examination findings and diagnostic testing results are paramount to determining a HF diagnosis. Diagnosing HFrEF and HFpEF along with determining ACCF/AHA stage of HF along with NYHA functional class provides useful information regarding the presence and severity of HF.

Incidence, Prevalence and Mortality

The number of Americans living with HF in the U.S. is estimated to be 5.1 million with approximately 550,000 new cases diagnosed each year (Go et al., 2014; Dunlay & Roger, 2014). According to Dunlay and Roger (2014), the estimated one-year mortality of HF after initial diagnosis ranges between 25-28%; five years after diagnosis the mortality for HF increases to 48-65%.

Advancing age is a major risk factor for HF. The incidence of HF of 0.3 per 1,000 in patients less than 55 years of age up to 18 per 1,000 in patients 85 years and older and as high as 47 per 1,000 in nonagenarians (Dunlay & Roger, 2014). Not surprisingly, higher incidence rates have been found in studies limited to older populations such as those focused on Medicare beneficiaries. Conversely, lower incidence rates can be found in studies limited to younger

populations. Multiple U.S. studies that included Medicare beneficiaries, patients enrolled in the Henry Ford Health System, participants of the Multi-Ethnic Study of Atherosclerosis (MESA), Atherosclerotic Risk in Communities (ARIC) and the Coronary Artery Risk Development in Young Adults (CARDIA) studies have found that HF affects African-Americans disproportionately compared to Caucasian-Americans (Bahrami et al., 2008; Bibbins-Domingo et al., 2009; McCullough et al., 2002; Loehr et al., 2008). The MESA study examined HF incidence amongst other races and found the highest incidence to be in African-Americans, followed by Hispanics, then Caucasian-Americans, and finally Chinese individuals (Bahrami et al., 2008).

Hospital Readmissions and Economic Burden

Currently, heart failure is the leading cause of hospitalizations among Medicare beneficiaries in the U.S. (Dunlay & Roger, 2014). Patients diagnosed with HF also have the highest 30-day readmission rate over any diagnosis and greater than 50% of patients are readmitted within the same year, often with multiple admissions (Jencks, Williams & Coleman, 2009). Presently, the all-cause readmission rate among Medicare beneficiaries in the U.S. is approximately 23.0% (McIlvennan & Allen, 2014). Every year, there are over 1 million hospitalizations for HF in the U.S. alone (Blecker, Paul, Taksler, Ogedegbe & Katz, 2013). Of the 1 million hospitalizations for heart failure in the U.S. each year, it is estimated that, on average, 18% are readmitted within 30 days, 50% are readmitted within six months and 60% are readmitted within nine months (Smith et al., 2015). Total direct medical costs for patients with HF are $21 billion annually and are expected to increase to $53 billion annually by the year 2030 with hospitalizations accounting for 75% of those costs (Heidenreich et al., 2013). Heidenreich et

al. (2013) also reported the total estimated cost of care in patients living with heart failure in 2012 was approximately $31 billion and with a projected increase to $70 billion by 2030 (Heidenreich et al., 2013). The economic burden arises from productivity losses, healthcare service, and medication costs.

In response to this major economic health problem in the U.S., HF readmissions have been a target within healthcare reform. More specifically, the Hospital Readmissions Reduction Program within the Affordable Care Act required the Center for Medicare and Medicaid Services (CMS) to begin financially penalizing hospitals with higher than expected 30-day readmission rates for HF, pneumonia and acute myocardial infarction (CMS, 2016). According to CMS, a hospital's excess readmission ratio is a measure of a hospital's readmission performance compared to the national average for the hospital's set of patients with that applicable condition (2016). In turn, the excess readmission ratio is calculated for each applicable condition and is used, in part, to calculate the readmission payment adjustment (CMS, 2016). As a result, hospitals and outpatient offices are working diligently to reduce hospital readmissions.

Local Problem

Healthcare systems and providers are challenged to provide care that is safe, effective, patient-centered, timely, efficient and equitable, in an era with rising health care costs and diminishing resources (Committee on Quality, 2001). In efforts to address the national epidemic of HF and its considerable economic burden, I examined and reflected on the current practices within my cardiology group. Currently, I am a Masters prepared Nurse Practitioner in a multi-office, 16 physician, 14 Physician Assistant and 4 Nurse Practitioner cardiology practice with interventional and electrophysiology sub-specialties. We have offices located in the Goodyear,

Glendale, Peoria and Sun City all western suburban cities of Phoenix, Arizona. Our medical staff also provides inpatient care in seven different hospitals that belong to three different hospital organizations.

Our practice has an established Heart Failure Clinic for patients diagnosed with HF. Patients are referred to the clinic by their cardiologist during an office visit or an inpatient hospitalization for new onset HF, an acute exacerbation of their existing HF or a patient diagnosed with HF that needs additional education and help with symptom management. The clinic is optional. The purpose of this nurse run clinic is to empower patients to be active participants in the management of HF by providing disease specific education and also assist in managing their medications to prevent hospital admissions and readmissions (CS Heart Failure Management Patient Information Guide, n.d).

According to the CS Heart Failure Management Patient Information Guide (CSHFMPIG), the HF clinic visit schedule is dependent upon the individual patient's response to educational material and the severity of their illness (n.d). After HF clinic referral and enrollment, patients are assigned to a HF Registered Nurse (HF RN) who the patient will see during one-on-one visits for the duration of their enrollment. The purpose of assigning each patient their own individual HF RN allows for continuity of care and supports positive rapport between patient and HF RN. There are three visit schedule phases within the HF clinic. During *Phase I: Primary education* patients are seen on a biweekly schedule for the first two months and then monthly during the next three months (CS Heart Failure Management Program Guide, n.d). During *Phase II: Maintenance* patients are seen once every three months and during *Phase III: Long-Term Maintenance* patients are seen once every three months indefinitely (CS Heart

Failure Management Program Guide, n.d). Additionally, patients also have the option to enroll in up to five additional HF educational classes taught by a registered nurse that cover topics including *HF explanation, Prognosis, Activity, Medications and Dietary Recommendations* (CS Heart Failure Management Program Guide, n.d).

During these visits the HF RN's utilize practice approved protocols derived from *2013 ACCF/AHA Guidelines for the Management of Heart Failure* including obtaining initial and serial laboratory evaluations, documenting the most recent EF measurement, obtaining body weight and blood pressure during each visit, evaluating and managing the clinical signs and symptoms of fluid overload through diuretic optimization, evaluating activity level, providing continuous education and reinforcement regarding disease management and health related behavioral changes. Additionally, they also ensure that patients are on Guideline Directed Medical Therapy (GDMT) as per the *2013 ACCF/AHA Guidelines for the Management of Heart Failure* consisting of Beta Adrenergic Receptor Blockers (BB), Angiotensin Converting Enzyme Inhibitors (ACEI), HMG-CoA Reductase Inhibitors (Statins), Diuretics, Aldosterone Antagonists (AA), Hydralazine, Isosorbide Dinitrate and Digoxin (2013). Guidelines will be discussed in detail later in this paper.

Last year, the practice saw 16,254 patients. Of those, 3,435 unique patients were diagnosed with HF with 2,303 patients enrolled and seen in our HF clinic and 1,241 patients not enrolled in the HF clinic. However, despite the purpose and goals of our HF clinic, our practice has not conducted a data set statistical analysis to determine if there is a relationship between HF clinic enrollment and hospital admission and readmission rates. Further, I would like to identify the demographic characteristics between the two groups so that in the event a relationship

between HF clinic enrollment and hospital admissions and readmissions is found those enrolled in the HF clinic can be better targeted for future enrollment.

Theoretical Framework

The theoretical framework used to guide this project is Dorothy Orem's Self-Care Theory. Orem's *Self-Care Theory* supports the HF clinics purpose. Orem's theory asserts that nursing is a form of action or interaction between two or more people and individuals should be self-reliant and responsible for their own care (Denyes, Orem, & Bekel, 2001). The HF clinic provides patients with education and knowledge of their ongoing disease process, symptom assessment, prognosis, activity, medications and dietary recommendations. This, subsequently, empowers patients to be active participants in the management of their condition to prevent hospital admissions and readmissions (CS Heart Failure Management Patient Information Guide, n.d). According to Orem, successfully meeting universal and developmental self-care requisites are paramount to primary prevention and further complication of any given disease process. In order to accomplish this, individuals are required to have knowledge of current and potential health problems (Denyes, Orem, & Bekel, 2001).

Purpose of the DNP Project

The purpose of this DNP Project is to examine data that will address the following question: *In adult patients diagnosed with HF is there a relationship between HF clinic enrollment and hospital admission and readmission rates*? Further, I would like to identify demographic characteristics of patients enrolled and not enrolled in the HF clinic.

Intended Improvement

The aims of this project are two-fold. The primary aim of this study is to determine if a relationship between HF clinic enrollment and hospital admission and readmission rates exists. Additionally, I will evaluate the demographic characteristics between both groups. I hope to explore factors associated with hospital admission and readmission rates amongst both groups.

CHAPTER 2: LITERATURE REVIEW

A review of the literature was conducted using PubMed and Google Scholar in order to evaluate current HF clinical practice guidelines and multidisciplinary HF clinics aimed at reducing HF hospital (re)admissions. In both databases, the terms "clinical practice guidelines" or "guidelines" and "heart failure" were utilized. The results were then filtered to include articles published in English, within five years and regarding humans in PubMed. Google Scholar did not allow for filtering of research by language or human subjects. After said filters were applied, this search yielded 1,586 articles in PubMed and 17,300 articles in Google Scholar and of which eight were retained for review. A separate search was conducted for multidisciplinary HF clinics aimed at reducing HF hospital admissions and readmissions. In both databases the terms "heart failure" or "congestive heart failure" or "systolic hear failure" or "diastolic heart failure" and "nurse clinic" were utilized. The results were then filtered to include articles published in English, within five years and regarding human subjects. Google scholar did not allow for filtering of research by language or human subjects. After said filters were applied, this search yielded 39 articles in PubMed and 6,640 in Google Scholar of which nine were retained for review.

2013 ACCF/AHA Guideline for the Management of Heart Failure

According to the ACCF/AHA Guideline for the Management of Heart Failure, the current clinical practice guidelines are meant to assist clinicians in clinical decision making by describing a range of generally acceptable approaches to the diagnosis, management and prevention of specific diseases or conditions (2013). During this most recent update, the term "*guideline-directed medical therapy"* was introduced to represent optimal medical therapy as

defined by the ACCF/AHA guidelines. The ACCF/AHA guidelines go on to define HF, discuss classifications of HF such as the ACCF/AHA stages and NYHA-FC, and discuss the epidemiology and disparities noted with HF, all of which have been previously discussed within this paper (Yancy et al., 2013).

Initial Evaluation Recommendations

The 2013 ACCF/AHA guidelines suggest the initial and serial evaluation of patients diagnosed with and/or presenting with new onset HF include a thorough history and physical examination in order to identify cardiac, non-cardiac disorders or behaviors that might cause or accelerate the development or progression of HF (Class I, LOE C). The use of validated risk scoring tools can be useful in estimated subsequent risk of mortality in ambulatory or hospitalized patients with HF (Class IIa, LOE B) (Yancy et. al, 2013). Initial diagnostic tests to obtain when evaluating a patient with HF signs and symptoms include a complete blood count (CBC), urinalysis (UA), electrolytes, blood urea nitrogen (BUN), creatinine, glucose, fasting lipids, liver function tests (LFT), thyroid stimulating hormone (TSH), electrocardiogram (EKG), chest radiograph and an echocardiogram (Class I, LOE C) (Yancy et al., 2013). A B-type natriuretic peptide (BNP) or NT-proBNP are useful diagnostic labs that may support clinical decision making regarding the diagnosis of HF in the setting of clinical uncertainty in patients presenting with shortness of breath and also to establish prognosis for disease severity in both outpatient and inpatient settings (Class I, LOE A) (Yancy et al., 2013). Additionally, BNP or NT-proBNP can be useful in achieving optimal dosing of GDMT in patients who are clinically euvolemic and are followed in a well-structured HF disease management program (Class IIa/LOE B) (Yancy, et al., 2013). The *2013 ACCF/AHA Guidelines for the Management of Heart*

Failure suggest screening for hemochromatosis, HIV, rheumatologic disease, amyloidosis, and pheochromocytoma in patients presenting with HF signs and symptoms in whom there is a clinical suspicion of these diseases (Class IIa/LOE C).

Noninvasive cardiac imaging is suggested for initial HF diagnosis as mentioned above. Additionally, a repeat echocardiogram is suggested in patients who have had significant changes in clinical status, experienced or recovered from a clinical event, received GDMT that might have had a significant effect on cardiac function or in patients who may be candidates for device therapy (Class I, LOE C) (Yancy et al., 2013). Non-invasive imaging such as radionuclide venticulography or Magnetic Resonance Imaging (MRI) to detect myocardial ischemia and viability is reasonable in patients presenting with new onset HF who also have coronary artery disease without the presence of angina, unless the patient is not eligible for revascularization of any kind (Class IIA/LOE C) (Yancy et al., 2013).

Stage A Recommendations

According to the *2013 ACCF/AHA Guidelines for the Management of Heart Failure*, pharmacotherapy is based on the individual patient's HF stage and comorbid conditions. For patients in Stage A, (patients who are at risk for HF but without structural heart disease or symptoms of HF) it is recommended that HTN and HLD should be controlled in accordance with contemporary guidelines in order to decrease the risk of HF (Class I/LOE A) (Yancy et al., 2013). Additionally, other conditions that may lead to HF, such as, obesity, diabetes, tobacco use or other known cardiotoxic agents should be controlled or avoided (Class I, LOE C) (Yancy et al., 2013).

Stage B Recommendations

Patients in Stage B (structural heart disease without signs or symptoms of HF) have recommendations for pharmacotherapy, which includes a Beta Blocker (BB) for all patients with history of myocardial infarction (MI) or acute coronary syndrome (ACS) or anyone with a decreased LVEF in order to reduce mortality (Class I, LOE B) (Yancy et al., 2013; HFSA, 2010; Caboral-Stevens, 2014; Kaldara, Sanoudou, Adamopoulos and Nanas, 2015). Additionally, an angiotensin converting enzyme inhibitor (ACEI) or Angiotensin II Receptor Blocker (ARB) (if ACEI intolerant) should be prescribed to all patients with history of MI, ACS or anyone with decreased LVEF in order to prevent symptomatic HF and also to reduce mortality (Class I, LOE A) (Yancy et al., 2013; HFSA, 2010; Caboral-Stevens, 2014; Kaldara, Sanoudou, Adamopoulos & Nanas, 2015). Statins should be used in all patients with history of MI or ACS to prevent symptomatic HF and cardiovascular events (Class I, LOE A) (Yancy, et al, 2013). It is also recommended that blood pressure be controlled in accordance to clinical practice guidelines for hypertension to prevent symptomatic HF in patients with structural cardiac abnormalities in absence of MI or ACS (Class I, LOE A) (Yancy et al. 2013). An internal cardio-defibrillator (ICD) is reasonable in patients with asymptomatic ischemic cardiomyopathy who are at least 40 days post MI and have an EF of < 30%, are on appropriate medical therapy and have a reasonable expectancy of survival with good functional status (Class IIa, LOE B) (Yancy et al., 2013).

Stage C Recommendations

Nonpharmacological interventions. According to the *2013 ACCF/AHA Guidelines for the Management of Heart Failure,* patients with Stage C (structural heart disease who have

previously had or currently have symptoms of HF) should receive HF specific education to facilitate self-care (2013). Exercise training or regular physical activity is recommended to patients who are able to participate in order to improve functional status (Yancy et al., 2013). Sodium restriction is a reasonable recommendation for patients with symptomatic HF in order to decrease congestive symptoms (Class I, LOE A) (Yancy et al., 2013). Continuous positive airway pressure (CPAP) ventilation is recommended in patients with concurrent obstructive sleep apnea and HF in order to increase LVEF and improve functional status (Class IIa, LOE B) (Yancy et al., 2013). Cardiac rehabilitation is recommended in clinically stable patients with HF to improve functional capacity, exercise duration, health related quality of life and mortality (Class IIa, LOE B) (Yancy et al., 2013).

Pharmacological interventions for Stage C HFrEF. According to the *2013 ACCF/AHA Guidelines for the Management of Heart Failure*, patients with Stage C who also have HFrEF (EF of </= 40%), measures listed as Class I recommendations for patients stage A and B, are recommended, where appropriate, for patients in stage C (Yancy et.al). The mainstay of pharmacologic therapy for HFrEF should be GDMT as depicted in Figure 1 (Yancy et al., 2013). Diuretics are recommended in patients with evidence of fluid retention and with HFrEF, unless contraindicated (Yancy et al., 2013). ACEI are recommended for Stage C patients with HFrEF, unless contraindicated, in order to reduce morbidity and mortality (Class I, LOE A) (Yancy et al., 2013). ARB therapy is recommended in Stage C patients with HFrEF who: are ACEI intolerant in order to reduce morbidity and mortality (Class I, LOE A), as an alternative first line therapy for patients who are already taking ARBs for other indications in order to reduce morbidity and mortality (Class IIa, LOE A) and as an addition to ACEI therapy in patients who

are persistently symptomatic and are already being treated with ACEI and BB in whom an aldosterone antagonist (AA) is not indicated or tolerated (Class IIb, LOE A).

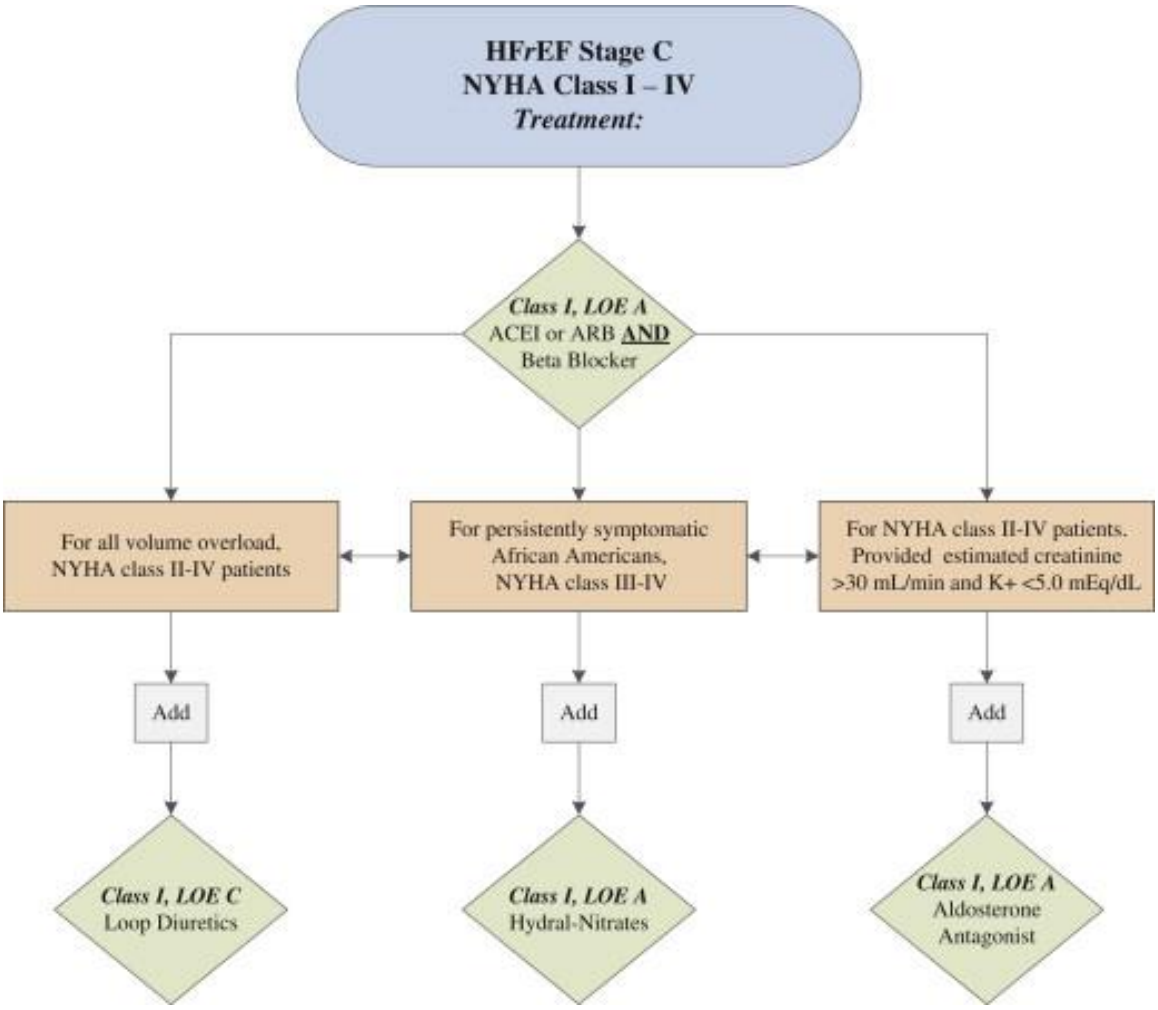

FIGURE 1. Guideline Directed Medical Therapy.
Stage C HF*r*EF: evidence-based, guideline-directed medical therapy. ACEI indicates angiotensin-converting enzyme inhibitor; ARB, angiotensin-receptor blocker; HF*r*EF, heart failure with reduced ejection fraction; Hydral-Nitrates, hydralazine and isosorbide dinitrate; LOE, Level of Evidence; and NYHA, New York Heart Association. Adapted from "2013 ACCF/AHA guidelines for the management of heart failure: executive summary: a report of the American College of Cardiology Foundation/American Heart Association Task Force on practice guidelines" by Yancy, C. W., Jessup, M., Bozkurt, B., Butler, J., Casey, D. E., Drazner, M. H., ... & Johnson, M. R., 2013, *Journal of the American College of Cardiology*, *62*(16), 1495-1539.

Beta-blocker (BB) therapy with either bisoprolol, carvediolol or metoprolol succinate is recommended for all patients with Stage C with HFrEF, unless contraindicated, in order to

reduce morbidity and mortality (Yancy et al., 2013). Aldosterone antagonists (AA) or mineralocorticoid receptor antagonists (MRA) are recommended in patients with Stage C with HFrEF and a LVEF < 35% and NYHA class II-IV in order to reduce morbidity and mortality (Class I, LOE A) (Yancy et al., 2013). In patients who are NYHA class II, in order to be considered for AA, these patients should have a prior cardiovascular hospitalization or have an elevated BNP (Yancy et al., 2013). Patients receiving AA or MRA therapy should have a Cr level < 2.5mg/dl in men and <2.0mg/dL in women with potassium < 5.0mEq/L and should have close monitoring of renal function and electrolytes in order to reduce risk of hyperkalemia or renal insufficiency (Class I, LOE A) (Yancy et al., 2013). Additionally, AA or MRA are also recommended in patients following an acute MI who have an EF of </= 40% and who develop signs or symptoms of HF or have a history of DM, unless contraindicated (Class I, LOE B) (Yancy et al., 2013). Hydralazine and isosorbide dinitrate is recommended for self-described African Americans with NYHA III-IV with HFrEF receiving optimal therapy with ACEI and BB in order to reduce morbidity and mortality, unless contraindicated (Class I, LOE A) (Yancy et al., 2013). It can also be used in patients with Stage C HF with HFrEF who are cannot receive ACEI or ARB due to intolerance, renal insufficiency or hypotension in order to reduce morbidity and mortality, unless contraindicated (Class IIa, LOE B) (Yancy et al., 2013). Digoxin is recommended in patients with HFrEF to decrease hospitalizations for HF, unless contraindicated (Class IIa, LOE B) (Yancy et al., 2013). Omega-3 polyunsaturated fatty acid supplementation is recommended in patients with HFrEF and HFpEF with NYHA class II-IV symptoms in order to reduce mortality and cardiovascular hospitalizations, unless contraindicated (Class IIa, LOE B)

(Yancy et al., 2013). Device therapy for Stage C HFrEF will not be discussed in this paper as it is beyond the scope of this DNP project.

Pharmacological interventions for Stage C HFpEF. According to the *2013 ACCF/AHA Guidelines for the Management of Heart Failure*, in patients with Stage C, who also have HFpEF (EF of >50%), it is recommended that both systolic and diastolic blood pressure is controlled in agreement with published clinical practice guidelines in order to prevent morbidity (Class I, LOE B) (Yancy et al., 2013). In patients with volume overload, diuretics can be used for symptom relief (Class I, LOE C) (Yancy et al., 2013). In patients with HFpEF and coronary artery disease, coronary revascularization is reasonable in when angina or ischemia is thought to be having an adverse effect on symptomatic HFpEF despite GDMT (Class IIa, LOE C) (Yancy et al., 2013). In patients with symptomatic HFpEF, management of atrial fibrillation according to published clinical practice guidelines is reasonably recommended to help improve symptoms (Class IIa, LOE C) (Yancy et al., 2013). The use of BB, ACEI and ARB for blood pressure control is reasonable for patients with concurrent HFpEF (Class IIa, LOE C) (Yancy et al., 2013). In patients with HFpEF, the use of ARBs may be considered to decrease hospitalizations (Class IIb, LOE B) (Yancy et al., 2013).

Stage D Recommendations

According to the *2013 ACCF/AHA Guidelines for the Management of Heart Failure*, patients with Stage D (recall these are patients with refractory signs and symptoms of HF requiring specialized interventions), should be placed on a fluid restriction of 1.5-2.0L daily in order to reduce congestive symptoms (Class IIa, LOE C) (Yancy et al., 2013).

Inotropic support. Patients with cardiogenic shock should receive temporary intravenous inotropic support to maintain systemic perfusion and preserve end-organ performance until definitive therapy (coronary revascularization, mechanical circulatory support or transplant) or resolution of the acute precipitating problem has occurred (Class I, LOE C) (Yancy et al., 2013). In patients with stage D HF refractory to GDMT and device therapy, who are eligible and awaiting mechanical circulatory support or cardiac transplantation, continuous intravenous inotropic support is reasonable as bridge therapy (Class IIa, LOE B) (Yancy et al., 2013). In hospitalized patients with severe systolic dysfunction, who present with hypotension and significantly depressed cardiac output, short-term, continuous intravenous inotropic support may be reasonable in order to maintain systemic perfusion and preserve end-organ performance (Class IIb, LOE B) (Yancy et al., 2013). In select patients with Stage D HF despite optimal GDMT and device therapy who are ineligible for mechanical circulatory support or cardiac transplantation, long-term continuous intravenous inotropic support may be considered as palliative therapy for symptom support (Class IIb, LOE B) (Yancy et al., 2013). Indications for mechanical circulatory support and cardiac transplantation will not be discussed in this paper as they are beyond the scope of this DNP project.

Multidisciplinary Heart Failure Clinics

A literature search was conducted in PubMed and Google Scholar in order to evaluate current trends outpatient HF clinics. Specifically, I was interested to see if there was any established literature on outpatient multidisciplinary HF clinics aimed at reducing HF hospital admissions and readmissions. This literature search demonstrated the lack of studies that exist with respect to multi-disciplinary nurse-run HF clinic providing comprehensive heart failure care

based on the current guidelines and their effects on hospital admission and readmission rates. The literature search conducted did reveal that HF quality improvement initiatives aimed at reducing hospital readmissions have included measures such as nurse-led home and clinic visits, nurse practitioner facilitated and multi-disciplinary HF group clinic appointments on self-care skills, nurse-led titration clinics, timely follow-up visits, and tele-monitoring and structured telephone support. Those studies will be discussed in further detail.

In a randomized control trial conducted in Australia, Nurse-led Intervention for Less Chronic Heart Failure (NIL-CHF), Stewart et al. (2014) examined the effectiveness of a long-term, nurse-led, multidisciplinary program of home and clinic visits on preventing progressively worsening cardiac dysfunction in individuals at risk for developing new onset chronic heart failure. They hypothesized that a structured, nurse-led, hybrid home and clinic-based intervention program would: prevent progressive cardiac dysfunction and significantly reduce incident CHF hospitalizations or all-cause mortality in hospitalized individuals >45 years of age with overt cardiovascular disease (but not CHF) and the intervention would be superior to standard care in reducing cardiovascular related hospital admissions (Stewart et al., 2014). The NIL-CHF nurse led intervention encompassed both short term and long-term interventions. The short-term intervention included a detailed home visit at 7-14 days and a clinic-based visit at 30-days post-hospital discharge that focused on collecting information to determine the clinical stability and optimal management of the patient (Carrington & Stewart, 2010). Based on the information obtained in the aforementioned assessments an individualized, sliding-scale program of intervention focused on clinical stability, risk factor profile and targeted therapy to achieve maximal cardiac, renal and neurological protection was developed (Carrington & Stewart, 2010).

Additionally, patients received gold standard pharmacological and non-pharmacological therapy, enhanced surveillance and facilitated access to a cardiac nurse and self-care behaviors were promoted (Carrington & Stewart, 2010). The long-term intervention included an annual clinic-based reassessment of clinical management targets, cardiac, renal and neurological status in addition to a home visit following any cardiovascular disease-related hospital readmission (Carrington & Stewart, 2010).

Stewart et al. (2014) found the nurse-led intervention of home and clinic visits was ineffective in preventing chronic heart failure and re-hospitalization. It was, however, associated with reduced hospital stay and improved long-term cardiac function (Stewart et al, 2014).

The *Self-Management and Care of HF through Group Clinics Randomized Control Trial* (SMAC-HF) evaluated the effects of nurse practitioner facilitated, multi-disciplinary HF group clinic appointments on self-care skills and re-hospitalizations among high-risk HF patients (Smith et al., 2015). Patients were randomized to a group clinic or standard care. The intervention included five clinic appointments for 4-8 patients recently discharged from the hospital. This intervention was based on the Chronic Care Model, which emphasizes engaging patients in self-management relationships with multidisciplinary professionals (Smith et al., 2015). During the group appointments, patients were educated on how to complete daily self-monitoring diaries, which included areas to document daily weight, fluid intake, sodium intake, physical activity, emotions and HF symptoms (Smith et al., 2015). Patients also viewed and discussed a five-part digital videodisc (DVD) series that illustrated HF patients using the national ACCF/AHA guideline-based HF self-management strategies (Smith et al., 2015). A single DVD from the series, which focused on different self-management topics, was shown at each

appointment and subsequently discussed with the multi-disciplinary professionals. They found the intervention to be associated with improvements in HF self-care knowledge and home care behavior skills in managing their HF. Subsequently, better self-care was associated with reductions in heart failure related readmissions (Smith et al, 2015). Their analysis demonstrated a 33% reduction in the readmission rate (incidence rate ratio, 0.67) associated with the intervention group when compared with control group in the 12-month period that followed the study (p = 0.04). Smith et al. (2015) assert that building patient's self-care skills and knowledge with regard to HF, recognition of HF symptoms and managing their discouragement related to HF should be intervention strategies used to reduce HF related (re)admissions.

A prospective randomized controlled trial completed in Australia evaluated the effectiveness of a nurse-led titration clinic, led by a nurse specialist with cardiologist support in a CHF clinic, versus usual care, through their primary care provider, in improving the time required for patients to reach optimal doses of BB agents (Driscoll, Srivastava, Toia, Gibcus & Hare, 2014). The sample consisted of a prospective cohort of 28 patients who were randomized over six months to either the nurse led titration clinic or usual care. The primary endpoint of this study was time to maximal BB blocker dose and a secondary end-point of the proportion of patients reaching target BB dose within six months (Driscoll et al., 2014). Driscoll et al. (2014) found the nurse-led titration clinic improves optimization of BB therapy through an increasing proportion of patients reaching target dose and facilitating rapid up-titration of BB therapy in patients with HFrEF (p <0.0005).

In a systematic review and meta-analysis, Inglis, Clark, McAlister, Stewart and Cleland examined the effects of structured telephone support (STS) or tele-monitoring (TM) on primary

outcomes of all-cause mortality, all-cause hospitalizations and HF-related hospitalizations with secondary outcomes of cost, length of stay and quality of life in patients diagnosed with HF (2011). Inglis et al. (2011) identified 25 peer-reviewed publications of which 16 studies evaluated STS with two evaluating both STS and TM in separate intervention arms compared with usual care, and 11 studies evaluated TM. Structured telephone support is defined as monitoring and/or self-care management delivered via telephone technology but data may have been collected and stored in a computer (Inglis et al., 2011). Whereas, TM is defined as digital/broadband/satellite/wireless or blue-tooth transmission of physiologic data such as an EKG, blood pressure, weight, pulse oximetry, respiratory rate to name a few (Inglis et al., 2011). The term "all cause hospitalization" was defined as a hospitalization for any cause. The terms "HF related hospitalization" and "all-cause mortality" were not defined. The meta-analysis found that tele-monitoring reduced all-cause mortality {risk ratio (RR) 0.66 [95% confidence interval (CI)] 0.54-0.81, $p < 0.0001$}. Structured telephone support showed a similar trend though not significant {RR 0.99 [95% (CI)] 0.76-1.01, $p = 0.08$}. Both TM {RR 0.79 [95% (CI)] 0.67-0.94, $p = 0.008$} and STS {RR 0.77 [95% (CI)] 0.68-0.87, $p < 0.0001$} demonstrated a reduction in HF-related hospitalizations (Inglis et al., 2011). Additionally, both TM and STS improved quality of life, reduced costs and were acceptable to patients (Inglis et al., 2011).

Kashiwagi, Burton, Kirkland, Cha and Varkey (2012) conducted a retrospective analysis of patients discharged from a tertiary care academic medical center evaluated the relationship between timely outpatient follow-up appointments and unplanned readmissions. The sample size included 1044 patients who were discharged home; of which 518 (49.6%) patients scheduled a 14-day follow-up, 52 (4.9%) patients scheduled a follow-up at 15 days or greater and 474

(45.4%) patients had no scheduled follow-up. They found no statistically significant difference in 30-day readmission rates when comparing patients who followed up within 14 days of discharge and those who followed up 15 days or longer following their discharge (p=0.36) (Kashiwagi et al., 2012). There was no difference found between patients who followed up within 14 days and those with no follow-up (p= 0.75) (Kashiwagi et al., 2012). They did not find a significant difference between patients who followed up 15 days or more following their discharge and those with no follow-up (p=0.25) (Kashiwagi et al., 2012). In this study, one can conclude there is no relationship between hospital readmission and follow-up within 14 days, 15 days or greater and no follow-up at all.

The *Tele-monitoring in the Management of Heart Failure Study* (TEMA-HF1) examined the effect of a tele-monitoring facilitated collaboration between general practitioners and a heart failure clinic and mortality and re-hospitalization rates (Dendale et al., 2012). One hundred and sixty five patients diagnosed with HF were randomized to six months of intense follow-up facilitated by tele-monitoring or usual care. Patients assigned to the TM group measured and reported daily body weight, blood pressure and heart rate on electronic devices that transferred the data automatically to an online database with automatic email alerts generated to the general practitioner and the HF clinic when previously defined limits were exceeded (Dendale et al., 2012). Dendale et al. found a significant difference in all-cause mortality in favor of the TM group when compared to the UC group (p= 0.01) (2012). Additionally, they found the number of hospitalizations for heart failure per patient showed a trend in favor of the TM group, though not significant (Dendale et al., 2012).

The literature search conducted demonstrated HF quality improvement initiatives aimed at reducing hospital readmissions included measures such as nurse-led home and clinic visits, nurse practitioner facilitated and multi-disciplinary HF group clinic appointments on self-care skills, nurse-led titration clinics, timely follow-up visits, and tele-monitoring and structured telephone support. The NIL-CHF study demonstrated that individualized patient management programs, gold-standard pharmacological therapy and non-pharmacological, enhanced surveillance, facilitated access to nurse and promotion of self-care behaviors was associated with decreased hospital stays (Stewart et al., 2014). The SMAC-HF Trial demonstrated a 33% reduction in readmission rate ($p=0.04$) through evaluation of group clinic appointments focused on self-care skills such as self-monitoring diaries, weight, fluid intake, NA, activity, emotions and HF signs and symptoms (Smith et al., 2015). Another study found that patients enrolled in a nurse-led clinic improved optimization of BB therapy through an increased number of patients reaching BB target dose and facilitation of rapid up-titration of BB therapy in patients with HFrEF (Driscoll et al., 2014). Inglis et al. (2011) conducted a meta-analysis that evaluated the effects structured telephone support vs tele-monitoring on all-cause mortality, all cause hospitalization and HF related hospitalizations. Inglis et al. (2011) found that tele-monitoring reduced all-cause mortality, both tele-monitoring and structured telephone support demonstrated a reduction in HF related hospitalizations and improved quality of life, reduced costs and were acceptable to patients. Kashiwagi et al., (2012) found no relationship between hospital readmission and follow-up within 14 days, 15 days or greater and no follow-up at all. The TEMA-HF1 study examined the effect of tele-monitoring facilitated collaboration between general practitioners and a HF clinic on mortality and re-hospitalization rates and found a

significant difference in all-cause mortality in favor the TM group when compared to the UC group (Dendale et al, 2012). They also found the number of hospitalizations for HF per patient demonstrated a trend in favor of the TM group, though not significant (Dendale et al., 2012).

Despite these findings, paucity in the literature exists with respect to multi-disciplinary nurse-run HF clinics that provide comprehensive heart failure care based on the current *2013 ACCF/AHA Guidelines for the Management of Heart Failure* and their effects on hospital admission and readmission rates.

CHAPTER 3: METHODS

The *Plan, Do, Study, Act* (PDSA) Cycle is a framework for conducting quality improvement projects and served as the framework for the phases in this project. PDSA cycles provide a structure of iterative testing of changes in order to improve the quality of healthcare systems (Taylor et al., 2014). According to Taylor et al., (2014) the PDSA cycle provides a pragmatic scientific method for testing changes in complex systems. As seen in Figure 2, four stages mirror the scientific experimental method that includes formulating a hypothesis, collecting data to test this hypothesis, analyzing and interpreting the results and making inferences to iterate the hypothesis (Taylor et al., 2014).

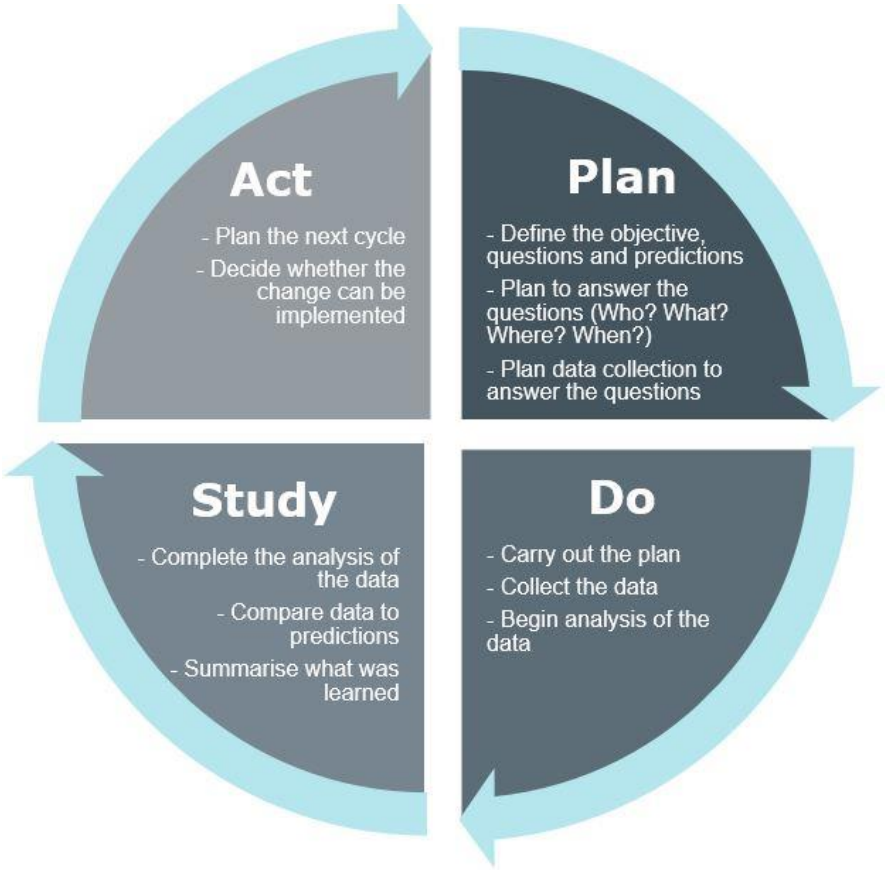

FIGURE 2. PDSA Cycle.
(Adapted from "Quality Improvement-A Clinical Analysis" (2014). Retrieved from https://clarity.co.uk/quality-improvement-a-clinical-analysis/)

The *Plan* phase of this PDSA cycle has included: completing a literature review; drafting a proposal to the cardiology practice administrative team; meeting with the Manager of Clinical outcomes to discuss current data collection processes; obtaining practice specific data with regard to size, HF diagnosis and HF enrollment data; obtaining permission to conduct my DNP project in my practice setting. The *Do* phase was the acquisition of data in the form of a dataset that was prepared and populated by the practice manager of clinical outcomes. The *Study* phase included re-coding the data set, data analysis and interpretation. The *Act* phase included a final findings report and presentation to the administrative team, physicians, nurse practitioners and physician assistants of the group. In the event that a significant difference is found in readmissions between patients who participate in HF clinic and those who do not, the PDSA cycle will repeat itself with plans to target an increase in enrollment.

The following section includes a description of the ethical issues, setting, describing the intervention, planning the study of the intervention, methods of evaluation and analysis. Furthermore, it includes the way in which the data was obtained and managed, and human subject's protection.

Ethical Issues

This project seeks to identify if there is a difference in hospital admission and readmission rates between patients enrolled in the practice's HF clinic and those who are not enrolled. This will be completed via a secondary analysis of a dataset collected and compiled by the practice's clinical outcomes manager during 2015. The dataset includes demographic and clinical information that was used for analysis by the practice. The author of this DNP project will have no contact or interaction with the individuals in the dataset.

Protection of Human Subjects

This DNP project was approved by the human subject protection program from the University of Arizona Institutional Review Board prior to dataset acquisition, evaluation and analysis. There were no known risks to patients and all information acquired, evaluated and analyzed was treated in an anonymous and confidential manner. The research study involved only a retrospective data analysis of the parent data set and no patients, family members or providers were recruited. The parent data set contained de-identified raw data that was collected by my practice over the year 2015 regarding heart failure admissions, readmissions and heart failure clinic enrollment. The author of this DNP project has no conflicts of interest to disclose.

Setting

The setting for this DNP Project is a multi-site cardiology practice with interventional and electrophysiology sub-specialties with 16 physicians, 14 Physician Assistants and three Nurse Practitioners. There are offices located in Goodyear, Glendale, Peoria and Sun City West; all western suburban cities of Phoenix, Arizona. Additionally, the medical staff provides inpatient cardiology, interventional cardiology, and electrophysiology care in seven different hospitals that belong to three different hospital organizations.

Describing the Intervention

Given the complexity of HF, the practice providers decided to establish a multi-disciplinary nurse-run with the purpose and intention to empower patients to be active participants in the management of HF by providing disease specific education and assist in managing their medications to prevent hospital admissions and readmissions (CS Heart Failure Management Patient Information Guide, n.d.). Patients are referred to the clinic by their

cardiologist during an office visit or an inpatient hospitalization for new onset HF, an acute exacerbation of their existing HF, or a patient diagnosed with HF that needs additional education and help with symptom management. The clinic is optional. The intervention, enrollment in the HF clinic, has been ongoing in the practice and was implemented during an earlier quality improvement project at the cardiology practice. This DNP Project builds upon and evaluates the prior QI project via a *PDSA* cycle and will focus on analyzing the parent dataset collected over the year 2015 concerning HF admissions, clinic enrollment, and patient demographics. The planning phase of this *PDSA* cycle has included: completing a literature review; requesting and obtaining permission to conduct a DNP project in my practice setting from the cardiology practice administrative team; meeting with the manager of clinical outcomes to discuss data collection process; and obtaining practice specific data with regard to practice size, patients diagnosed with HF and HF clinic enrollment data.

Planning the Study of the Intervention

A descriptive study design was selected to evaluate the relationship between HF clinic enrollment on hospital admission and readmission rates. After receiving human subject protection approval from the University of Arizona Institutional Review Board, the de-identified data set was provided by the practice.

Currently, the practice employs a Registered Nurse who functions as the clinical outcomes manager. She collects data for the practice regarding HF admissions, clinic enrollment and patient demographics. She collects this data via multiple methods to ensure HF admission and readmission data is not missed. The first approach to HF data collection is through daily surveillance of our billing software. During this surveillance, she examines the diagnoses entered

for billing and the reason for cardiology consultation. During this evaluation, if the reason for cardiology consultation includes orthopnea, PND, edema or dyspnea (cardinal signs and symptoms of HF) then the cardiology consultation, discharge summary and final cardiology progress notes are reviewed to determine if in fact said admission was in fact HF related. Any patient who is seen in our office as a follow up visit, yearly visit, or in any of our clinics (Pro-Time, Amiodarone, Multaq, HF, Lipid) is asked whether they have had a hospitalization since their previous visit. The answer is recorded in the medical record. A *yes* answer to this question is auto-populated into a list via the electronic medical record so that the admission can be further researched.

The dataset was compiled and collected by the practice's clinical outcomes manager. The dataset includes the following variables: subject ID, age, gender, initial chief complaint, Length of stay (LOS), final diagnosis per cardiology consultation note, diagnoses entered in our billing software program, index admission, readmission, insurance type, HF clinic enrollment, primary cardiologist, hospital of admission, follow-up compliance, EF and NYHA FC.

Analysis

The practice currently has a clinical outcomes manager that has collected and compiled a dataset with regard to HF, hospital admissions, and readmission rates. However, the clinic providers have not conducted an analyses of the dataset to determine if a relationship exists between HF clinic enrollment and hospital admission and readmission rates exists between patients enrolled in the HF clinic versus those who are not enrolled. Further, demographic characteristics between the two groups have not been examined.

The dataset was collected and complied into an Excel spreadsheet for the year 2015 by the clinical outcomes manager of the practice. After receiving the data set it required extensive recoding within excel in order for the data to be analyzed. For example, the fields did not contain numerical values which could be easily interpreted by excel or SPSS. Instead, the majority of the variable fields for each individual patient included narrative information, which then had to be re-coded as a numerical value for ease of interpretation. Another example is the term "end-stage" which was found in at least three different places: the reason for admission, reason for not being in the clinic and in the notes section at the very end of the data set. A new column for this variable was created and each subject ID entry was evaluated to see if the term was present and this was recoded into a numerical value and entered in the end-stage column. Another example occurred in the hospital of admission column. This column had actual hospital names, hospital abbreviations with often multiple abbreviations for one hospital. All of those entries were re-coded to a single numerical value for each hospital and each hospital only had one possible value. Statistical analyses were completed using excel and SPSS. In an effort to be consistent with prior HF research and the decision for a 95% confidence interval, significance was accepted at the level of $p \leq 0.05$. Continuous data is presented as mean (standard deviation). Categorical data is presented as an absolute number (%).

The hospital admission outcome variables reported in this study include length of stay, HF admissions, all-cause readmission, HF-related readmission, and deceased during admission and alert flags. Length of stay is defined as the total number of days for which the patient was admitted. The term HF admission is defined as an admission that was HF-related. All-cause readmission is defined as a readmission that occurred for any reason within 30 days following

the previous admission discharge date. A HF-related readmission is defined as a readmission for HF that occurred within 30 days following the previous admission discharge date. Deceased during admission means that the patient died during their admission for HF. An alert flag is a pop-up alert that is placed in the patient electronic chart to indicate the patient has had a previous HF admission and is high risk for readmission.

Patient outcomes variables included deaths as of March 2016 and EF improved during study period. The term deceased as of March 2016 is defined as patients who were deceased when the data set was received. The term EF improved during study period is based on a comparison of lowest recorded EF with the latest recorded EF on echo during 2015.

Inclusion and Exclusion Criteria

After the data set underwent extensive recoding within excel in order for the data to be analyzed, the individual patient admissions documented were evaluated for relevance to this DNP project. The data set initially contained 1,729 patient admissions, this included admissions that were not HF related and those were subsequently excluded. Additionally, the parent dataset also contained admissions for patients < 65yrs of age. Since the current emphasis on reducing hospital readmissions surrounds Medicare beneficiaries, due to decreased reimbursement for excess readmissions by CMS, patients less than 65 years of age were also excluded. This left a total sample size of 767 patients and their respective 1,014 admissions and readmissions.

Not every unique patient had a value for every variable recorded. However, in efforts to preserve a meaningful data set sample for analysis, patients that did not have a value for every variable in the data set were not excluded. Analyses for this DNP Project are based on the total values available for each variable and are noted and disclosed in each table.

CHAPTER 4: RESULTS

Demographics

The baseline characteristics and clinical profile of the sample are summarized in Table 4. The data set included 767 unique patients, the mean age is 79.72 (*SD*=7.48) and 57.6 % are male with a mean EF of 0.43 (*SD*=0.16). The No HFC group mean age is 79.49 (*SD*=7.65) and 54.6% are male with mean EF of 0.44 (*SD*=0.17). The HFC group mean age is 80.39 (*SD*=6.94) and 66.5% are male with a mean EF of 0.42 (*SD*=0.15).

A total of 39 patients were categorized as *End Stage Disease* meaning that these patients had end-stage HF, end-stage renal disease or were enrolled in hospice care. Thirty-four (6.0%) were in the No HFC group and five (2.6%) were in the HFC group. There was no difference between the two groups in this category (*p*=0.066).

The highest documented NYHA-FC in 2015 was utilized for this value and was available for 470 patients. The NYHA-FC was available for 293 patients in the No HFC group and 177 patients in the HFC group. The No HFC group (n=293) had 46 (15.7%) patients designated as Class I, 152 (51.9%) patients designated as Class II, 89 (30.4%) patients were designated as Class II and 6 (2.0%) were designated as Class IV. The HFC group (n=177) had 26 (14.7%) patients designated as Class I, 70 (39.5%) patients designated as Class II, 74 (41.8%) patients were designated as Class II and 7 (4.0%) were designated as Class IV. There was a significant difference between these groups (*p*=0.026).

The EF value was based on the earliest recorded values on an echocardiogram in 2015 and was available for 526 patients. The EF value was available for 378 patients in the No HFC group and 148 patients in the HFC group. The No HFC clinic group (n=378) had 23 (6.1%)

patients with an EF < 20%, 143(37.8%) patients with an EF of 20-40%, 23 (6.1%) patients with an EF of 41-49% and 189 (50%) had an EF >50%. The HFC group (n=148) had eight (5.4%) patients with an EF < 20%, 65 (43.9%) patients with an EF of 20-40%, 16 (10.8%) had an EF of 41-49% and 59 (39.9%) had an EF > 50%. There was no difference between these two groups (p=0.086).

Diastolic dysfunction (DD) grades are based on the earliest recorded DD grade on an echocardiogram in 2015. A Diastolic Dysfunction grade was available for 177 patients, of which 134 were in the No HFC group and 34 were in the no HFC clinic group. The No HFC group (n=134) had 18 (13.4%) patients with no DD, 69 (51.5%) patients had Grade I DD, 27 (20.1%) patients had Grade II DD and 20 (14.9%) had Grade III DD. The HFC group (n=43) had 12 (27.9%) patients with no DD, 23 (53.5%) patients had Grade I DD, 5 (6.0%) patients had Grade II DD and three (7.0%) patients had Grade III DD. There was no difference between these groups (p=0.074).

Seventy five patients had both DD and an EF < 50% of which 57 (42.5%) patients were in the No HFC group and 18 (41.9%) were in the HFC clinic group (p=0.938). There was no difference between these two groups.

The baseline characteristic *reasons for not enrolling in clinic* was measured for each hospital stay because patients could have been enrolled in the HFC during some hospitalizations and not others (n=320). Reasons listed for not enrolling in the HFC included: patient refusal [n=89 (27.8%)], insurance did not cover the cost of the clinic [n=53 (16.6%)], out of pocket or copay cost was too high [n=5 (1.6%)], no outpatient follow-up [n= 94 (29.4%)], patient deceased during admission [n=34 (10.6%)], end-stage disease [n=26 (8.1%)] and unknown [n=19 (5.9%)].

TABLE 4. *Baseline Patient Characteristics.*

Characteristic	No HF Clinic Enrollment (n=573; 74.7% of sample)		HF Clinic Enrollment[a] (n=194; 25.3% of sample)		All patients (n=767)		*P* Value[b]
Mean (SD) age in years	79.49	7.65	80.39	6.94	79.72	7.48	*0.147*
Mean (SD) EF[c]	0.44	0.17	0.42	0.15	0.43	0.16	*0.139*
	n	%	n	%	n	%	
Male	313	54.6	129	66.5	442	57.6	*0.004*
End-stage disease[d]	34	6.0	5	2.6	39	5.1	*0.066*
NYHA functional class[e]							*0.026*
Class I	46	15.7	26	14.7	72	15.3	
Class II	152	51.9	70	39.5	222	47.2	
Class III	89	30.4	74	41.8	163	34.7	
Class IV	6	2.0	7	4.0	13	2.8	
EF category[c]							*0.086*
Less than 20%	23	6.1	8	5.4	31	5.9	
20% to 40%	143	37.8	65	43.9	208	39.5	
41% to 49%	23	6.1	16	10.8	39	7.4	
50% or more	189	50.0	59	39.9	248	47.1	
DD[f]							*0.074*
No DD	18	13.4	12	27.9	30	16.9	
Grade 1 DD	69	51.5	23	53.5	92	52.0	
Grade 2 DD	27	20.1	5	11.6	32	18.1	
Grade 3 DD	20	14.9	3	7.0	23	13.0	
Systolic & Diastolic HF[g]							0.938
EF</= 50 & Grade I DD or higher	57	42.5	18	41.9	75	9.8	
Reasons for not enrolling in clinic[h]			n/a	n/a	n/a	n/a	n/a
Refused	89	27.8	n/a	n/a	n/a	n/a	n/a
Insurance[i]	53	16.6	n/a	n/a	n/a	n/a	n/a
Cost (out of pocket cost/copay cost)	5	1.6	n/a	n/a	n/a	n/a	n/a
No outpatient follow-up	94	29.4	n/a	n/a	n/a	n/a	n/a
Deceased	34	10.6	n/a	n/a	n/a	n/a	n/a
End-stage disease[c]	26	8.1	n/a	n/a	n/a	n/a	n/a
Unknown	19	5.9	n/a	n/a	n/a	n/a	n/a

[a] Enrollment in HF clinic for at least 1 admission.
[b] Statistical tests comparing HF clinic enrollees versus non-enrollees; analysis of variance for age and ejection fraction, and Pearson chi-square for all categorical variables.
[c] Earliest recorded values based on echocardiogram in 2015. EF information available for no HF clinic enrollment (n=378) and HF clinic enrollment (n=148).
[d] End Stage Disease (n=39): ESRD, end-stage HF, or hospice.
[e] Highest documented NYHA class in calendar year 2015. NYHA information available for no HF clinic enrollment (n=293) and HF clinic enrollment (n=177).
[f] Earliest recorded values based on echocardiogram in 2015. DD information available for no HF clinic enrollment (n=134) and HF clinic enrollment (n=43).
[g] Earliest recorded values based on echocardiogram in 2015. DD and EF</= 50 available for no HF clinic enrollment (n=134) and HF clinic enrollment (n=43).
[h] This variable was measured for each hospital stay because patients could have been clinic-enrolled for some stays and not others.
[i] Indicated that patient's insurance does not cover HF clinic services.
DD=diastolic dysfunction; EF=ejection fraction; ESRD=end stage renal disease HF=heart failure; NYHA=New York heart association; SD=standard deviation.

Hospital Admissions Outcomes

The *Hospital Admission Outcomes by Clinic Enrollment Status* are summarized in Table 5. A total of 16,254 patients were seen in the practice at least once during the study period of January 1-December 31, 2015. There were 3,435 patients diagnosed with HF who were seen and managed by a CS provider and 2,303 patients enrolled and seen in our HF clinic at least once during the study period. The remaining 1,241 patients were not enrolled in the HF clinic. There were 767 HF admissions between January 1 and December 31 2015, of which 573 (46.2%) were in the No HFC group and 194 (8.4%) were in the HFC group ($p<0.001$). The total number of all-cause readmissions were 132; of which 95 (14.5%) were in the No HFC group and 37 (16.2%) were in the HFC group ($p=0.534$). There were 95 HF-related readmissions; of which 72 (11.0%) were in the No HFC group and 23 (10.0%) were in the HFC group ($p=0.700$). Thirty-four (3.9%) patients died during their admission; 19 (2.9%) were in the No HFC group and 15 (6.6%) were in the HFC group ($p=0.013$). Seven hundred nineteen admissions had an alert flag placed in the patient chart; 529 (80.9%) were in the No HFC group and 190 (83.3%) were in the HFC group ($p=0.412$).

TABLE 5. *Hospital Admission Outcomes by Clinic Enrollment Status*.

Outcome Measure	No HF Clinic Enrollment (n=654; 74.15% of sample)		HF Clinic Enrollment[a] (n=228; 25.85% of sample)		All Admissions (n=882)		*P* Value[b]
Length of Stay Mean (SD)	5.43	4.20	5.03	4.26	5.33	4.22	*0.212*
	n	%	n	%	n	%	
HF Admissions[c]	573	46.2	194	8.4	767	21.6	*<0.001*
All-cause readmission[d]	95	14.5	37	16.2	132	14.9	*0.534*
HF-related readmission[d]	72	11.0	23	10.0	95	10.7	*0.700*
Deceased during admission	19	2.9	15	6.6	34	3.9	*0.013*
Alert flag[e]	529	80.9	190	83.3	719	81.5	*0.412*

[a] Enrollment in clinic during the hospital admission.
[b] Statistical tests comparing HF clinic enrollees versus non-enrollees; analysis of variance for length of stay and Pearson chi-square for all other variables.
[c] Patients admitted with a diagnosis of HF during the study period. Number of unique patients with diagnosis of HF who were managed by a CS provider in the hospital or in the practice during the study period (n=3544). No HF clinic enrollment (n=1241), HF clinic enrollment (n=2303). Number of unique patients with at least one admission during the study period (n=767).
[d] All-cause readmission means that the patient was readmitted for any reason within 30 days following the discharge date. HF-related readmission means that the patient was readmitted for HF within 30 days following the discharge date.
[e] An "alert flag" is a pop up alert that is placed in the patients electronic chart to indicate the patient has had a previous HF admission and is high risk for readmission.

Patient Outcomes

The *Patient Outcomes by Clinic Enrollment Status* are summarized in Table 6. A total of 162 patients were deceased as of March 2016; 100 (17.5%) were in the no HF clinic group and 62 (32.0%) were in the HF clinic group ($p<0.001$).

The outcome measure *EF improved during study period* was based on a comparison of the lowest recorded EF with the most recent recorded EF on echocardiogram in 2015. A total of 203 patients had a change in EF during the study period of which 120 were in the No HFC group and 83 were in the HFC group. The No HFC group had 60 (50.0%) patients had an improved EF. The HFC group had 54 (65.1%) patients with an improved EF. There was no significant difference between these two groups ($p=0.061$).

TABLE 6. *Patient Outcomes by Clinic Enrollment Status.*

Outcome Measure	No HF Clinic Enrollment (n=572; 74.7% of sample)		HF Clinic Enrollment[a] (n=194; 25.3% of sample)		All patients (n=767)		*P* Value[b]
	n	%	n	%	n	%	
Deceased as of March 2016	100	17.5	62	32.0	162	21.1	*<0.001*
EF improved during study period[c]	60	50.0	54	65.1	114	56.2	*0.061*

[a] Enrollment in HF clinic for at least 1 admission.
[b] Pearson chi-square test comparing HF clinic enrollees versus non-enrollees.
[c] Based on a comparison of lowest EF recorded on patient flowsheet with latest EF recorded on echocardiogram. This is limited to patients whose lowest EF date was chronologically earlier than latest echocardiogram date. No HF clinic enrollment n= 120 (59.1%) and HF clinic enrollment n=83 (40.9%). All patients (n=203).

Distribution of Admissions by Hospital

The *Distribution of All Admissions by Hospital* is summarized in Table 7. The names of the hospitals have been de-identified for the purpose of this DNP project. There were 882 total admissions with 654 (74.15%) in the No HFC group and 228 (25.85%) in the HF clinic group. Hospital 1 had a total of 335 admissions with 237 (36.2%) in the No HFC group and 98 (43.0%) in the HFC group. Hospital 2 had 290 admissions with 202 (30.9%) in the No HFC group and 88 (38.6%) in the HFC group. Hospital 3 had 93 admissions with 76 (11.6%) in the No HFC group and 17 (7.5%) in the HFC group. Hospital 4 had 63 admissions with 52 (8.0%) in the No HFC group and 11 (4.8%) in the HFC group. Hospital 5 had 62 admissions with 56 (8.6%) in the No HFC group and six (2.6%) in the HFC group. Hospital 6 had 28 admissions with 23 (3.5%) in the No HFC group and five (2.2%) in the HFC group. Hospital 7 had 11 admissions with eight (1.2%) in the No HFC group and three (1.3%) in the HFC group.

TABLE 7. *Distribution of All Admissions by Hospital*.

Hospital	No HF Clinic Enrollment (n=654; 74.15% of sample)		HF Clinic Enrollment[a] (n=228; 25.85% of sample)		All Admissions (n=882)		*P* Value[b]
Admissions	n	%	n	%	n	%	0.003
Hospital 1	237	36.2	98	43.0	335	37.8	
Hospital 2	202	30.9	88	38.6	290	32.7	
Hospital 3	76	11.6	17	7.5	93	10.5	
Hospital 4	52	8.0	11	4.8	63	7.1	
Hospital 5	56	8.6	6	2.6	62	7.0	
Hospital 6	23	3.5	5	2.2	28	3.2	
Hospital 7	8	1.2	3	1.3	11	1.2	

[a] Enrollment in clinic during the hospital admission.
[b] Pearson chi-square test comparing HF clinic enrollees versus non-enrollees.

CHAPTER 5: DISCUSSION

The purpose of this *PDSA* cycle was to evaluate the relationship between HFC group enrollment versus No HFC enrollment on hospital admission and readmission rates, and analyze demographic and clinical characteristics between both groups. This section will discuss the DNP project findings and possible implications of the descriptive analysis of the data. Additionally, unintended findings, limitations and recommendations for future quality improvement projects will be discussed.

DNP Project Findings

The purpose of the practice's HF clinic is to empower patients to be active participants in the management of their HF by providing disease specific education and also assist in optimization of medical therapy through the utilization of practice approved protocols derived from the ACCF/AHA Guidelines for the Management of heart Failure in order to prevent hospital admissions and readmissions.

Admissions

The sample consisted of 767 patients with a diagnosis of heart failure who were managed by a clinic provider in the hospital or in the practice during the year 2015. There 573 (46.2%) patients with No HFC enrollment and 194(8.4%) with HFC enrollment who had at least one admission each, with some patients having more than one admission (*p=<0.001).* The No HFC enrollment group sample size may be falsely elevated as it includes office patients and new patients encountered during the initial admission. Patients new to the practice haven't necessarily been referred to, enrolled in or declined by the HF clinic. Nonetheless, this is an important finding in favor of HFC enrollment. This finding is in contrast to the NIL-CHF study, which

evaluated individualized patient management programs, gold standard pharmacological therapy and non-pharmacological therapy, enhanced surveillance, facilitated access to a nurse and promoted self-care behaviors (Carrington & Stewart, 2010). This study hypothesized that a structured nurse-led, hybrid home and clinic-based intervention program would prevent progressive cardiac dysfunction and significantly reduce incident CHF hospitalizations and all-cause mortality in hospitalized patients > 45yrs of age. The NIL-CHF intervention was ineffective in preventing both HF and hospitalizations. Perhaps, these differences may be secondary to the studies being conducted in different countries and different HF management guidelines may exist.

All-Cause Readmissions

There was a total of 132 (14.9%) all-cause readmissions; of which 95 (14.5%) were in the No HFC group and 37(16.2%) were in the HFC group (p=0.534). While no difference was found between these two groups, it is noteworthy to mention that both groups have an all-cause readmission rate far less than the national average. Presently, the all-cause readmission rate among Medicare beneficiaries in the United States is approximately 23.0% (McIlvennan & Allen, 2014).

Heart Failure Related Readmissions

The total number of HF-related readmissions was 95 (10.7%) with 72 (11.0%) in the No HFC group and 23(10.0%) in the HFC group (p=0.700). While there is no significant relationship between HFC enrollment and HF-related readmissions, these findings show a trend in favor of the HFC group. Similarly, the SMAC-HF trial evaluated the effects of nurse-practitioner facilitated, multi-disciplinary HF group clinic appointments on self-care skills and

re-hospitalizations among high-risk HF patients (Smith et al., 2015). They found the intervention to be associated with improvements in HF self-care knowledge and home care behavior skills in managing HF. Subsequently, better self-care was associated with a 33% reduction in HF related readmissions (Smith et al., 2015). Smith et al., assert that building a patient's self-care skills and knowledge with regard to HF, recognition of HF symptoms and managing their discouragement related to HF should be intervention strategies used to reduce HF related admissions and readmissions.

While our HF clinic does not offer nurse practitioner-led, multi-disciplinary group clinic appointments, it does attempt to build patient self-care skills, knowledge of HF signs and symptoms by providing disease specific education and reinforcement regarding disease management and health related behavioral changes. These actions may be contributing factors of the trend in favor of HF clinic enrollment group with regard to HF-related readmissions. While we do not have a national average for just HF-related readmissions, we know that both groups do have a lower than national average when compared to the all-cause national readmission rate among Medicare beneficiaries of 23% (McIlvennan & Allen, 2014).

In contrast to this study, the systematic review and meta-analysis conducted by Inglis, Clark, McAlister, Stewart and Cleland (2011) examined the effects of structured telephone support (STS) or tele-monitoring (TM) on primary outcomes of all-cause mortality, all-cause hospitalizations and HF-related hospitalizations and secondary outcomes of cost, length of stay and quality of life in patients diagnosed with HF. They found that both TM {RR 0.79 [95% (CI)] 0.67-0.94, $p = 0.008$} and STS {RR 0.77 [95% (CI)] 0.68-0.87, $p < 0.0001$} demonstrated a reduction in HF-related hospitalizations (Inglis et al., 2011). Our HF clinic does not currently

have TM or STS as integral components of our HF clinic. Given the aforementioned findings and their relationship on HF-related hospitalizations, we should consider incorporating STS or TM in the future in order to achieve significantly different results.

Deceased Patients

Patients enrolled in the HFC group have a higher mortality rate when compared to patients in No HFC group. Thirty-four (3.9%) patients died during their admission during 2015; 19 (2.9%) were in the No HFC group and 15 (16.6%) were in the HFC group (p=0.013). Additionally, 162 (21.1%) patients were deceased as of March 2016 with 100 (17.5%) in the No HFC group and 62 (32.0%) in the HFC group (p>0.01). However, this may be an example of a disease severity issue. The demographic data demonstrated that there was a greater percentage of patients enrolled in the HF clinic with an EF <40% when compared to those not enrolled in the HF clinic. We know from our literature review, that LVEF can be used to determine both the presence *and* the severity of HF (Yancy et al., 2013). Additionally, the MAGGIC meta-analysis found that patients with HFrEF were at a higher risk of death compared to those diagnosed with HFpEF, even after adjustments for age, gender, etiology, history of hypertension, diabetes and atrial fibrillation were made (2012). Furthermore, it was also noted that the risk of death increased notably when the EF fell below 40% (MAGGIC, 2012). The HF clinic doesn't necessarily cause an increased mortality rate. It may be that patients enrolled in the HF clinic are sicker to begin with and already at an increased risk of mortality.

Ejection Fraction Improvement

A total of 203 patients experienced a change, positive or negative, in their EF during 2015; 120 (59.7%) were in the No HFC group and 83 (40.9%) were in the HFC group. The total

number of patients who experienced an improvement in EF was 114 (56.2%); 60 (50%) patients were in the No HFC group and 54 (65.1%) patients were in the HFC group (p=0.061). Though, not a significant finding, the trend favors the HF clinic enrollment group. Not surprisingly, improvement in EF is often seen in patients on Guideline Directed Medical Therapy (GDMT) and in this case is reflected in both groups, as it is the standard of care for patients diagnosed with HF. This is assuming that patients were tolerant of and compliant with GDMT.

Driscoll et al., (2014) evaluated the effectiveness of a nurse-led titration clinic, led by a nurse specialist with cardiologist support in a HF clinic, versus usual care through their primary care provider, in improving the time required for patients to reach optimal doses of BB agents. The nurse-led titration clinic improved optimization of BB therapy through an increasing proportion of patients reaching target dose (Driscoll et al., 2014). Additionally, the nurse-led clinic facilitated rapid up-titration of BB therapy in patients with HFrEF (p<0.0005). Improvement in EF in our clinic may be an example of patients receiving optimization of medical therapy through HF clinic enrollment. However, further studies are warranted to evaluate GDMT and target doses within our HF clinic patient population.

Implications

This DNP project demonstrated that utilization of structured HF clinics with protocols derived from the *2013 ACCF/AHA Guidelines for the Management of Heart Failure* can decrease hospital admission, readmission and all-cause readmission rates. While no difference was found between the No HFC and HFC enrollment groups with regard to HF-related readmission and all-cause readmissions, these percentages are far less than the national average.

Additionally, there were patients who experienced an improvement in their ejection fraction through GDMT and self-care education provided in the HF clinic.

Unintended Findings

Often times, unintended quality improvement opportunities are found when conducting quality improvement projects. One of the major unintended findings in this DNP project was that data-set analysis was much more involved and time-consuming than anticipated. The University of Arizona Internal Review Board (IRB) did not allow for review of the data set prior to receiving human subject protection program approval for this DNP project. During the IRB application process, I only had a list of variables included in the data set. Upon receipt of the IRB approval, I was provided the data set by my practice which contained plenty of data (>1,700 entries), though not in a manner interpretable by Excel or SPSS statistics software and containing admissions not pertinent to this project. The data set required application of inclusion and exclusion criteria along with extensive re-coding in order to be able to run baseline descriptive statistics. Nearly all of the cells within the Excel spreadsheet contained narrative values that had to be converted to numeric values for interpretation. For example, the terms “index” and “admission” were found in the column for admissions. The term “index” meant an initial HF admission and “admission” meant readmission were re-coded into numerical values. There were multiple terms and abbreviations noted for the same hospital. Non-JCAHO approved abbreviations were noted throughout the data set; such as AthHD signified atherosclerotic cardiovascular disease, which is normally abbreviated ASCVD. The term “end-stage” disease was found in the chief complaint, diagnosis and notes sections of the spreadsheet. Subsequently, this term was given its own variable column, each entry was then evaluated for presence of this

term, and this finding was converted into a numeric value. It took approximately 75-100 man-hours to re-code the data in order for it to be analyzable and interpretable.

Limitations

There were many limitations to this DNP project. In analyzing a pre-existing data set, we are assuming that all of the information contained therein is accurate. The data set required extensive manual re-coding with a possibility of human error. While the data set contained a vast amount of entries, not all entries were applicable to this project and were excluded. For example, the data set contained entries for all CS patient admissions including non-HF patient admissions. Those patients were excluded. The data set also contained HF-related admissions for patients < 65 years of age. Given that the current emphasis on reducing hospital readmission surrounds Medicare beneficiaries, due to decreased reimbursement for excess readmissions by CMS, patients less than 65 years of age were also excluded.

Many patients did not have a value for every variable recorded and/or analyzed. However, in efforts to preserve a reasonable sample size for analysis those patients were not excluded. Excluding patients who did not have a value for every variable contained within the data set would have yielded a very small-to-no data set. For example, 241 patients were missing an EF value, 590 patients were missing a DD value and 297 patients were missing a NYHA-FC value. As such, these analyses were based on the total values available for each variable and were noted and disclosed in the results section. Lastly, we did not have access to the entire sample of patients diagnosed with HF and their respective characteristics. This limited the analysis of demographic characteristics to those patients diagnosed with HF that had an admission or readmission during 2015.

Inherently, selection bias is present because the groups aren't the same to begin with. Patients are typically referred to the clinic by their cardiologist during an office visit or an inpatient hospitalization for new onset HF, an acute exacerbation of their existing HF or a patient diagnosed with HF that needs additional education and help with symptom management. Patients who have HF and are well-controlled with usual care provided by their primary cardiologist are typically not referred; thus illustrating selection bias.

Conclusions

This DNP project demonstrated that a significant difference between the No HFC group and the HFC group with regard to HF admissions. This suggests that structured HF clinics that utilize protocols derived from the current ACCF/AHA Guidelines for the Management of Heart Failure can decrease HF admissions. While no significant difference was found between the groups with regard to HF-related readmission and all-cause readmissions, it is noteworthy to mention that these percentages are far less than the national average. Additionally, there were patients who experienced an improvement in their ejection fraction through GDMT and self-care education provided in the HF clinic.

Although there are recommendations for further prospective studies to evaluate the relationship between HF clinic enrollment on hospital admission and readmission rates, the unintended findings of data collection and data set compilation prevent further studies to be completed with ease. At this time, it is recommended that a new *PDSA* focus on this process. Furthermore, a new literature search is warranted to evaluate variables that positively impact HF patients (i.e., GDMT adherence, target doses achieved, clinic compliance, etc.) so that those variables can be collected in the future.

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