HOME VISITS BY A CARDIAC NURSE CLINICIAN AND PATIENTS DIAGNOSED WITH HEART FAILURE

by

Jennifer Jane Krzyczkowski

Diploma in Nursing, British Columbia Institute of Technology, 1996

B.S.N, University of Victoria, 2009

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Abstract

Heart failure (HF) is a debilitating syndrome affecting thousands of Canadians every year. It is one of the leading causes of death in Canada and has been found to be the leading cause of readmission to hospital in North America. We sought to determine if home visits by a cardiac nurse clinician reduced heart failure readmissions to hospital in Canada. A retrospective cohort study design examined the effect of an existing post-discharge home visit intervention program for patients with heart failure. The study sample consisted of 215 patients, each hospitalized with a "most responsible inpatient diagnosis of heart failure." Between 2011 and 2013, 103 patients were referred to the home visit intervention program and seen by the cardiac nurse clinician at home. The usual care group 112 patients was randomly extracted from Discharge Abstract Database between 2009 and 2011. Meleis' Transitions Theory informed and guided the study, and Wagner's Chronic Care Model guided the intervention. The main outcome measure was 30-day hospital readmissions for heart failure. The intervention group had fewer readmissions to hospital for heart failure and a higher number of referrals to cardiac rehabilitation than usual care group ($p \leq 0.001$). No significant differences were found between all-cause readmissions, length of stay of readmissions, or all-cause emergency visits between the two groups. Our results suggest that there may be a relationship between home visits by a cardiac nurse clinician and heart failure readmissions with patients who are diagnosed with heart failure. Furthermore, we believe the model may be beneficial for treatment of other cardiac patients. There may be a cost saving for the healthcare system in reducing heart failure readmissions to hospital; however, we recognize that a proper cost analysis is needed to confirm the economic benefits of the model. More work is needed in testing this intervention in other geographic areas (e.g., rural), as well as with patients who have different socioeconomic characteristics. A more rigorous study design,

such as a randomized controlled trial or interrupted time series, is needed to further test the model of home visits with those patients who suffer from heart failure.

Lay Summary

Heart failure is one of the leading causes of death in Canada, and it has been found to be the leading cause of readmission to hospital in North America. Home visits by a cardiac nurse have previously been shown to reduce readmissions to hospital in the Scotland and Australia. We sought to determine if home visits by a cardiac nurse would reduce readmissions to hospital in Canada. Patients in study were seen by the cardiac nurse at home or had the usual follow-up care with a physician in an office. Those seen by a cardiac nurse had fewer readmissions to hospital for heart failure, and a higher number of referrals to cardiac rehabilitation than usual care group. This model of care may be associated with a cost saving for the healthcare system. However, more research is needed on the economic benefits to determine the exact nature of those benefits.

Preface

The research design and ethical application submitted to the University of British Columbia Ethics Board was a collaboration between me and Wong S. Ethical approval was obtained from the University of British Columbia Behavioral Research Ethics Board [H15-01091] and approval to conduct research was granted from Vancouver Coastal Health Authority, prior to commencing data collection. Wong S. recommended conceptual and theoretical frameworks for the thesis. I was the lead investigator and responsible for consecutively choosing intervention group, conducted randomization of usual care group; I ordered charts, and performed data collection. I conducted analysis of data with verification from Wong S. I wrote the body of the thesis with edits conducted by Wong S., Mackay M., and Baumbush J.

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Dedication

This Thesis is dedicated to Herbert Wilfred Green, my beloved grandfather, who always encouraged me and believed in my abilities to accomplish anything and everything that life set out for me! As well, I would also like to dedicate this thesis to all of my cardiac patients and family members who have welcomed me into their home.

Chapter 1: Introduction

1.1 Statement of Purpose

The objective of this research study was to determine whether there is a relationship between home visits by a cardiac nurse clinician, and all-cause and heart failure readmissions in the adult population greater than 18 years of age, who have been diagnosed with heart failure.

1.2 Heart Failure and Treatments

Heart failure is a debilitating complex syndrome that manifests itself as a result of an inefficient heart muscle, and can be caused by one of several chronic pathological conditions i.e., ischemic heart disease, hypertension, arrhythmias, valve disorders, myocarditis, cardiomyopathy, amyloidosis, sarcoidosis, or metabolic disorders (Nicholson, 2014). Some of these conditions are reversible, and some are not. For example, ischemic heart disease can be resolved with stenting or coronary artery bypass grafting, and valve disorders can be repaired.

The non-reversible causes of heart failure are considered chronic heart failure. The two most common forms of chronic heart failure exist in the presence of a reduced left ventricular contraction, or a preserved left ventricular contraction. Treatment for chronic heart failure is primarily based on pharmacotherapy. However, lifestyle management with a reduction in dietary sodium, fluid restriction, and daily exercise can also help to maintain a stable health status, in conjunction with pharmacotherapy. For patients living with heart failure, a decline in health status is inevitable, and this can occur earlier when patients do not follow recommended treatment (Van Der Wal, Veldhuisen, Veeger, Rutten, & Jaarsma, 2010). Negative outcomes such as increased mortality and readmission to hospital, have been reported when treatment is not optimized (Van Der Wal, Veldhuisen, Veeger, Rutten, & Jaarsma, 2010).

1.3 Epidemiology

Heart Failure is one of the leading causes of hospitalization and death, throughout many countries around the world (Dai et al., 2012). Canada is no exception, with an estimated 500,000 individuals living with heart failure and 50,000 people being newly diagnosed with heart failure each year (Ross et al., 2006). The prevalence of heart failure has risen in recent decades, continuing to rise with the aging Canadian population and increased life expectancy (BC Heart Failure Network, 2012). In 2011, there were 90,000 patients in British Columbia (BC) living with heart failure and by 2030 this number is projected to double (BC Heart Failure Network, 2012). Heart failure has had the smallest decline in mortality in recent years, compared to myocardial infarction, ischemic heart disease, and stroke (Dai et al., 2012). In 2009, there were 9,911 deaths related to heart failure in British Columbia (BC Stat, 2009). Research from the United Kingdom indicated that the one-year mortality rate for patients with heart failure is 25 %, with an in-hospital mortality rate at 9% (Nicholson, 2014). Researchers have described heart failure as a "disease of epidemic proportions" (Duffy, Hoskins & Chen, p. 349, 2004). The increasing incidence of heart failure among elderly individuals has caused a strain on the Canadian healthcare system (Dai et al., 2012).

Heart failure is a costly chronic disease with British Columbia (BC) health care dollars expenditures upward of 590 million dollars, per year (BC Ministry of Health, 2011). The cost of treatment for heart failure in British Columbia continues to rise (BC Ministry of Health, 2011). It was estimated that in 2009 the cost of hospitalization for patients admitted with heart failure was 338, 519, 607 million dollars (BC Statistics, 2009). A large portion of the cost of heart failure to the British Columbia healthcare system is related to recurrent hospitalizations (BC Heart Failure Network, 2012).

1.4 High Risk of Readmission to Hospital

Researchers have suggested that heart failure is the most frequent readmission diagnosis to hospital and that the number of heart failure readmissions will continue to rise with the aging population (Giamouzis et al., 2011). The OPTIMIZE (Organized Program To Initiate Life Saving Treatment In Hospitalized Patients With Heart Failure) registry predicted that readmission rates for patients with heart failure was 30% within the first 60-90 days after discharge from hospital (Fonarow et al., 2007). Readmission rates were estimated to be similar for patients who have reduced left ventricular ejection fraction and those who have preserved left ventricular ejection fraction heart failure (Fonarow et al., 2007).

Michalsen, Konig, and Thimme (1998) linked heart failure readmissions to medication compliance and suggested that hospital readmissions for heart failure could be prevented in some cases. Annema, Luttik and Jaarsma (2009) indicated that patients and health care providers believed non-adherence to medication was a factor in readmission to hospital and that earlier treatment and multidisciplinary support could prevent a readmission to hospital. However, Stewart (2004) noted that, "pharmacological treatments do not completely ameliorate the high morbidity and mortality rates associated with heart failure in the elderly and that there is a need to develop cost effective nurse specialist intervention programs to decrease the burden of hospital readmissions" (p. 309). A recent 2016 report on the burden of heart failure indicated that patient education by specialized heart failure nurses is an excellent strategy to reduce heart failure readmissions to hospital (Heart and Stroke Foundation, Canada).

There has been recent focus within the healthcare system on reducing the risk of readmissions to hospital for those patients who suffer from heart failure. Some hospitals in the United States have been penalized with reduced Medicare transfer payments for having higher

heart failure readmission rates (Feltner et al., 2014). These punitive initiatives prompted some hospitals in the United States to create programs that would better support patients who suffer from heart failure after discharge from hospital (Feltner et al., 2014).

In British Columbia, the Early Supportive Discharge Project was funded by the Ministry of Health and was designed to support those patients who have higher readmission rates to hospitals. The three conditions chosen for the Early Supportive Discharge Project were stroke, chronic obstructive pulmonary disease, and heart failure. Several hospital sites around the province participated in the Early Supportive Discharge Project, with each site having a unique program design. One such hospital site created a cardiac nurse clinician home follow-up program for those patients who suffered from heart failure.

Feltner et al., (2014) noted the importance of the need for more research in the area of transitional care after discharge from hospital for those patients who suffer from heart failure. The author of this thesis proposes that home visits by a cardiac nurse clinician can reduce heart failure and all-cause readmissions to hospital through education, ongoing support, and early intervention to prevent an exacerbation of acute heart failure. Stewart (2004) noted that it is important for "specialist heart failure nurses to quantify the therapeutic benefits of individualized care" (p.712).

1.5 Research Questions

1. Is there a relationship between home visits by a cardiac nurse clinician, and heart failure and all-cause readmissions in the adult population (18 years of age or older), who are diagnosed with heart failure?
2. Is there a relationship between home visits by a cardiac nurse clinician and length of stay of readmission to hospital, in the adult population (18 years of age or older) who are

diagnosed with heart failure?

3. Is there a relationship between home visits by a cardiac nurse clinician and emergency visits in the adult population (18 years of age or older) who are diagnosed with heart failure?
4. Is there a relationship between home visits by a cardiac nurse clinician and referrals to cardiac rehabilitation?

Chapter 2: Literature Review

This chapter provides an overview of the past and current research on home visits by cardiac nurses with patients who are diagnosed with heart failure. Meleis' Transitions Theory and Wagner's Chronic Care Model are frameworks used to guide this research study. Furthermore, gaps in the current research on home visits by cardiac nurses and patients with heart failure are identified.

As previously identified in Chapter 1, heart failure is a debilitating syndrome that affects hundreds of thousands of Canadians every year (Ross et al., 2006) and is one of the leading causes of death in Canada (Dai, et al., 2012). Experts predict that the number of Canadians who suffer from heart failure will continue to rise as life expectancy increases (Ross et al., 2006) and the baby boomer generation ages (Stewart, Mcintryre, Capewell & McMurray, 2002). Greene et al., (2015) noted that post-discharge outcomes for patients diagnosed with heart failure remain quite poor, even with symptom improvement from medications such as diuretics and vasodilators.

In recent years the healthcare system has been experiencing a marked increase in readmissions from those patients who suffer from heart failure (Gheorghiade, Vaduganathan, Fonarow, & Bonow, 2013). Researchers reported that patients who suffer from heart failure have been identified to be at high risk of readmission to hospital within 90 days of discharge (Fonarow et al., 2007). This is a particular burden upon the healthcare system (Stewart & Horowitz, 2002). Initiatives have been created to reduce this burden and prevent patients with heart failure from reentering the acute care system. Transitional care after discharge is one topic of particular interest to researchers and the healthcare system (Greene et al., 2015).

The transitional phase has been deemed "the vulnerable phase" for those who suffer from heart failure (Greene et al., 2015, p. 1), and previous research has suggested that this phase occurs within the first 90 days after discharge from hospital (Greene et al., 2015). Given the transitional phase is a period of vulnerability for those patients who suffer from heart failure, it has been suggested these patients need more comprehensive follow-up care post discharge from hospital (Feltner et al., 2014). Researchers conducted a systematic and meta analysis of transitional care interventions with patients diagnosed with heart failure and they reported that high intensity home-visiting programs reduced all-cause readmissions and deaths in the first 30 days post discharge from hospital. Furthermore, three to six months after discharge, home-visiting programs reduced heart failure specific readmissions, all-cause readmissions, and deaths (Feltner et al., 2014). Feltner et al. (2014) found that nurses provided the home visit intervention most often.

2.1 Home Visits and Patients With Heart Failure

The research on post discharge interventions with patients who suffer from heart failure is vast and past research has examined outcomes surrounding community clinics, readmissions factors, cost, nursing, patient education, telephone follow-up, and home visits. A 2012 Cochrane Review conducted by Takeda et al. (2012) examined disease management interventions for patients diagnosed with heart failure. Takeda et al. (2012) reviewed randomized controlled trials lasting for a minimum of six months. There were 25 randomized controlled trials selected for the review between 1998-2008. The studies were further classified into three categories: case management intervention with intense follow-up of either home visits or telephone, clinic office setting, or multidisciplinary intervention. The usual care, length of follow-up, and intensity varied across all 25 studies. Takeda et al., (2012) reported "there is good evidence that case type

management interventions led by heart failure specialist nurses can reduce all-cause readmissions and mortality for up to 12 months post discharge" (p.2). Researchers were unable to determine the common element of the programs that were effective in reducing admissions and all-cause mortality; however, telephone follow-up was the most common intervention. Furthermore, it was also determined that there is "limited evidence to support congestive heart failure interventions with clinic follow-up as a major component" (Takeda et al, 2012, p.2).

A review of the literature on heart failure and home visits found that researchers have utilized pharmacists, nurses, and physicians to conduct the home interventions (Jaarsma, Brons, Kraai, Luttik, & Stromberg, 2013). Leff et al., (2005) had both physicians and nurses conducting home visits with patients with heart failure, but most studies noted that physicians were utilized to adjust medications and consult on the treatment regimen (Jaarsma et al., 2013). Stewart, Vandenbroeck, Pearson, and Horowitz (1999) utilized both a nurse and pharmacist to conduct the home intervention and found that the intervention group had fewer unplanned hospital readmissions and out of hospital deaths. However, Holland et al., (2005) found that home visits by pharmacists alone with patients with heart failure did not decrease readmissions to hospital. The study concluded that the intervention group had a higher number of readmissions to hospital than the control group (Holland et al., 2005).

The majority of studies conducted in the home with patients who have been diagnosed with heart failure have utilized nurses to conduct the intervention (Jaarsma, Brons, Kraai, Luttik, & Stromberg, 2013). A recent systematic review on care for heart failure patients in the home found that nurses performed the intervention in the home most often compared to other health care professionals (Fergenbaum, Bermingham, Krahn, Alter, & Demers, 2015). Fergenbaum et al., (2015) found that care in the home for patients with heart failure caused a reduction in

hospitalizations, and in visits to the emergency department, and was more cost effective than usual care. Quality of life also improved when care was delivered in the home compared with usual care (Fergenbaum et al., 2015). There are three distinct categories for the studies involving home-based nursing interventions and patients with heart failure: cardiac nurses, home and community nurses, and advanced-practice nurses.

Past research examining home visits by cardiac nurses with patients with heart failure demonstrated positive outcomes of reduced hospital readmissions and out-of-hospital deaths, for up to six months post discharge from hospital (Blue et al., 2001; Stewart, Marley, & Horowitz, 1999). Each study has used a different term to describe the cardiac nurses performing the intervention. One study used the term "nurse specialist" (Blue, et al., 2001), another used "qualified cardiac nurse" (Stewart, Marley, & Horowitz, 1999), and yet another used " specialist nurses and congestive heart failure nurses" (Stewart et al., 2014).

Researchers conducted a secondary analysis of the data collected from Stewart, Marley, & Horowitz (1999), while extending the follow-up to 18 months after discharge from hospital (Stewart, Vandenbroeck, Pearson, & Horowitz, 1999). They concluded that home visits by a qualified cardiac nurse reduced unplanned readmissions, length of hospital stay, hospital based costs, and mortality (Stewart, Vandenbroeck, Pearson, & Horowitz, 1999). Stewart, Marley, and Horowitz (1999) conducted another study in Australia of similar design but with a larger sample of 200 patients. Home-based visits by a cardiac nurse with patients diagnosed with heart failure reduced hospital readmissions, days in hospital upon readmission, and hospital related costs (Stewart, Marley, and Horowitz, 1999).

Blue et al., (2001) conducted a randomized controlled trial for one year examining home-based visits and telephone contact by cardiac nurse specialists with patients who had been

diagnosed with heart failure, and who were recently discharged from hospital. The study intervention was conducted with the Glasgow Heart Failure Liaison Service, and the purpose of the study was to "determine whether a home-based nurse intervention, in addition to conventional care, could reduce unnecessary hospital readmissions and improve quality of life with patients with systolic heart failure" (Blue et al., 2001). Researchers documented that the intervention nurses completed more home visits than in previous studies, but it was not clearly outlined how many home visits were actually performed. Previous studies were designed for a single visit within 7-14 days after discharge (Stewart, Marley, & Horowitz, 1999; Stewart, Vanderbroeck, Pearson, & Horowitz, 1999). Blue et al., (2001) reported that the intervention group had fewer readmissions, deaths, and days in hospital. These results were deemed to be statistically significant and prompted funding through the Glasgow Health Authority for a heart failure liaison service for the city of Glasgow, Scotland.

Stewart et al., (2012) conducted the WHICH? (Which Heart Failure Intervention is Most Cost Effective and Consumer Friendly in Reducing Hospital Care) study. This multicenter randomized trial compared home-based interventions with heart failure specialist nurses to clinic-based interventions for patients who were diagnosed with heart failure. Patients were enrolled and randomized to either the clinic or home-based intervention. The clinic setting was multidisciplinary, with nurses and physician specialists. It was not specified in the article whether the physicians were cardiologists. Stewart et al., (2012) reported that the home-based intervention group had fewer days in hospital and lower accrued costs than the clinic intervention group. Stewart et al., (2014) did a secondary analysis of the WHICH? trial data and extended the follow-up to 3 years, to assess for longer-term benefits of a home-based intervention versus a clinic-based intervention. They found that the home-based intervention group had statistically

significant fewer deaths and days in hospital than the clinic-based intervention (Stewart et al., 2014).

The most recent study that has been published on home-based interventions and cardiac patients was Stewart et al., (2016). This study was an analysis of three randomized controlled trials of 1226 patients with varying cardiac diagnoses, including heart failure. The results of the study indicated that the home visit intervention group lived longer and had fewer all-cause hospitalizations. Researchers reported that the intervention was most effective for those who were 60 to 82 years of age. McMurray (2016) commended the work of Stewart et al. (2016) describing it to be a "remarkable report" (p. 1836), while also critically analyzing study methodology and rigor.

A study on home visits by a cardiac nurse was conducted in France with 1222 participants (Agrinier et al., 2013). Researchers examined home visits of specialty-trained cardiac nurses with patients who were diagnosed with heart failure. Researchers compared the readmission rate of participants in the Insuffiscance Cardiaque en Lorraine (ICALOR) program to the readmission rate of the general population using, a national database. The ICALOR program was a disease management program that included home visits. The results of the study showed that patients in the ICALOR program had a 7.9% reduction in risk of heart failure readmissions.

Past research on home visits by community nurses with patients who have been diagnosed with heart failure did not yield statistically significant results for readmissions (Delany & Apostolidis, 2010; Feldman et al., 2004; Kwok, Lee, Woo, Lee, & Griffith, 2006; Li, Morrow-Howell, & Proctor, 2004; McCoy, Davidhizar, & Gillum, 2007). Some studies conducted an intervention utilizing protocols for the nurses to follow and the nurses also received education

sessions on heart failure (Delany & Apostolidis, 2010; Feldman et al., 2004; McCoy, Davidhizar, & Gillum, 2007). Li, Morrow-Howell, & Proctor (2004) compared patients with heart failure, who received community nursing or no community nursing, and found that there was no statistically significant difference in hospital readmissions. Kwok, Lee, Woo, Lee, and Griffith (2006) did not specify the education training for the community nurses involved in the study.

However, Rich et al. (1995) found that home visits by homecare nurses for patients diagnosed with heart failure reduced hospital readmissions. In addition to homecare visits by community nurses, the intervention included a hospital component of multidisciplinary assessment and an educational session at the bedside with an experienced cardiovascular nurse. It is possible that the other parts of the intervention, rather than the home visits, reduced readmissions. One particular study did not specify the background of the intervention nurses (Vavouranakis et al., 2003), but researchers found that home visits reduced cardiovascular readmissions to hospital. This study had a small sample of only 33 participants.

Naylor and McCauley (1999) conducted a study examining home visits by advanced-practice nurses with a sample of cardiac, medical, and surgical patients. The intervention consisted of a home visit by an advanced-practice nurse once a week for four weeks after discharge. The cardiac patients in the intervention group had fewer readmissions to hospital, and the most frequent readmission diagnosis was heart failure (Naylor & McCauley, 1999). Coordinated discharge planning and continuity of care were also noted to be important factors in reducing readmission for high-risk older adults with significant cardiac disease (Naylor & McCauley, 1999).

The one study to date that has been conducted in Canada examining home visits with cardiac nurses and patients with heart failure was a qualitative study in Montreal, Quebec

(Young, Purden, Sauve, Dufor, & Common, 2008). The study was a small sample of only 5 patients who were diagnosed with heart failure. The goal of the study was to explore the patients' perceptions of home nursing visits under the basket of care nursing intervention. The themes that were identified from this qualitative study were "staying home, being connected, and checking on." These themes could be interpreted to mean that patients were satisfied and perceived that they benefited from the home visits.

Previous research in the area of home visits by a cardiac nurse has examined readmissions to hospital, deaths or mortality, and cost. There are some gaps that exist in the research. One notable gap is that only one study has been conducted in Canada (Young, Purden, Sauve, Dufor, & Common, 2008). Brotons et al., (2009) recommended more studies on home nursing interventions with patients who are diagnosed with heart failure, particularly within differing healthcare contexts. It is unclear whether the results of the previous studies can be generalized to the British Columbia healthcare system or other provinces within Canada. In his recent editorial in the journal Circulation, McMurray (2016) noted that the most recent study was conducted in the same country as previous studies; therefore, similar research in another country is warranted.

Another gap in the research is that many of the previous studies have included only those patients who suffer from reduced ejection fraction heart failure (Stewart & Horowitz, 2002; Stewart, Marley, & Horowitz, 1999; Stewart, Vandenbroeck, Pearson, & Horowitz, 1999). These studies excluded patients who had preserved ejection fraction heart failure, had structural abnormalities, undergone cardiac surgery, or were waiting for cardiac surgery. However, heart failure has many etiologies. Some investigators have taken this into account. Blue et al., (2001) classified patients according to the echocardiogram results as part of the demographic profile,

and Stewart et al., (2016) had broader inclusion criteria than those for previous studies on home nursing intervention with a cardiac nurse specialist working with patients diagnosed with heart failure.

Patients with underlying heart failure, regardless of the etiology, could benefit from home visits by a cardiac nurse. Examining the frequency of heart failure and all-cause readmissions according to the type of heart failure may provide evidence to whether home visits by a cardiac nurse are more or less beneficial, depending on the etiology of heart failure. It would be important to examine outcomes of patients with all causes of heart failure, but to classify them into three distinct groups: reduced ejection fraction, preserved ejection fraction, and structural abnormalities.

Furthermore, none of the previous research studies have examined any particular aspect of the nursing intervention that could be a factor in preventing readmissions. According to Wagner's Chronic Care Model, community resources and programs can provide additional support to healthcare practitioners in managing chronic disease (Bodenheimer, Wagner, & Grumbach, 2002). Examining the number of referrals to community programs and resources could provide information regarding a factor in the nursing intervention-information, which may assist to prevent readmissions with patient diagnosed with heart failure.

2.2 Theoretical Models

Meleis' Transitions Theory (2011) guided the overall rationale and design for our study. Transitions Theory was an appropriate choice for a theoretical framework to guide our study because Meleis (2011) outlined and described ways in which the discipline of nursing is paramount to facilitating life transitions. The period following discharge from hospital is a common life transition that patients' move through when they return home (Meleis, 2011). The

intervention or home visit by the cardiac clinician in our study parallels the transitional care model as described by Naylor and Cleave (2011). Naylor and Cleave described a patient with heart failure and transitional care undertaken to show how beneficial such care can be for those who suffer from heart failure. In addition to adopting Meleis' model, we decided that Wagner's Chronic Care Model was a useful addition to inform and guide the home intervention performed by the cardiac nurse clinician in the study. Wagner's Chronic Care Model outlines several key points to successful chronic disease management (Wagner, 1998). Wagner described regular interactions with patients, as a way to reduce risk of acute exacerbations and complications of chronic disease, and this risk reduction was an important focus of the home follow-up intervention in our study. As well, our study looked at regular interactions in reducing readmissions. Wagner's Chronic Care Model outlines education, as a key component to improving self-management skills for patients, and certainly, that was also a key component of the intervention in our study.

2.3 Meleis Transitions Theory

Meleis' Transitions Theory (2011) guided and informed the rationale and design for this study. The Transitions Theory describes different types of life transitions that individuals face at different times in their lives. Meleis describes the response that individuals have to life transitions and shows how nurses can assist the individual to move through the life transition to maintain balance (Im, 2006). The Transitions Theory identifies new diagnosis, hospital discharge, and recovery process as a health and illness transition (Im, 2006). A patient who is hospitalized and newly diagnosed with heart failure may experience an illness transition in the period after discharge. Confronting the new life situation of illness is disorienting at best and traumatic at worst.

Meleis (2011) identified nursing therapeutics as assessment of transition conditions, preparation, and role supplementation (Im, 2006). The first of these, assessment of transitions, requires a thorough understanding of the client (Im, 2006). Nurses assess the patient in the first stage of the nursing process and it is through assessment that the nurse learns about the physical, psychological, and environmental factors affecting the patient's health. With respect to preparation, the second of these therapeutic steps, Im (2006) noted that patient education and information are key components of the nursing step of preparation. While patient education is part of nurses' everyday work, appropriate, targeted education is a vital component of caring for a patient who has been diagnosed with heart failure.

Meleis' Transitions Theory is a framework that can be utilized to understand the role of the home cardiac nurse clinician with patients diagnosed with heart failure. As noted patients with heart failure may experience a health/illness transition when they are newly diagnosed and admitted to hospital. A readmission to hospital and discharge is considered to be a stage within a life transition (Meleis, 2011). The cardiac clinician intervention in this research study assisted patients with the health/illness transition through assessment, education. As well, the clinician provided role supplementation by recognizing signs, and intervening to prevent readmission to hospital.

There is qualitative research and evidence of "what" heart failure specialist nurses are doing to facilitate successful transition from hospital to community, and this research data helps to inform the rational for using Meleis' Transitions Theory (2011) to guide this research study. Researchers have documented nurses executing pharmacological management and palliative care referrals (Dowding, Spilsbury, Thompson, Brownlow, & Pattenden, 2009; Davidson, Paull, Rees, Daly, & Cockburn, 2005). Moreover, nurses have monitored patients for signs and

symptoms of decline, promoted self-management through education, and provided psychological support to patient and family as well as forging the necessary link between members of the healthcare team (Dowding, Spilsbury, Thompson, Brownlow, & Pattenden, 2009; Davidson, Paull, Rees, Daly, & Cockburn, 2005). The description of the nursing actions in previous studies aligns with Meleis' description of nursing therapeutics (Im, 2006) and also with the cardiac nurse clinician role, the intervention, for our study.

2.4 Wagner's Chronic Care Model

Wagner's Chronic Care Model (1998) was also used to guide the cardiac nurse clinician intervention in this research study. Bodenheimer, Wagner, and Grumbach (2002) noted that the chronic care model is a "concrete guide" (p. 1777) to improving care for patients who are chronically ill. Using Wagner's Chronic Care Model (1998) to guide treatment of patients with chronic illness has specific benefits: notably, reducing the risk of acute episode or exacerbation of the chronic condition; reduce hospitalization, and improve quality of life. Anderson and Horvath (2004) defined chronic conditions as "conditions that last a year or more requiring ongoing medical attention and that limit activities of daily living" (p.263). The Chronic Care Model identifies six main elements necessary for effective chronic disease management. The six elements are: community resources and policies, health care organizations, self management support, delivery system design, decision support, and clinical information systems.

Wagner's Chronic Care Model (1998) is suitable to use for care of patients suffering from heart failure. Each of the elements of the model is essential to maximizing support for patients with chronic disease. The model involves elements such as community resources and programs that can provide additional support to the patient beyond that of the primary care provider. Self-management support is also a key factor to managing chronic illness long term, and that support

exists in the patient's partnership with the health care provider. (Bodenheimer, Wagner, & Grumbach, 2002). Furthermore, Wagner outlines specific elements for the healthcare system and the individuals working within the system to ensure patients with chronic disease are best supported. First, a healthcare organization must view chronic disease management as a priority, and Bodenheimer, Wagner, and Grumbach (2002) noted " the reimbursement environment of a provider organization has a major impact on chronic care improvements" (p. 1176). Second, technology and decision support tools must be in place in order for healthcare providers to be able to deliver optimal care to patients with chronic disease (Bodenheimer, Wagner, & Grumbach, 2002). And, third, the delivery of care must be structured and must be centered on the patient. Bodenheimer, Wagner, and Grumbach (2002) recommended nurses and physicians work together as disease management teams, with nurses providing self management strategies and ongoing support, while physicians intervene with more complex cases. In this study, in line with the practices suggested above, the cardiac nurse clinician intervention in this study included education and self-management support. A team of healthcare providers was available to the patient to provide optimal support.

Chapter 3: Methods

This chapter provides an overview of the research design, sampling plan, and statistical methods for this research study. External and internal validity of the study has been reviewed and ethical considerations have also been discussed. The data collection tool is described and a copy of the data collection tool is contained in the appendices A and B.

3.1 Research Design

The research design was a retrospective cohort study design in which the author examined the effect of the intervention in a two-year period from 2011 to 2013. The intervention group had been hospitalized for heart failure, admitted to the intervention home visit program, and seen by the cardiac nurse clinician at home between September 16, 2011- September 16, 2013. The usual care group was not admitted to the intervention program but was hospitalized for heart failure between August 16, 2009 - September 15, 2011. Prior to September 16, 2011 the intervention program did not follow patients who were discharged from hospital with a diagnosis of heart failure.

3.2 Sample

This research study gathered the sample from one hospital site, with a total sample of 215 patients. The intervention group was comprised of 103 patients chosen consecutively from the census of the Early Supportive Discharge Project, after the ethical certificate was received. A decision-support manager extracted the usual care group from the Discharge Abstract Database, after the intervention group was formed. A random sample of numbers was generated from Research Randomizer website. The patients for the usual care group were chosen by the researcher as they matched the random number on the excel spreadsheet. There were 112 patients who met the inclusion criteria for the usual care group. There were 40 patients from

usual care group and 10 patients from the intervention group who were excluded due to such factors as resident of extended care, admitted to the intervention program, hospitalization outside the specified dates, no confirmed diagnosis of heart failure, and death upon index hospitalization.

3.3 Inclusion Criteria

The inclusion criteria for this study were the following: 1) age of greater than 18 years; 2) admission to study hospital and/or intervention program from August 16, 2009 – September 16, 2013; 3) most responsible diagnosis deemed to be heart failure; 4) resident of British Columbia. This study excluded patients who had not met all of the inclusion criteria outlined as above and patients who were residents of an extended care facility.

3.4 Power Analysis and Sample Size

Previous research reported being able to detect a statistically significant difference between the intervention (receiving home visits by a cardiac nurse specialist) and control group (usual care) with patients who were diagnosed with heart failure (Blue et al. 2001; Stewart et al., 2012; Stewart, Marley & Horowitz, 1999; Stewart, Vanderbroeck, Pearson, & Horowitz, 1999). Blue et al. (2001) had total sample of 164 heart failure patients for an effect size of 0.40. They were able to detect a statistically significant difference in all-cause and heart failure readmissions between the intervention and control group. These previous results have allowed for an *apriori* power calculation.

An *apriori* power analysis was conducted with G*Power 3.1, to determine sample size. G*Power 3.1 is considered a reliable power analysis program for social, behavioral, and biomedical research (Faul et al., 2007). With a 5% level of significance 80% power and effect size of 0.40, we determined that a total sample size of 215 (107/8 per group) was needed to

detect a statistically significant difference between the two groups on the dependent variables of heart failure and all-cause readmissions to hospital.

3.5 Data Quality Management

Friedemann, Mayorga, and Newman (2007) recommended that regular data checks be performed to increase quality of data and decrease risk of data error entry. The data collector checked regularly for numbers that may have been entered incorrectly. The thesis supervisor examined frequency distributions of the data to check for data entries that were abnormal.

3.6 Ethical Considerations

This study received ethical approval from the University of British Columbia Behavioral Research Ethics Board, and received Vancouver Coastal Health Authority approval to conduct research prior to commencing data collection. The research protocol, outlined for the specific institution where the research was conducted, was diligently followed. The research manager of the institution was consulted prior to commencing data collection. She was a key individual in the institution to assist with research projects within the institution.

There was no personal identification information obtained or kept on record for the purpose of this study. A number identified each study-participant case. All information on the study participants was stored in an Excel file on a password-protected computer and password-protected network drive. The computer station was located in a locked room. Only the main author of the study had access to the password for laptop and network drive.

3.7 Statistical Analysis

The study sample was described using descriptive statistics. Categorical variables were described using frequencies and percentages. Measures of central tendency (mean, median, and interquartile range) were used to describe continuous variables. The Chi-square test was

performed to determine if there were any differences between the intervention and usual care group for categorical variables. The dependent variable of all-cause readmission was collected as a dichotomous variable of yes or no and the Chi-square test was performed to determine if differences existed between the groups in all-cause readmissions, heart failure readmissions and recorded emergency visits.

The independent-samples t-test was utilized to determine if there was difference between the two groups in those variables that were continuous and had a normal distribution (number of days to readmission, number of days to emergency visits, discharge hemoglobin level). Prior to conducting the t-test these variables were assessed for skewness to determine their distribution. For those variables that did not have a normal distribution (age, length of stay of admission and readmission, frequency of heart failure readmissions, left ventricular ejection fraction, creatinine level, sodium level, and brain naturetic peptide level), the Mann-Whitney U test was performed.

The categorical dependent variables of interest were: all-cause readmission (yes, no), emergency visits (yes, no) and cardiac rehabilitation referral (yes, no). Logistic regression was performed to determine whether the relationship between the intervention and cardiac rehabilitation referrals remained statistically significant, after controlling for potentially confounding variables (e.g., age, myocardial infarction, percutaneous coronary intervention, hypertension). The variables were entered into the model using the stepwise method.

Furthermore, the continuous dependent variable of interest was the frequency of heart failure readmissions. The predictors of the frequency of heart failure readmissions were determined through the use of multiple regression with the stepwise method. All analyses were performed using IBM SPSS V21.0 and V24.

Chapter 4: Results

There were a total of 215 patient charts reviewed (usual care n = 112 participants; intervention n = 103) for the study (Table 1). The main language was English and the distribution of male to female participants was similar between the usual care and intervention group (Table 1). The usual care group was significantly older 82.7 ± 10.15 years ($p \leq 0.05$), compared to the intervention group at 78.0 ± 11.6 years.

Table 1 Demographic Characteristics

Variable	**Usual care n = 112**	**Intervention n = 103**
Female n (%)	61 (54)	46 (45)
Age years* mean (SD)	82.7 ± 10.2	78.6 ± 11.6
Lives alone n (%)	46 (41)	39 (22)
English speaking n (%)	108 (96)	98 (95)

Note. * $p \leq 0.05$.

The clinical characteristics of the sample are summarized in Table 2. The number of comorbidities and the baseline laboratory values were similar between the two groups. There were similar numbers of patients who had mitral, tricuspid, and aortic valve dysfunction. The rate of atrial fibrillation was similar in both groups. The mean ejection fraction and the number of patients who held a preserved ejection fraction were also similar across the groups. However, there were significantly more participants ($p \leq 0.05$) who had a history of myocardial infarction and a documented history of hypertension in the intervention group ($p \leq 0.05$). There were also more patients who had undergone percutaneous coronary intervention in the intervention group ($p \leq 0.001$). There was no difference in the length of the index hospitalization between the groups.

Table 2 Clinical Characteristics

Characteristic	**Usual care n = 112**	**Intervention n = 103**
Cardiac conditions: n (%)		
Atrial fibrillation	64 (57)	53 (51)
Hypertension*	43 (38)	63 (61)
Myocardial infarction*	19 (17)	39 (40)
PCI***	4 (4)	24 (23)
CABG	14 (13)	12 (12)
Aortic stenosis	18 (28)	22 (23)
Mitral/tricuspid valve insufficiency	29 (42)	31 (32)
Reduced left ventricular ejection fraction: median	30 (22, 55)	40 (25, 60)
Preserved ejection fraction	24 (40)	41 (42)
Chronic conditions: n (%)		
Diabetes	23 (20)	33 (32)
Coronary artery disease	46 (41)	55 (53)
Hypercholesterolemia	24 (21)	33 (32)
Chronic kidney disease	4 (4)	24 (23)
COPD	14 (13)	12 (12)
Cancer	11 (10)	7 (7)
Cerebral vascular accident	14 (13)	14 (13)
Hypercholesterolemia	24 (21)	33 (32)

Characteristic	Usual care n = 112	Intervention n = 103
Osteoporosis	8 (7)	7 (7)
Discharge laboratory		
Hemoglobin 135-170 g/L mean SD	114 ± 19	121 ± 20
Creatinine 60-100 mmol/L median (IQR)	125 (82, 88)	105 (92, 131)
Sodium 135-148 mmol/L median (IQR)	138 (137, 140)	105 (96, 131)
Hospitalization		
Length of stay index admission: median (IQR)	4 (1, 95)	5 (1, 23)

Note. CABG = coronary artery bypass graft; PCI = percutaneous coronary intervention; COPD = chronic obstructive pulmonary disease
* $p \leq 0.05$, *** $p \leq 0.001$

The evidence-based medications for heart failure prescribed upon discharge are listed in Table 3. The discharge prescriptions that were extracted from the medical record were similar between the two groups. However, in the usual care group there were significantly more discharge prescriptions missing and not documented in the medical record (≤ 0.001) .

Table 3 Prescribed Discharge Medications

Medication	Usual care n = 112	Intervention n = 103
	n (%)	**n (%)**
Beta blocker	50 (69)	77 (76)
Angiotensin-converting-enzyme inhibitor	36 (49)	50 (49)
Angiotensin II receptor blocker	5 (7)	18 (18)
Mineralocorticoid receptor antagonist	11 (15)	27 (27)
Missing discharge prescription in medical record ***	39 (35)	1

Note. Beta blocker: metoprolol, atenolol; Angiotensin-converting-enzyme inhibitor: ramipril, coversyl; Angiotensin II receptor blocker: candesartan, irbesartan; Mineralocorticoid receptor antagonist: spironolactone, eplerenone
*** $p \leq 0.001$

No significant differences between the groups were found between all-cause readmissions, length of stay of all-cause readmissions, or all-cause emergency visits (Table 4). While most study participants who went to the emergency room visited for reasons other than heart failure or cardiac symptoms, the usual care group had a higher number of visits to emergency ($p \geq 0.05$; table 5). The intervention group had fewer readmissions to hospital for heart failure and higher number of documented cardiac rehabilitation referrals ($p \leq 0.001$) (Table 4).

Table 4 Readmissions, Emergency Visits, & Cardiac Rehabilitation

Variable	**Usual care n = 112**	**Intervention n = 103**
	n (%)	**n (%)**
All-cause readmission	29 (26)	16 (16)
Heart failure readmission***	24 (21)	3 (3)
All-cause emergency visit	10 (9)	10 (10)
Cardiac rehabilitation referral***	2 (2)	20 (20)

Note. *** $P \leq 0.001$

Table 5 Unadjusted All-Cause Readmissions & Emergency Visits by Diagnosis

	Usual care n = 112	**Intervention n = 103**
All-cause readmission	**n = 29**	**n = 16**
Heart failure ***	24 (82)	3 (19)
Cardiac diagnosis	0	2 (13)
Other diagnosis	8 (28)	1 (69)
All-cause emergency visit	**n = 10**	**n = 10**
Heart failure	3	0
Cardiac diagnosis	1	3
Other Diagnosis n (%)	6 (60)	7 (70)

Note. *** $P \leq 0.001$

Controlling for patient characteristics (e.g., age, hypertension, myocardial infarction, percutaneous coronary intervention) using logistic regression revealed that receiving home visits by the cardiac nurse clinician was associated with 10-fold higher odds of being referred to a cardiac rehabilitation program ($p \leq 0.01$; Table 6). Those who were younger were also more likely to be referred to cardiac rehabilitation ($p \leq 0.001$; Table 6). Furthermore, the intervention and frequency of heart failure readmissions remained statistically significant after controlling for potentially confounding variables (e.g., age, myocardial infarction, percutaneous coronary intervention, hypertension). Multiple regression modeling suggested that home visits by a cardiac nurse clinician were associated with lower heart failure readmissions ($p \leq 0.01$; Table 7).

Table 6 Predictors of Heart Failure Readmissions & Cardiac Rehabilitation Referrals

	Heart failure readmission			**Cardiac rehabilitation referrals**			
Variables	**B**	**95% CI**		**B**	**OR**	**95 % CI**	
Group***	- 0.19	- 0.08	- 0.30	2.28	9.78	1.96	48.07
Age***	- 0.010	- 0.006	0.004	- 0.09	0.91	0.87	0.96
Myocardial infarction	0.10	- 0.03	0.29	3.27	0.71	0.22	2.32
Percutaneous coronary intervention	- 0.08	- 0.25	0.09	0.69	2.00	0.55	7.20
Hypertension	- 0.009	- 0.111	0.091	0.17	0.53	0.97	2.95

Note. B = beta; SE = standard error; CI = confidence interval; OR = odds ratio; group = usual care = 0 or intervention home visit = 1.
*** $p \leq 0.001$.

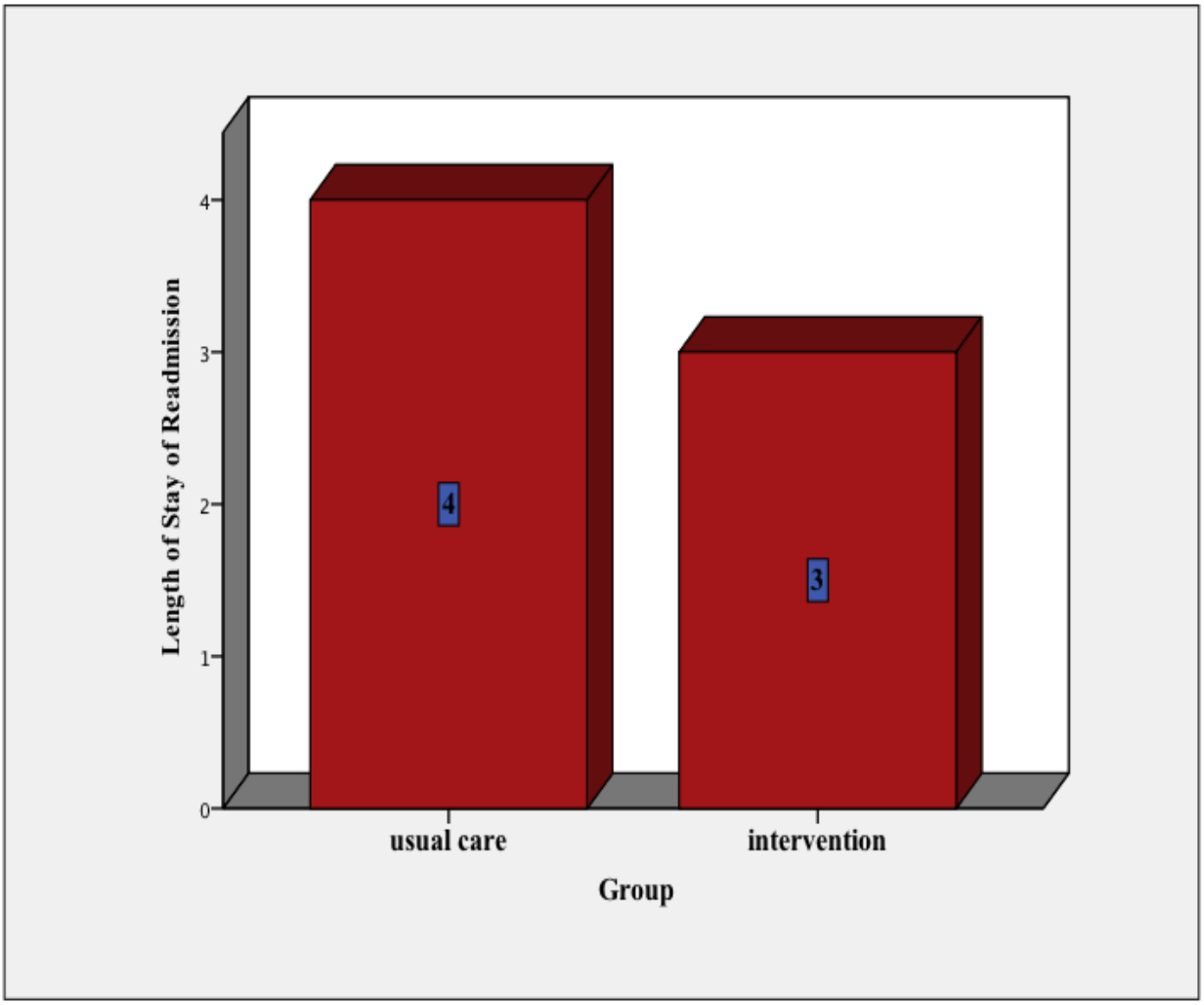

Figure 1 Median Length of Stay of All-cause Readmissions

Chapter 5: Discussion

Our study examined the only program in British Columbia through which heart failure patients receive home visits by a cardiac nurse clinician, upon hospital discharge. This study analyzed retrospective data from two groups of patients diagnosed with heart failure and also hospitalized in the period between 2009 and 2013. The patients in the intervention group received home visits by a cardiac clinician after discharge from hospital while the comparison group did not receive home visits but had usual follow-up care. Our results suggest that there may be a relationship between home visits by a cardiac nurse clinician and heart failure readmissions with patients who are diagnosed with heart failure. These findings are similar to those of previous randomized controlled trials conducted in the United Kingdom and Australia with regard to heart failure readmissions. (Blue et al., 2001; Stewart & Horowitz, 2001; Stewart, Marley & Horowitz, 1999; Stewart, Vanderbrock, Pearson & Horowitz, 1999).

In addition, those who received a home visit were more likely to be referred for cardiac rehabilitation services, compared to those who received usual care. This secondary finding supports Wagner's Chronic Care Model, one of two theories that guided the study. Cardiac rehabilitation is not as well utilized in the heart failure population of patients as in other cardiac patients (Schopfer & Forman, 2016). Our findings highlight the importance of nursing referrals to cardiac rehabilitation. The logistic regression model examining the predictors of cardiac rehabilitation referrals suggested the intervention was a predictor for cardiac rehabilitation referral; that is, those patients who had the intervention were ten times more likely to be referred to a cardiac rehabilitation program. The strength of this relationship is weak, due to the wide confidence interval and this may not represent the true population mean. The wider confidence interval may be related to the small sample size, and there may be risk of Type II error. We also

found that those patients who were referred to a cardiac rehabilitation program were more likely to be younger in age. This is a similar finding in past research on predictors to cardiac rehabilitation (Grace et al., 2009).

Furthermore, we did not find a relationship between the intervention and all-cause readmissions or length of stay in hospital. This finding differs from those in previous studies, and there are several factors that may provide an explanation for the differences between our results and those of previous studies, such as mean age and participants with preserved ejection fraction. First, the mean age of the participants in the current study was higher than that of participants in previous research studies (Blue et al., 2001; Stewart & Horowitz, 2002; Stewart, Marley & Horowitz, 1999; Stewart, Vanderbrock, Pearson & Horowitz, 1999). The mean age of our intervention group was lower than that of the usual care group, but the participants were even younger in previous studies (Blue et al., 2001; Stewart & Horowitz, 2002; Stewart, Marley & Horowitz, 1999; Stewart, Vanderbrock, Pearson & Horowitz, 1999). Wellan et al. (2016) have suggested that older patients who suffer from heart failure may be at higher risk for readmission to hospital than younger patients. Second, the current study included patients who had preserved ejection fraction heart failure whereas previous studies have excluded those with preserved ejection heart failure (Blue et al., 2001; Stewart & Horowitz, 2002; Stewart, Marley & Horowitz, 1999; Stewart, Vanderbrock, Pearson & Horowitz, 1999).

Previous researchers have suggested that the model of care consisting of post-discharge home visits for patients who suffer from heart failure could have multiple benefits to the healthcare system in the form of reducing all-cause and heart failure readmissions (Blue et al., 2001; Stewart & Horowitz, 2002; Stewart, Marley, & Horowitz, 1999; Stewart, Vanderbrock, Pearson & Horowitz, 1999). Stewart, Marley & Horowitz (1999) calculated that a reduction in

readmissions for those who suffer from heart failure produced a cost saving for the Australian healthcare system. Within the Canadian healthcare context, the Canadian Institute for Health Information (2012) estimated that each medical readmission, including heart failure, costs the healthcare system $10,404. Loosely applying this estimate to the two groups in the current study shows that there was a substantial cost saving for placing patients in the home visit intervention group. That is, the intervention could have potentially saved $210,000 in costs due to lower readmission rates for heart failure ($30,000 for intervention group versus $240,000 for usual care group). We recognize a proper cost analysis study should be conducted in order to confirm our suggestion of cost savings with home visits by a cardiac nurse clinician and patients who are diagnosed with heart failure.

Our proposed model of care may also be beneficial for other cardiac patients. Stewart and colleagues (2016) suggested recently that a relationship exists between home visits and a reduction in hospital readmissions for those who suffer from other forms of chronic heart disease. Among cardiac patients, those who suffer from heart failure and acute myocardial infarction are at highest risk for readmission to hospital (House, 2016); therefore, this proposed model of care of home visits by a cardiac nurse clinician could have a large impact in terms of reducing hospital readmissions.

5.1 Limitations

At the time of the implementation of the intervention program, there was no research study planned to examine the efficacy or effectiveness of the intervention. Therefore, random assignment to intervention or usual care did not take place. As well, this study took place at one urban hospital site and generalization to a broader population may not be applicable.

In addition, other factors associated with the intervention may be linked to the difference in heart failure readmissions. Stewart, Marley & Horowitz (1999) surmised that other unmeasured confounding variables associated with the intervention could also be related to the difference in heart failure readmissions. In some cases, the cardiac nurse clinician required a physician's order to adjust medication and treatment when a patient showed a clinical deterioration and increasing signs of heart failure; fortunately, the physicians who work at the site hospital are very supportive of the intervention program. Furthermore, the physicians generally responded quickly to a phone call or text from the intervention nurse. It could be the prompt action of the nurse and physicians together that had an impact on prevention of heart failure readmissions.

Another factor that may be associated with the difference in heart failure readmissions is a higher number of missing discharge prescriptions in the usual care group. Fewer evidence-based medications could increase the readmission risk. However, the absence of a discharge prescription in the chart may be attributed to filing or clerical error and not to prescriber error.

There may also be researcher bias since the intervention nurse who performed the home visits between July 2011 and January 2013 was also the main author of the current study. Therefore, she may have gone to greater lengths to reduce readmissions with the patients with heart failure, knowing that the frequency of readmissions was going to be analyzed. However, between January 2013 and September 2013 a different cardiac clinician made home visits. Unfortunately, there was no coverage on the days the intervention nurse was absent from work; As a result, patients were left without support for one month during the intervention study period.

5.2 Implications for Nursing Practice

The results from this study may have significant implications for nursing practice, with particular relevance for care practice of acute care nurses and primary care providers. Nurses who work in acute care need to be aware of the high risk of readmission to hospital with heart failure patients and the efficacy of post-discharge follow-up in the home with a cardiac nurse to reduce the likelihood of readmission to hospital. Unfortunately, few community programs with similar elements to the intervention in this study currently exist in Canada. Nevertheless, nurses in acute care who are involved with preparing heart failure patients for discharge from hospital should facilitate post-discharge follow-up with existing community programs and primary care providers: this action may reduce the likelihood of readmission to hospital.

The responsibility for post-discharge follow-up lies not solely with nurses it also lies with the primary care providers in the community. That primary care providers arrange follow-up after a heart failure patient returns home is critical. Acute care and primary care providers working together could significantly improve post-discharge follow-up care for heart failure patients. However, it was noted by Dr. Sean Virani, provincial heart failure physician lead at Cardiac Services in British Columbia that a disconnection exists in the healthcare system when it comes to the care for those patients who suffer from heart failure (Heart & Stroke Foundation, Canada, 2016). Dr. Virani described the care of heart failure as “separate silos ” (Heart & Stroke Foundation, Canada, 2016) referring to the healthcare system’s disconnection with multiple providers working in isolation rather than together. Dr. Virani recommended a more cohesive system for the care of those that suffer from heart failure (Heart & Stroke Foundation, Canada, 2016). Our model of care based on Wagner’s Chronic Care Model with partnerships between providers and the intervention program in this study works in partnership with the acute care

hospital to ensure a seamless transition back to the home and community. More such partnerships between acute hospitals and the community may be beneficial to those suffering from heart failure, especially as they navigate periods of personal transition.

The growing awareness of the need for collaborative care for heart failure patients is reflected in professional activities related to nursing, as well as in papers and articles in medical journals (Dimitry & Ezekowitz, 2014; Bodenheimer, Wagner, & Grumbach, 2002). For example, the "UBC Heart Failure Symposium 2017" in Vancouver featured " Patient-Centered Heart Failure Care" for the overall symposium theme. Dr. Justin Ezekowitz (2017) of the University of Alberta, spoke on "Collaborative Care - How and When?" and a workshop was devoted to " The Role of Nurses in Optimizing Self-Care in Heart Failure" (Luehr & Nordquist, 2017). Here, the collaborative approach for patients who suffer from heart failure is focused on care in the context of the heart function clinic setting. Ezekowitz (2016) said " heart function clinic nurses are excellent and counsel patients, as do family doctors, often small changes and telephone counseling can help them avoid being re-admitted". (Heart & Stroke Foundation, Canada, 2016). Our proposed model of care is a collaborative approach, too, but within a different context, notably the home.

Furthermore, the theories that guided our study could provide a framework to assist nurses who care for heart failure patients not only in acute care but also in the community. These theories should be discussed and integrated into practice to increase the focus on post-discharge follow-up for heart failure patients. Wagner's Chronic Care Model recommends that multiple healthcare providers work together rather than in isolation when providing care to patients with chronic disease, and this theory resonates for the care of heart failure patients. Meleis'

Transitions theory outlines hospitalization and discharge as a life transition, placing nurses' as pivotal providers in assisting patients in the post-discharge period following a hospital stay.

5.3 Recommendations for Research

The results of this study are promising in that home visits by a cardiac nurse clinician could reduce the readmission frequency in the heart failure population. More work is needed in testing this intervention in other geographical areas; such as rural areas where medical supports are not readily available and where travel constraints are an issue. This work was carried out in an urban environment with fairly ready access to community supports, medical and other. More work is needed to look at the range of socioeconomic backgrounds of patients because this study was conducted in an urban area where the patients who suffer from heart failure may have higher levels of education and income.

Furthermore, a more rigorous study design, such as a randomized controlled trial or interrupted time series, is needed to further test the model of home visits in patients diagnosed with heart failure. A larger sample size could produce more data validating our model of care. Previous researchers, (Blue et al., 2001; Stewart et al., 2012; Stewart et al., 2014; Stewart et al., 2016 Stewart, Marley, & Horowitz, 1999; Stewart, Vanderbroeck, Pearson, & Horowitz, 1999) have found that fewer deaths occurred when home visits were performed with those who suffer from heart failure (Blue et al., 2001; Stewart et al., 2012; Stewart et al., 2014; Stewart et al., 2016; Stewart, Marley, & Horowitz, 1999; Stewart, Vanderbroeck, Pearson, & Horowitz, 1999); therefore, examining mortality as an outcome may be beneficial. A cost analysis study developed from the current study data could also verify the cost benefits of this model of care. Post-discharge home visits could also be studied, focusing on the Canadian context and those who

suffer from other forms of cardiac disease, as Stewart et al. (2016) did in Australia, looking at those patients who are admitted to hospital with atrial fibrillation and myocardial infarction.

Research might be undertaken with patients suffering from chronic medical conditions other than heart failure to investigate whether this model of intervention with a clinical specialist may be effective. A chronic condition such as chronic obstructive pulmonary disease may be a cohort of patients who could benefit from post-discharge home follow-up visits. Finally, within the discipline of nursing there is a need for nurses, especially cardiac clinicians to conduct or engage in research studies to further develop the model of home visits with those who suffer from heart failure.

5.4 Conclusion

Home visits by a cardiac nurse clinician are associated with reducing heart failure readmissions to hospital and with an increased number of cardiac rehabilitation referrals. Our proposed model of care has potential to reduce healthcare costs by reducing the frequency of readmissions to hospital. This study adds to the existing knowledge of home visits for those patients who suffer from heart failure, and is the first study of its kind to be conducted in Canada.

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Appendix A: Glossary of Terms

Cardiac Nurse Clinician. A cardiac nurse clinician is a registered nurse with specialty training and experience in cardiology who has obtained cardiovascular certification by the Canadian Nurses' Association.

Home Visits. Home visits are defined as face-to-face visits by the cardiac nurse clinician in the current or temporary primary residence of the patient. The primary residence could be a house, apartment, or assisted living facility.

Heart Failure Readmission. A heart failure readmission to hospital is defined as the first admission to a hospital within the health authority of the research site, and within 30 days from the date of discharge with a most responsible diagnosis or discharge diagnosis of heart failure. The 30-day time frame was a benchmark outcome utilized for the Centers for Medicare and Medicaid Services quality initiative in the United States (Kromholz et al., 2009). The Centers for Medicare and Medicaid Services hospital quality initiative include 30-day readmission rates as an outcome for patients with heart failure (Kromholz et al., 2009). The patient had a record indicating inpatient status, for it to be considered an admission to hospital, and an inpatient status can be identified in the chart and in the Care Connect database. A visit to the emergency department where an inpatient status is not assigned, did not count as a readmission.

Emergency Department Visits. The emergency department is sometimes the only option for assessment and prompt treatment due to frailty, transportation issues, or physician office closures; therefore, it is important to examine and document emergency visits. An emergency department visit is defined as "emergency inpatient status" in the absence of hospital inpatient status. Emergency inpatient status and hospital inpatient status can be determined in the Care Connect database and the medical record.

Intervention. The intervention provided care to patients who had a discharge diagnosis of heart failure and who were seen by the cardiac clinician in the home between September 16, 2011 - September 16, 2013.Referrals were sent from within the research site hospital and from other tertiary care hospitals that may have admitted patients who live within the catchment area of the research site hospital.

The goals of the intervention were to promote self-management skills through patient education, assessment and nursing intervention, in order to reduce risk of readmission and maximize quality of life. The procedure manual for the intervention indicated that each home visit should be compromised of a full head-to-toe assessment, vital signs, baseline electrocardiogram on first visit, and further electrocardiograms with a change in health status. Patient teaching, to increase self-management skills, was also a key component of the intervention. Patients received the booklet *Living With Congestive Heart Failure* by The Heart and Stroke Foundation of Canada, and standard sheets on sodium, fluid, weight, and discharge instructions. The topics covered for patient teaching sessions consisted of medication management, signs and symptoms of heart failure, daily weights, fluid restriction, low sodium diet, lifestyle factors, and activity progression. Follow-up appointments with specialists or primary care physicians, and referral to cardiac rehabilitation and other community programs were also arranged during the intervention visit.

Each patient received one visit per week until the patient was medically stable with no new heart failure symptoms and vitals signs were within stable range. Patients also must have met the self-management goals of taking medication correctly and understanding lifestyle management skills for heart failure. More than one visit per week was arranged if the patient was experiencing complications or symptoms. Patients were made aware that they could contact the

intervention program for any health-related concerns even after they had been discharged from the program. If a patient was readmitted to hospital after discharge from the intervention program, the home visits commenced again upon discharge from hospital.

The intervention included communication with the patients' physicians as necessary, based on the nurse clinician's assessment. Stewart, Marley, and Horowitz (1999) suggested that because the nurse provided the cardiologist with an updated assessment from discharge, the physicians were able to provide better care to the patient with this updated patient assessment. The specialist and family physician both received a discharge summary when the home visits ceased and the patient was medically stable.

Usual Care Group. The usual care group received the usual care from a specialist physician or general practitioner but not from the intervention program. The patients in the usual care group would not have received targeted post-discharge teaching and counseling in the home from a cardiac clinician; however they may or may not have received inpatient hospital teaching from acute care nurses.

Research Protocol

The intervention group was selected from the Early Supportive Discharge Project records after the ethical certificate was received. The intervention group was not a random sample but chosen consecutively as there were only 113 patients who were admitted to the intervention program between September 16, 2011 and September 16, 2013. However of those, only 103 patients admitted to the intervention program between the specified dates met the inclusion criteria of the study

The decision support manager extracted the usual care group from the Discharge Abstract Database after the ethical certificate was received. The researcher then chose the usual care

group by randomly using a list of numbers generated from the Research Randomizer website and matching the number to the appropriate row on the spreadsheet that contained the list of admissions.

For each patient the data were extracted first by entering the medical record number into Care Connect, the electronic medical record system. The heart failure admission was identified by the date specified in the Discharge Abstract Database extraction for controls and from the program records and chart for the intervention group. For verification that the inclusion criteria were met the discharge summary was reviewed to confirm diagnosis of HF, date of index admission to hospital, living situation, and discharge home confirmation. Laboratory and clinical data that could not be found in Care Connect were obtained from the original medical record chart.

The medical record number and specified admission, or readmissions when applicable, were all utilized to locate the original medical record chart in the Vancouver Coastal Health Medical Records Department or off site at the holding company. Unfortunately, some medical records of control group patients could not be located due to passage of time and/or death. However, the intervention group's charts were held in the locked filing cabinet in the program office. These charts were more readily accessible to the data extractor.

Data Collection Tool

A data collection tool (see Appendix B) was used to record the information from the patients' charts. The information was recorded using Microsoft Excel. It was deemed important to examine and record other variables that may affect readmission to hospital with patients who are diagnosed with heart failure. The information that was collected from the chart review also provided specific characteristics of the two groups of patients, which could help to determine if

the findings could be generalized to the larger population of patients who suffer from heart failure. The following variables were contained in the data collection tool.

Demographic variables

The patient's age and sex were recorded on the data collection tool. Age can be a predictor of heart failure readmission; however, sex has not been shown to be a predictor of heart failure readmissions (Giamouzis et al., 2011). Those patients who lacked social support and lived alone, factors which also were recorded, could have been at increased risk for hospital readmission (Giamouzis et al., 2011). Ability to speak English was collected as a dichotomous variable.

Confirmation of Diagnosis of Heart Failure

It was important for the data collector to verify first the most responsible diagnosis of heart failure to ensure validity of the study results. The verification of the most responsible diagnosis of heart failure most often was contained within the discharge summary. The physician's notes in the patient's chart were another source of confirmation of a most responsible diagnosis of heart failure.

Medical History

Co-morbid conditions were collected from the patient's chart (in the discharge summary or physician consultation notes). These conditions outlined in the data collection could have been factors in a readmission to hospital. Past research has identified that comorbid conditions have an impact on heart failure readmission (Giamouzis, et al., 2011)

Discharge Laboratory Blood Test

Physiological predictors of heart failure readmissions have included blood levels of creatinine, hemoglobin, and sodium (Giamouziz, et al., 2011, Betihavas et al., 2012)). The

laboratory data was located in the laboratory section of the chart or obtained from Care Connect database. Stewart and McMurray (2004) noted that a low hemoglobin level increased risk of heart failure readmission. The blood levels of these laboratory levels as close to discharge date as possible were used, because some levels could have been higher upon admission and then decreased during hospital stay.

Discharge Ejection Fraction

Previous research in heart failure and home nursing interventions has focused on those patients who have impaired left ventricular dysfunction (Blue et al., 2001). Patients who have preserved ejection fraction have been deemed a high risk for readmission (Giamouziz et al., 2011); therefore, the discharge ejection fraction identified the type of heart failure (preserved versus reduced ejection fraction) of each study participant. There has been limited evidence-based outcome-modifying therapy for patients with preserved ejection fraction (Mckelvie et al., 2013; Giamouziz et al., 2011) noted that past studies have shown increasing risk for re-hospitalization with both depressed ejection fraction and preserved ejection fraction. The ejection fraction was located in the discharge summary or the formal echocardiogram report in the chart. However, echocardiogram reports were not always located and missing data was recorded appropriately in the spreadsheet.

Heart Valvular Dysfunction

Patients with heart valvular dysfunction have been found to have a "4-hold higher likelihood of hospitalization" (Giamouziz et al. 2011, p. 59) than those patients who did not have any valvular dysfunction. We extracted the presence of aortic stenosis and mitral/tricuspid valve dysfunction from the discharge summary in Care Connect or from the echocardiogram located in the medical chart.

Admission B-Type Natriuretic Peptide (BNP) level

The BNP level is utilized to diagnose heart failure and is routinely assessed upon admission to hospital. Giamouziz et al. (2011) noted that a BNP level of > 200 pg/ml on admission predicted heart failure readmission, and that both admission and discharge BNP levels are predictors of readmission. The BNP level is usually taken upon admission or if the patient further deteriorates while in hospital. BNP levels were located in the laboratory section of the chart or found in the Care Connect database. The BNP level closest to discharge was recorded.

Discharge Medications

Pharmacological management has been deemed to be the main treatment for heart failure (Mckelvie et al., 2013) and it was important to collect data regarding discharge medications prescribed for each patient. The discharge medications were located in the discharge summary.

Appendix B: Data Collection Form

Current Date_____ Data Collector Initials_____
Patient ID number _____
Date of Index Hospitalization **(dd/mm/year)**_____

Date of Discharge Index Hospitalization (**dd/mm/year**)_____
Length of hospital stay **(#days**)_____

Confirmation of HF Discharge Summary ☐ Chest X-ray ☐ Positive BNP ☐

Preprinted HF Order Set Utilized Yes ☐ No ☐

Age	_____Number of years
Date of Birth on Index Hospitalization	_____(dd/mm/year)
Sex	Female □ Male □
Lives Alone	Yes □ No □
Non English Speaking	Yes □ No □
HTN	Yes □ No □
Diabetes	Yes □ No □ Type 1 2 Diet Controlled
Atrial Fibrillation	Yes □ No □
Coronary Artery Disease	Yes □ No □
Chronic Kidney Disease Prior MI Prior PCI or CABG	Yes □ No □ Yes □ No □ Yes □ No □
COPD	Yes □ No □

Hyperlipidemia	Yes □ No □
TIA/CVA	Yes □ No □
Cancer in last 5 years	Yes □ No □
Osteoporosis	Yes □ No □
BNP level on admission	_____
Discharge Laboratory Values or **last blood work to be done before discharge**	Creatinine_____ Sodium_____ Hemoglobin_____
Discharge Medications	Beta Blocker □ ACE inhibitor □ ARB □ Spironolactone □ Furosemide □ Digoxin □
BNP level on admission	_____
Discharge Ejection Fraction Reduced Ejection Fraction HF	_____ Yes ☐ No ☐ Yes ☐ No ☐

Preserved Ejection Fraction HF	
Aortic Stenosis	Yes □ No □
Mitral or Tricuspid Valve Dysfunction	Yes □ No □
Referrals to Other Healthcare Supports	Cardiac Rehab □ OT □ PT □ Palliative Care □ Other □
Readmission to hospital	Yes □ No □ If yes date of admission _____(DD/MM/year) Discharge Date_____(DD/MM/year) Discharge Diagnosis_____ LOS_____ Number of HF admissions _____

Emergency Visit	Yes □ No □ Date of Emergency Visit _____(DD/MM/Year) Discharge Diagnosis _____ Number Emergency visits HF_____