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UNIVERSITY OF SAN DIEGO
HAHN SCHOOL OF NURSING AND HEALTH SCIENCE

HOME TELEHEALTH IN HEART FAILURE PATIENTS

FINAL PRESENTATION

OF

Tanna R. Thomason

for the Degree of

DOCTOR OF PHILOSOPHY IN NURSING

April 16, 2015
Hahn School of Nursing and Health Science, Room 109
10:00 am

Dissertation Committee

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Cynthia D. Connelly, PhD, RN, FAAN

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Abstract

Aim: Technology holds a great potential to improve the quality of health care delivery.

The use of remote patient monitoring, or telehealth (TH), has been widely adopted by many home care agencies to facilitate early identification of disease exacerbation, particularly for patients with chronic diseases such as heart failure.

Rationale: TH has been successfully utilized by agencies to improve symptom detection and potentially reduce rehospitalization rates. Quantifying program effectiveness through data analysis is a critical step for program improvement, resource allocation, and future strategic planning.

Methods: Utilizing the OASIS-C database, a retrospective analysis was conducted examining 22-months of heart failure patient data from one home care agency in southern California. Seventy patients receiving TH were compared to patients who received usual home care nursing services.

Results: No major differences in baseline socio-demographics were found between the two groups. While receiving home health care services, the non-TH patients had a 21% all-cause hospital re-admission rate, compared to the home TH patients with a 10% all-cause re-admission rate. Statistical differences were found between groups on the variables of fall risk, vision, smoking, shortness-of-breath, the ability to bathe and take oral meds, along with having been discharged from a skilled nursing facility in the past 2-weeks.

Implications: These results indicate that aggregate data analysis is useful in providing insight into program analysis and baseline practices. Understanding baseline data facilitates the continued progression in modifying and building future TH programs. TH

programs have the potential to reduce the burden associated with rehospitalizations in the heart failure population

Dedication

To my husband Rick, who has empowered me with his continuous love, humor and encouragement. Your partnership and support has sustained me throughout this doctoral educational journey. You are a man of integrity and wisdom. I am proud and blessed to be your wife and life partner.

To my adult children Kenneth, Kelsey and Elizabeth, who continually inspire me and add to my knowledge thru the lens of their educational and life-learnings. I love each of you more than you will ever know and feel blessed to be your mom. Always tell yourself that you *can* accomplish your goals regardless of your age, barriers, or circumstances.

To my mother for her unconditional love, support, and Christian role modeling. I aspire to be like you.

To my family, friends and neighbors who provided me with laughter and insights. To my Sharp Memorial Hospital nursing colleagues who have blazed the trail before me, and lead the way with advice and encouragement.

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Dissertation

Chapter One

Home Telehealth in Heart Failure Patients

Tanna Thomason

University of San Diego

Home Telehealth in Heart Failure Patients

Chapter One

Introduction

Heart failure (HF) patients are one of the largest and most costly cohorts of chronically ill patients in the United States (US). Today, HF affects 5 million people in the US causing approximately 300,000 deaths per year (American Heart Association, 2011). The incidence of HF in the US is on the rise, with 825,000 new cases each year (Go, Mozaffarian, and Rodgers, 2013). HF is often characterized with frequent exacerbations requiring hospitalizations. The national average of HF hospital readmissions within 30-days of discharge is 23 percent, or nearly 1 in 4 patients (Hospital Compare, 2014).

Patient education and self-care training for patients hospitalized with HF may be inadequate for preventing future adverse events (Riegel, Lee, and Dickson, 2011). HF most often affects the older patient population creating challenges related to the medication regimen, dietary modifications, laboratory monitoring, and interactions with existing comorbid conditions (Robinson et al., 2011). Increased age, declining cognitive function, challenges associated with HL, polypharmacy, and altered living arrangements are just a few variables which may place the HF patient at an increased risk for re-hospitalization. Additional challenges related to outpatient management of HF frequently include accessibility and availability to health care providers.

HF management requires a high level of patient involvement and self-care (Bui and Fonarow, 2012; Clarke, Shah, & Urvashi, 2011). Adequate HL (HL) is critical for interpreting treatment information and following recommended treatment plans. Many HF patients struggle to understand the written educational materials, home medication

management, and how to optimize their sodium restricted diet, fluids, and weight management. The National Assessment of Adult Literacy Report (2003), states 36% of adult Americans and 59% of adults 65 years or older have below basic, or basic, HL (Kirsch, Jenkin and Kolstat, (2002). The assessment of HL is critical to tailor educational programs appropriately and provide special assistance to patients with limited ability to manage the complexities associated with HF.

With the goals of improving early symptom recognition, self-care, and decreasing hospital admission rates, home technology represents a promising approach enabling patients with chronic HF to be monitored more closely. Studies utilizing a home telehealth (TH) device to improve self-care and reduce HF re-admission rates have yielded mixed findings; therefore, additional research in this area is still warranted (Bradley, Curry, and Horowitz, 2012). Nurses are key members of the health care team and play an integral role in providing customized educational approaches for the implementation and evaluation of home TH adoption in the HF population.

Literature Search Methods

To establish a thorough review of the literature the following steps were taken. An electronic search of published manuscripts was conducted using three electronic databases (PubMed, CINAHL, and Google Scholar), and the Health Technology Assessment Database (HTA) of the Cochrane Library. Peer reviewed manuscripts on adult patients with HF and home telemonitoring and/or HL published between 2009 through March 2015 were sought. The key words used for this search strategy included key words, title, or abstracts including the words heart failure combined with patient management, self-care, telemonitoring, telehealth, perceptions, acceptance, adoption, re-

admissions and HL. Both quantitative and qualitative studies were sought. The research articles included descriptive, exploratory, intervention, and evaluation studies.

After the initial electronic database searches were completed, hand searches were also conducted of the citations in the reference lists of relevant articles. Electronically searchable scientific statements (e.g. American Heart Association, American College of Cardiology, American Association of Heart Failure Nurses, National HL agencies), and printed proceedings (e.g., University of California, San Francisco, Symptom Management Symposia; American Association of Heart Failure Nurses) were also examined. This synthesis of the literature review is focused on HF demographics, hospital re-admissions, literacy, the role and benefits of home TH, and characteristics that may facilitate the adoption of utilizing home TH.

Overview of the Problem

HF is a chronic, progressive condition and remains the number one diagnostic related group (DRG) for people over the age of 65 (Chen, Normand, Wang, & Krumholtz, 2011). This challenge places a strain on our healthcare system. More than \$30 billion was spent on HF patient management in 2012 and more than \$43 billion is projected for 2020 (Heidenreich, Albert, & Allen, 2013). Common reasons for HF exacerbations include delays in symptom recognition; medication and dietary noncompliance; and lack of knowledge, HL, and skills for self-care management (Hall, Dodd, Harris, & Dasco, 2014). Upon discharge, the health trajectory of this population varies widely. The ability of patients to understand discharge materials and follow-up appointments may be an influencing variable. As the US health care industry begins the transition into a value-based reimbursement environment, controlling the costs of caring

for these patients is of paramount concern. Nurses are instrumental in the education and care coordination for this vulnerable population (Riegel et al., 2011).

The Patient Protection Affordable Care Act has created new incentives to reduce hospital re-admissions. Hospitals with high re-admissions rates will lose a percentage of their Medicare reimbursement (Patient Protection and the Affordable Care Act, 2010). These fines may create a ripple effect, ultimately influencing the financial viability of health care organizations and the services they provide. In addition, the consumer may access information on quality measures, ranging from infection to re-admission rates from several public web sites (Kocher & Adashi, 2011) and use these data to make decisions regarding their health plan, primary care provider selection, and hospital alignment (Institute of Healthcare Improvement Centers for Medicare and Medicaid Services, 2014).

Improved strategies geared toward identifying subtle clinical changes and anticipating exacerbations of HF decline are needed (Baker, DeWalt, Schillinger, Hawk, Ruo, Bibbins-Domingo et al., 2011). In an effort to limit hospitalizations for HF patients, a variety of approaches are being incorporated including the optimization of home TH. In contrast to episodic and reactive patient behaviors, ideal HF management would include proactive symptom recognition. Home TH may be an important element in this continuum of patient engagement and successful HF clinical management.

Heart Failure Self-Care Management

The American Heart Association defines self-care as the decision-making process patients use to maintain physiologic stability (Riegel, Moser, & Anker, 2009). Heart failure is a chronic illness, where the patient's knowledge and potential to perform self-

care are highly important. A number of aspects on self-care have been identified. Ten factors have been identified pertaining to self-care and these include: experience, skill, motivation, culture, confidence, habits, function, cognition, support from others, and access to care (McMurray, Adamoupolos, & Anker, 2012).

Self-care includes multiple components such as adhering to medications, following diet and exercise recommendations, and actively monitoring for signs and symptoms of worsening heart function (Inglis, Clark, McAlister, Stewart, and Cleland, 2010). Standard management of the ambulatory HF patient involves patient education to monitor his/her symptoms and physiologic data including daily weight and blood pressure. Multiple comorbidities often compound the challenges of self-care that are frequently encountered in the HF patient population.

The diversity of needs in support of self-care activities can be influenced by the dynamics of changes within the individual's heart failure condition. Improved self-care practices can be empowering to the patient with a chronic illness. Self-care management training teaches self-care skills and reinforces positive behaviors including recognizing symptoms of worsening heart rate, monitoring for weight gain, restricting dietary salt, exercising, taking medications as prescribed, and implementing plans for what to do in the event of a HF exacerbation (McMurray et al., 2012). Improved self-care maintenance (i.e. symptom monitoring and treatment adherence) can result in improved self-care management and may also influence self-care confidence (Riegel & Dickson, 2008).

Home Telemonitoring

Remote patient monitoring for chronic HF is gaining increasing importance in healthcare. Telemedicine has been defined by the American Telemedicine Association

(2012 Paragraph 1), as “the use of medical information exchanged from one site to another via electronic communications to improve a patient’s clinical health status”. Closely associated with telemedicine are the terms “telemonitoring” or “telehealth”, which are used to encompass the broader definition of remote healthcare services including daily measuring of health parameters by the patient and their transmission via telephone, mobile phone, or the Internet to a telemedical center (Health Resources and Services Administration, 2012). These definitions exclude stand alone structured telephone support or video conferencing. Most home TH systems include at a minimum, measurement of daily weight, heart rate, and blood pressure recordings. These biometric data are transmitted to a central receiving station, typically within a home care agency or clinic where the data is analyzed by a healthcare professional. Many TH systems also include simple questions that are correlated to common symptoms associated with the exacerbation of HF symptoms (e.g. increased shortness of breath, increased fatigue, and/or weight gain). Improved HF symptom awareness may result through the correlation of subjective symptoms combined with objective biometric data, thereby, potentially improving self-care maintenance and management.

With the goals of improving symptom recognition, treatment adherence, and decreasing hospital re-admissions, home TH has been found to be a useful tool for HF patients (Boyne et al., 2014; Inglis et al., 2010). TH may assist in the early detection of HF deterioration, allowing for more prompt and effective interventions (Bui & Fonarow, 2012). With the incorporation of useful data from the home device, patients are empowered to view the data and correlate with daily symptoms. With improved early

detection of symptoms, HF patients may seek prompt and effective interventions (Dang, Dimmick, & Kelkar, 2009).

Mortality and re-hospitalization rates. Several meta-analyses of randomized controlled trials (RCT) have evaluated the impact of home TH in HF patients. These studies have shown that compared to usual care, home TH reduces all-cause mortality (Clarke et al., 2011; Inglis et al., 2010; Nakamura, Koga Iseki, 2014). In studies by Polisena et al. (2010) Xiang, Li, and Liu (2013), patients utilizing home TH had fewer hospitalizations when compared to non-TH patients.

Communication with Healthcare Team. With repeated use, the patient begins the process of home TH acceptance and adoption by correlating the daily biometric data (i.e. blood pressure, pulse, body weight) with their daily symptoms. Early symptom recognition and earlier communication with the healthcare team can result from regular TH use. In a study by Seto et al. (2012), home TH patients had greater awareness of their HF condition and liked the “real time” communication with the health care team on how to modify their life style. Similarly, in a qualitative study of 15 HF patients who were interviewed at 3 and 6 months (Riley, Gabe, & Cowie, 2013), researchers found after 6 months of use, TH patients had improved symptom recognition, felt empowered with self-care decision making, and had improved interactions with both the TH and communication with the TH nurse. Patients receiving home TH reported having increased access to care providers who were more accessible for questions (Hall et al., 2014). Earlier communication with the healthcare team could result in improved symptom management and reduced hospital re-admissions.

Self-care and Patient Satisfaction. In their qualitative analysis with in-depth interviews of 15 HF participants, Hall et al. (2014) describes home TH participants reported earlier identification of worsening clinical symptoms and increased knowledge as potential benefits of utilizing home TH. Studies have reported improved self-care (Lynga, Fridlund, Eklof, & Bohm, 2013), and improved patient satisfaction when using a home telemonitor (Kraai, Luhik, Jong, Jaarsma, & Hillege, 2011). In a systematic review, Inglis et al. (2010) reported patients receiving healthcare with home TH rated satisfaction between 76% and 100%.

Adoption of Home Telemonitoring. When utilizing home TH, the patient evaluates the usefulness of the TH device/program and begins an adjustment process. The usefulness of home TH can range from positive (i.e. helpful) to negative (i.e. too disruptive to routine or not helpful with symptom recognition). Prescher et.al. (2014) found high rates of adherence with home TH resulted when patients' received individualized training and perceived the equipment to be simple to use.

The development of trust is an important attribute of TH acceptance leading toward TH adoption. Patients must learn how to *trust the technology* believing it will ultimately enhance the multi-faceted (e.g. medications, activity, diet) management of their chronic HF condition. The patient must trust in the accuracy of the technology (e.g., the blood pressure reading is correct and correlates to data derived from their personal blood pressure devices) since mistrust has been reported to preclude patient use of home TH technology (Hall et al., 2014). Furthermore, patients must also trust the health care team to manage patient biometric data accurately, ethically (e.g. cannot be viewed by non-healthcare providers) and consistently (e.g., health care provider will call the patient

if values are abnormal). If the patient perceives a threat to the privacy of his/her data, a lack of consent may result (McLean, Protti, & Sheikh, 2011) along with mistrust of the technology (Hall et al., 2014). In a study by Domingo, Lupon, and Gonzalez (2012), 65% of the 97 patients who had used home TH wished to continue with the device even after the monitor was discontinued since the benefits of the TH were positively perceived, thereby implying the patients trusted and valued the technology in their self-care management practices.

Adoption and adherence with the home TH regimen appears to be influenced by the perceptions of ease of use, frequency in using the device, increased access to health care providers, improved self-care practices, and overall satisfaction associated with the TH use. These variables are important considerations when establishing or updating a home TH program for HF patients.

HL in Heart Failure Patients

Clear communication between health care providers and their patients is essential for patients to make good health care decisions and optimize their personal self-care. Literacy is the ability to read and process information. According to the U.S. Department of Health and Human Services, HL is the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions (Health People 2010).

Thirty-six percent of adult Americans and 59% of adults 65 years or older have below basic, or basic HL (Kirsch et al., 2002). In patients with cardiovascular disease, HL is a predictor of adherence to treatments (Murray et al., 2009). In a systematic review of HL in the HF population, Cajita, Cajita, and Han (2014) found 39% of HF patients

have low HL. Individuals with low HL may have trouble processing information on disease management, such as medication labels, comprehending verbal information from their healthcare providers, utilizing home TH, and understanding educational materials.

Age, race, years of education are predictors of HL. As age increases, HL may decline (Westlake, Sethares & Davidson, 2013). Female gender has been found to be associated with higher HL and, therefore, is a significant predictor of HL in the HF population (DeWalt, Schillinger, & Ruo, 2012). When compared to Caucasian patients, Hispanic and African American HF patients have been found to have lower HL (Chaudhry, Herrin & Phillips, 2011). Individuals who have not completed high school are more likely to have lower HL, which is indicative of a positive correlation of level of schooling and HL (DeWalt et al., 2012; Wu, Holmes, & DeWalt, 2013). Furthermore, low or below basic HL is associated with increased 30-day hospital re-admission rates and higher mortality (Wu et al., 2013) while basic or adequate HL is consistently correlated with higher HF knowledge (Cajita et al., 2014).

Summary

In summary, there is a growing body of scientific inquiry regarding TH in chronic diseases including HF. Research is still needed on the evaluation of home TH program effectiveness/outcomes, the impact of HL in home TH patients, and the over-arching concept of TH adoption in the HF patient. To date, current understanding of home TH in the HF patient is derived primarily from studies from large academic centers, with a paucity of research in HF patients affiliated with a community setting (Domingo et al., 2012; Polisena et al., 2010). To improve quality patient care services and evaluate program outcomes, hospital nurses and nursing working in the home care setting utilizing

home TH for their HF population should evaluate program effectiveness including patient selection and their characteristics, adoption of the device, and outcome measures. The literacy of HF patients may also play an important role in this analysis.

Purpose and Study Designs

The purpose of this study was to add to the scientific body of knowledge on the HF patient population participating in two separate home TH programs. Utilizing an existing database from a home care agency, a descriptive correlational research design explores numerous cognitive and physiologic variables in HF patients participating in a nurse-led home TH program compared to HF patients who received usual home care nursing services (i.e. no home TH). Variables evaluated included patient demographics (age, gender, race, living situation, zip code), cognition (confusion, anxiety, depression, and ability to take oral medications) and physiologic indicators (vision, fall risk, activities of daily living). Data from this study added to the empirical body of knowledge regarding optimal patient selection characteristics along with hospital re-admission rates for HF patients enrolled in a community-based home TH program.

The second HF home TH research study was from a separate data source. Between 2013-2014, a prospective, feasibility, RCT enrolling 30 hospitalized HF patients who were nearing discharge was conducted. Patients were randomly assigned into one of three intervention groups. HL was assessed in all patients; results were blinded to the researchers until the close of the study. The focus of this study was to explore HL with socio-demographic characteristics, study completion, and hospital re-hospitalizations between intervention groups.

The third purpose of this study was to fully explore the concept of home telehealth adoption, which is an inherent factor in the overall compliance with home telemonitoring use. Adoption of the prescribed home technology varies among patients. Using Walker and Avant's concept analysis framework (2011), the literature published from 2009-2014 was reviewed. Thematic analysis was carried out to identify critical attributes, antecedents, and consequences. The critical attributes of telehealth adoption were the *perceived benefits* of using the technology, *trust* in oneself, the device and others, along with *acceptance* of the TH device. From this analysis, the concept of adoption of telehealth was demonstrated when the patient (a) incorporated the use of the device into their daily routine; (b) correlated and appraised the biometric data with their symptoms; and (c) made an emotional commitment to utilize (adopt) the device to facilitate improved self-care management. This analysis provided an improved understanding of the concept of TH adoption in the HF patient and provided a forum for discussion surrounding patient compliance and self-care initiatives when utilizing a home telemonitoring device.

Findings from these studies are useful for the strategic planning of future allocation of TH resources. This information is useful for healthcare agencies that wish to refine existing TH programs or for agencies planning to initiate new home TH programs. HL findings will be useful to practitioners and agencies that are interested in assessing and custom-designing home TH programs and educational materials with considerations of literacy levels. Incorporating the identified defining attributes of TH adoption into new or existing home TH programs will also facilitate adjustment to the new technology.

Research Aims

Utilizing a home care nursing agency dataset for a retrospective secondary analysis, the research aims of this study are listed below:

Aim # 1: Examine for differences between HF patients enrolled in a home TH program compared to non-telemonitored HF patients receiving traditional (i.e. usual care) home care nursing services regarding sociodemographic variables (age, gender, ethnicity, zip code, and living situation) and cognitive/physiologic indicators (i.e., ability to bathe self and self-administer medications, risk of falling, vision, shortness of breath, use of home oxygen).

Aim # 2: Examine for differences between the HF patients enrolled in a home TH program and non-telemonitored HF patients who receive home care nursing care services regarding 30-day hospital re-admissions.

Utilizing a prospective feasibility RCT dataset on HF patients recently discharged from the hospital, the specific aims of this study are to:

Aim # 3 Examine the relationships between HL and demographic variables (age, gender, ethnicity, level of education and living situation), completion of a 4-month intervention, and hospital re-admission between the 3 study groups.

Aim #4: Identify the critical attributes, antecedents, and consequences of TH adoption in the heart failure population based on the concept analysis framework by Walker and Avant (2011).

These four research aims will provide the structure to facilitate generating new scientific evidence towards obtaining an improved understanding of this high-risk patient population, while contributing to the scientific body of nursing literature.

Conceptual Framework

A conceptual framework is needed to guide the exploration of the multidimensional nature of the symptom experience among chronically ill HF patients. Two conceptual models have guided this research. The Symptom Management Conceptual Model (SMCM) provides a global overview for this study. Developed at the University of California, San Francisco (UCSF) School of Nursing, this mid-range theory describes how the person interacts within the three domains of the symptom *experience*, symptom *management strategies*, and *outcomes*. The symptom *outcomes* includes quality of living and perceptions of self-care (Dodd, Janson, Facione, Faucett, & Froelicher, 2001). The second conceptual framework used to guide this study is the Situation-Specific Self Care of Heart Failure Model (Riegel & Dickson, 2008). This model provides insight into the complex decision making process utilized to explore and explain concepts regarding HF self-care *maintenance* and *management*, which is also influenced by the attribute of self-*confidence*. These two conceptual frameworks can be readily applied to the HF patient utilizing a home TH device.

In the Symptom Management Conceptual Model (SMCM), a *symptom* is defined as “a subjective experience reflecting changes in the bio-psychosocial functioning, sensations, or cognition of an individual” (Dodd et al., 2001, p.669). Two important components of the symptom experience are symptom *evaluation* and *response* (Dodd et al., 2001). Symptom evaluation refers to how individuals describe their symptoms, for example, in terms of frequency, duration, intensity, and distress. Home TH can influence how the HF patient evaluates their symptoms. Symptom response includes physiological, emotional, and/or behavioral reactions to a symptom (e.g. physical, cognitive, and

affective alterations). An individual's HL capabilities may influence how the symptom is evaluated and how the patient may respond to their symptom(s). Data from a home TH device may also influence how the patient responds to their symptoms (e.g. reduces salt intake or calls their health care provider) and may influence the adoption or rejection of the TH device (i.e. trust in the accuracy of the data). Within this model, there is a continuous interaction between the three spheres. For example, a patient may begin with the symptom experience of "shortness of breath". The perception, evaluation, and response to this symptom may evolve into various symptom management strategies. As the patient compares their symptoms with the data from the home telemonitor, the patient will consider their options for symptom management strategies. The patient begins to evaluate the outcomes of their symptom experience based on the critique of the management strategies (i.e. were they effective or ineffective). The process of TH adoption may result when the patient utilizes and correlates the TH data and determines this data to be useful with self-care management. With consistent use of a home HT device, the process of TH adoption will improve early symptom recognition and/or validate of the patient's subjective symptom experience resulting in improved self-care.

The symptom experience, management strategies, and outcomes are influenced by the larger scope of the *Individual Person, Health and Illness*, and the *Environment* (Dodd et al., 2001). Demographic, psychological, sociological, physiological, and developmental factors comprise the sphere of the *Person*. This sphere also incorporates the individual's psychosocial capabilities and willingness to embrace the concept of TH adoption into the home setting. Within this sphere, the individual's HL capabilities are an important variable that may influence the individual's ability to interface with the two

remaining spheres of the *Health and Illness* and the *Environment*. For example, individuals with inadequate HL may struggle with symptom evaluation and symptom response, thereby influencing health and illness outcomes. The SMCM is dynamic and provides a framework for the analysis of home TH adoption in the HF population, while incorporating HL, which has the potential to be highly influential in the symptom management process.

See Figure 1.

Figure 1. University of California, San Francisco, School of Nursing
Symptom Management Conceptual Model

Developed by Riegel and Dickson (2008), the Self-Care of Heart Failure Model (SCHFM) is a situation-specific theory. Situation-specific theories focus on specific clinical phenomena seen in practice (Im & Meleis, 1999). The key concepts of this

model are self care *maintenance* and self-care *management*. Self-care *maintenance* incorporates behaviors used to maintain physiologic stability with a focus on symptom monitoring and treatment adherence. The selective awareness of personal symptom recognition and interpretation of this experience are critical first steps of this model. HL may influence this first step. For example, if the patient is struggling to understand their discharge instructions and home medication schedule, self-care maintenance will be more challenging. Patients who utilize a home telemonitor may have improved symptom monitoring and treatment adherence. Treatment adherence, a component of self-care, involves following the advice of providers to follow the treatment plan. Using a home telemonitor may augment treatment adherence. Self-care *management* refers to the decision-making process in which patients recognize and respond to their symptoms. Self-care management is an active, deliberative process that is essential in HF for patients to successfully control the balance between relative health and symptomatic HF. In summary, Stage 1 reflects self-care maintenance, a process focused on symptom monitoring and treatment adherence. Stages 2 to 5 reflect self-care management, a process in which patients recognizes and responds to their symptoms. In Stage 3, patients are evaluating their symptoms. If the TH data is perceived as beneficial and trustworthy, TH acceptance followed by TH adoption may ensue. Within this model, confidence is thought to influence the entire self-care process. Confidence is seen as a mediator and/or a moderator of the relationships between self-care and outcomes. Confidence is thought to influence relationships between self-care and resources utilized (e.g. hospital re-admissions). According to the authors, confidence may be influenced by a person's level

of social support (Riegel & Dickson, 2008). HL may influence self-care maintenance, management, and overall confidence. *See Figure 2.*

Figure 2. Conceptual model of heart failure self care (Riegel & Dickson, 2008).

Ranging from minor to severe, the experience of HF symptoms prompts millions of patients to visit their healthcare providers each year (Heart Failure Society of America, 2010). The utilization of these two conceptual frameworks are needed to assist in the exploration of the broader concepts of the global symptom experience along with the situation-specific experience for the HF patient population. Successful management of troubling HF symptoms usually begins with personal awareness (self-care maintenance) and the evaluation of changes in clinical symptoms (self-care management). HL may influence all 5 stages of self-care maintenance and management. Home TH may enhance early symptom recognition and improve self-care maintenance and management, resulting in decreased and hospitalization.

Research Methodology Overview

Two data sets along with a concept analysis have been utilized for this study on HF patients receiving home TH. The research design, methods, and sample population are presented. Statistical methods and limitations are described. Both studies received approval from both the hospital/home care agency and the supporting academic university's Institutional Review Boards.

Secondary Data Analysis of Home Telemonitoring

The purpose of this study is to explore socio-demographic variables, cognitive, and physiologic variables, and hospital re-admission rates between HF patients participating in a home care agency's home TH program and those receiving usual (non-telemonitored) home care services. This study will add empirical knowledge on patient characteristics and hospital re-admission in this select HF population.

Research Design. This retrospective, non-experimental descriptive correlational research study was completed to answer following research questions:

1. What are the differences among the socio-economic, cognitive, and physiologic characteristics of HF patients participating in a home TH program compared to HF patients receiving traditional (usual care) home health nursing services?

Variables to be explored include age, gender, ethnicity, zip code, living arrangements, risk of falling, vision, shortness of breath, use of home oxygen, and the ability to bathe oneself and self-administer medications.
2. What are the differences among HF patients enrolled in home TH program compared to HF patients who receive traditional home health nursing services care regarding 30-day all-cause hospital re-admission rates?

Details pertaining to the study population, inclusion and exclusion criteria, procedures, data analysis reliability, validity and study limitations are described within the manuscript in Chapter Two.

HL and Home Telemonitoring in Older Heart Failure Patients

The purpose of this study is to explore the demographic characteristics of 26 HF participants and the relationships between HL and the duration of study participation and HL and hospital re-hospitalization rates between the three intervention groups. Study results will assist future researchers in the continued refinement in research on the topics of HL and home TH in the HF patient population.

Research Design. This prospective randomized control feasibility study answers the following question:

1. What are the relationships between HL and demographic variables (age, gender, ethnicity, level of education, and living situation), completion of the 4-month intervention, and hospital re-admission between the three study groups?

Details pertaining to the study population, inclusion and exclusion criteria, procedures, instrument psychometrics, and study limitations are described within the Chapter Three.

Home Telemonitoring Adoption. The concept of home telemonitoring adoption is evaluated and discussed in detail in Chapter 4 and completes the fourth study aim. Compliance with home telemonitoring can vary widely among patients. Results from this concept analysis will empower the healthcare provider with essential information to remove barriers and promote the adoption of this home technology into the patient's daily routine. Utilizing the conceptual framework from Walker and Avant (2011), Chapter 4

describes the critical attributes, antecedents, and consequences of home TH acceptance. In addition, several case examples are provided to enhance clarity of this important concept.

Conclusions

This synthesis of the heart failure, telehealth, and HL literature highlights the numerous challenges related to the care and management of the chronically ill HF patient along with the potential benefits that may result from the use of a home TH device. Emerging technologies provide opportunities to decrease resources and optimize HF patient outcomes (Hall et al., 2014). Clearly, future research is needed to further develop an increased understanding of patient selection criteria including socio-demographic, physiologic, and cognitive variables along with literacy considerations for this specific HF patient population. Both of the identified research studies along with the exploration of the concept of home TH adoption have been conducted with scientific rigor and will contribute to the scientific body of knowledge on HF patients with home TH.

Nurses are influential partners in discussions and decisions on the optimal patient selection for home TH along with providing customized educational methods based on literacy. Nurses play a critical role in facilitating the patients understanding of the perceived benefits of utilizing the home device, trust in the technology and oneself, along with factors that enhance TH acceptance. Findings from these two studies and this important concept analysis will be useful to healthcare providers, home care agencies, and TH agencies as they evaluate their TH patient selection criteria and HF program elements. Study findings may have implications for future strategic allocation of

resources and will contribute to the body of science in this growing field of home TH for chronically ill patient.

Chapter Two

Home Telehealth and Hospital Re-admissions: A Retrospective OASIS-C Data Analysis

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Home Telehealth Reduces Hospital Re-admissions: A Retrospective OASIS-C Data Analysis

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Introduction

The incidence of heart failure (HF) in the United States (US) is on the rise, with 825,000 new cases each year and an expected cost in 2030 of \$69.8 billion dollars (Go, et.al., 2014 & Heidenreich, et.al., 2013). This disease is one of the largest and most costly cohorts of chronically ill patient populations in the US. As our population ages, the prevalence of chronic diseases, including HF, will continue to rise (Mager & Madigan, 2010; Rodger, et.al., 2012).

Healthcare reform has established new standards for clinicians, hospitals, and home care agencies managing patients with HF and now penalizes healthcare providers with poor outcomes. Re-hospitalization rates for HF within 30-days of discharge are now the target of publicly reported performance measures, national improvement initiatives and government incentives (Patient Protection and Affordable Care Act, 2010). In fiscal year 2014, two percent of hospital's Medicare base payment will be at risk and tied to 30-day all-cause re-admissions. At the same time, the rate of 30-day mortality following heart failure discharges was added to the value based purchasing matrix. In calendar year 2015, the percentage HF re-admission per 1,000 patients will become a metric under the physician value-based payment system. Combined, these new metrics have created a new national conversation and heightened concern with a focus toward continued optimization of HF patient discharge and out-of-hospital care management.

The national average of HF re-admission is 23 percent (Hospital Compare, 2014). Many strategies and innovations are being implemented to reduce 30-day post hospital re-admission rates (Bradley, et.al, 2012). Obtaining a clear baseline understanding of current practices is a needed before future planning can occur. Clearly, self-care

management is foundational to successful management of this complex disease (Riegel, et.al, 2009). Customized education of HF patients is needed on topics pertaining to fluid management, daily weights, sodium restrictions and complex medication regimes. Even though HF is considered a progressive condition, current treatments including self-care management can stabilize the disease process (HFSA, 2010).

Purpose and Methods

Telehealth (TH) provides remote patient monitoring, whereby patient biometric data such as vital signs, weight and self-reported symptoms are captured from home monitoring devices and transmitted to health care professionals for review. TH holds a great potential to improve health care delivery through improved integration of care coordination between patients, home care agency and the physician.

With an average daily census of 430 patients, HF and TH data was analyzed from a hospital-based, Medicare Certified and Joint Commission accredited home health agency which serves a territory of approximately 800 square miles in a combined urban and rural metropolitan area located in northern San Diego County. Approximately 13% of these patients have HF as a primary or secondary diagnosis, or as a complicating comorbidity. With nine years of experience in TH, this article provides a description of program elements, patient demographics, clinical variables, and re-admission outcomes.

TH Patient Selection and Monitoring

HF patients meeting the following criteria are evaluated for the TH program: (1) recent discharge from one of the two affiliated agency hospitals with either a primary or secondary diagnosis of HF (2) Medicare as the primary payer; (3) cognitive capacity to interact successfully with the device; (4) willingness to participate; and (5) access to a

landline home phone (Figure 1). The rationale for prioritizing services to the Medicare patients is related to allocating scarce resources to prevent re-admission in this publicly reported specific patient population.

This agency has utilized the same TH device since the inception of the program in 2005. The device stores and transmits biometric data along with the answers to select customized heart failure questions. Home installation and patient/family instruction takes approximately 40 minutes. Because the device does not have wireless capabilities, some clients are eliminated from the program because they do not have a landline phone system. Patients often need more than one home visit to correctly utilize the device. Once the patient is competent, a designated agency nurse monitors the daily-transmitted data. With the capability of communicating in both English and Spanish languages, this agency averages 4 patients per day on TH services.

Clinical parameters and treatment guidelines are obtained from the physician. If the physician does not provide parameters, a standardized range is utilized. Each morning, patients are instructed to take their blood pressure, heart rate, oxygen saturation, weight, along with answering seven HF-directed questions (Table 1).

A specialty trained home care agency nurse manages the daily-transmitted data. If a yellow or red alert is identified, the nurse contacts the patient (Table 2). Based on the findings, the nurse may ask the patient to retake their biometrics. If the results indicated a problem, the nurse may contact the physician to report and obtain treatment orders if needed. In some cases, an extra home visit will be made to assess/treat the patient and/or troubleshoot the TH device. Utilizing a “teach back” method of education, the nurse is continually engaging the patient in symptom recognition and behavior

changes, while promoting self-care activities such as medication adherence and sodium restrictions.

Patient adherence with device utilization is very good; patients are able to utilize the device as a tool to correlate changes in vital signs and weight with increased symptom awareness and correlation to lifestyle choices. When the HF management is stabilized and the patient is successfully able to correlate personal symptoms, the TH device is discontinued.

The Outcome and Assessment Information data Set (OASIS) is the instrument used to collect and report performance data by home health agencies. Beginning in January 2010, home care agencies have been required to collect a revised version of the OASIS data set (OASIS-C) which includes additional data on specific evidence-based care processes.

The OASIS-C database was used in this retrospective analysis of de-identified HF patients receiving home care services from this agency from January 1, 2010 through October 21, 2012. The agency's Institutional Review Council (IRC) approved this study. Each home visit was entered into the OASIS-C database, along with admission, discharge and with each 30-day cycle of care services. Data was downloaded into Microsoft Excel TM and further analyzed using the Statistical Package for Social Science (SPSS) Version 22 TM. The original master database had a total of 8,885 OASIS-C entries during this 22-month timeframe. Data were sorted and reduced to include only patients having either a primary or secondary diagnostic related grouping ICD-CM-9 Code of 428, indicating a diagnosis of HF. The final data file used in this analysis consisted of 1, 434 HF patient

entries. The OASIS-C database contained over 50 demographic and clinical variables (Table 3).

Data were further analyzed by separating those HF patients receiving home TH and those who received usual home care services. Data from each variable was analyzed. Due to the de-identification of patient names or medical record numbers, the analysis for the number of home visits per patient, or the matching of patients on common demographic variables between groups (e.g., gender, age) was not possible. Therefore, to better understand the demographic and clinical data, each patient receiving TH services during this timeframe had an additional manual chart abstraction. To ensure inter-rater reliability, one researcher performed this separate retrospective manual medical record chart abstraction for the seventy TH patients. This process allowed for the final comparison of the entire HF OASIS-C database (1337 non-TH HF patient entries) compared to the 70 patients who received the TH program.

Results

Demographic and clinical variables are shown in Table 4. Six percent of the total HF patient volume seen by this agency received TH compared to the ninety four percent of the HF patients who received usual home care services. Approximately 4 patients per month were using the TH service; these patients continued with daily TH monitoring for an average 53 consecutive days. While receiving home care services within this 22-month timeframe, the non-TH patients had a 21% all-cause hospital re-admission rate, compared to the TH patients who experienced a 10% all-cause re-admission rate. Upon further analysis, 3 of the 10 (3%) of the TH patients were readmitted due to exacerbation

of HF symptoms. Due to limitations in the coding of the OASIS-C database, comparable HF-related hospital re-admission rates are not obtainable.

No major differences in the baseline socio demographics (age, gender, race and zip code) were found between the two groups. Both groups were comprised of predominately elderly (82 years non-TH; 84 years TH), Caucasian (83% non-TH; 80% TH), females (60% in both groups). Those who did not receive TH monitoring were more likely to have been discharged home from a skilled nursing facility within the past 14-days (25% non-TH; as compared to 5% TH). Non-TH patients had a higher fall risk assessment (68% non-TH; 52% TH) and had a greater history of falling in the past 12 months (27% non-TH; 16% TH). Non-TH patients had greater rates of impaired vision (16% non-TH, compared to 10% TH).

Several differences in pulmonary status were also noted. Non-TH patients were more likely to smoke cigarettes (20% non-TH compared to 5% TH). Despite smoking less, the TH patients had more shortness-of-breath (93% TH compared to 80% non-TH) and used more oxygen (35% TH; 26% non-TH). This was an unexpected finding. TH patients were also more independent in taking daily oral medications if reminded (28% TH; 18% non-TH). These variables appear to be associated with a reduced hospital re-admission for patients in the TH program. This could be the result of the patient selection process, the TH program itself, or additional variables not captured in this database.

Implications for Practice

Improved awareness of agency patient demographics and program goals will assist home care agencies in strategic patient selection and TH protocol development and

refinement. This agency has realized that not all HF patients are appropriate for TH, either due to comorbidities or advanced disease states. This retrospective analysis has found that HF patients who have physical stability, better vision, medication self-administration, and independently perform activities of daily living may have higher success in using a home TH monitor, and these variables may be correlated to the noted decreased hospital re-admissions. In this sample of patients, the TH patients smoked less, but had more SOB and oxygen use. This agency has identified the cardio-pulmonary patient population to be at risk, and has aligned TH resources to these patients.

To date, this agency continues to prioritize the use of TH monitoring with their Medicare patient populations, with an emphasis on the first of 30-days post discharge. A typical patient case study is described in Table 5. The agency has also learned that with initial installation and patient education, it is best if the patient and caregiver/family members are both in attendance along with leaving written instructions and contact information. After nine years of experience with TH home monitoring, patients demonstrate improved symptom recognition when they are accountable and are aware that the nurse is checking their results each day. In a collaborative approach, the patients know that they will receive a phone call if there are any yellow or red alerts on their data. The home care nurse is able to respond to early symptom warnings. Many patients actually enjoyed participating with the monitor and in their care; a few patients have requested a continuation of use, and prefer indefinite use of the home telemonitor.

Study Limitations

The incorporation of TH may be of use to others wishing to engage in targeted strategies for TH patient selection. Comparison or matching of patients between groups was not possible due to the removal of patient identifiers. Due to coding limitations when exporting the data out of the electronic medical record, a HF related hospital re-admission rate for non-TH patients was not obtainable for comparison. Study findings provide information to this specific agency located in the northern region of San Diego. The results cannot be generalized to other service areas or agencies.

Future

Effective patient management of HF is one of the major challenges for most healthcare systems and TH has been shown to be a useful tool for patients with chronic conditions. Recent legislation indicates CMS is expanding coverage for TH, which may extend beyond rural areas along with new state-specific legislation aimed at increasing coverage of TH services (CMS & Telehealth Resource Center). Nurses working in this specific home agency perceive their patients have improved symptom recognition, self-care abilities, and knowledge of when to call their provider before they transition off of the home telemonitor. This agency will continue to allocate TH services to the Medicare patient population for a minimum of 30-days, with the hopes of expanding eligibility to additional patients along with transitioning to a wireless device in the near future.

In an ongoing effort to raise standards and improve services, this agency has utilized an existing database to evaluate patient demographics, clinical variables and re-admission outcomes. TH is a promising approach to improve patient symptom

recognition and self-care, with the potential to reduce the burden associated with re-hospitalizations in the HF patient population. Agencies are encouraged to use their OASIS-C data for program evaluation and strategic planning.

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Table 1

Tele-Health CHF Questions

Questions	Answer Choices
Are you experiencing more difficulty breathing today?	Yes or No
Have your feet, ankles or legs been swollen more than usual?	Yes or No
Did you take all your medications prescribed?	Yes or No
Are you more fatigued today compared to a normal day?	Yes or No
Are you having any difficulty following a low salt diet?	Yes or No
To sleep comfortably last night, did you need:	Select one: No extra assistance needed Extra pillows To sit in a chair

Table 2

Tele-Health Alerts with Nursing Follow Up

Green Alerts: No response needed

Yellow Alerts: Patient data may be incomplete (e.g. B/P, HR, weight, answers to questions). Call the patient to determine reason(s) for omission of data. Ask the patient to retest.

Red Alerts: Call the patient and ask:

Weight Gain:

- ☐ Do you have increased difficulty in breathing and/or swelling in your feet/legs?
- ☐ Did you dress differently today?
- ☐ Are there any recent medication changes?
- ☐ Has the scale been moved or loss of calibration?

Blood Pressure:

- ☐ Have you taken your medications today? If no, have the pt take meds and retest in one hour.
- ☐ What kind of activity were you doing prior to taking your vital signs?
- ☐ Were you sitting still or moving, talking or coughing during the test?
- ☐ Have you had any medication changes?

Heart Rate:

- ☐ Are you having SOB?
- ☐ Are you feeling weak or dizzy today?
- ☐ Have you taken your meds?
- ☐ What kind of activity were you doing prior to taking your vital signs?

Table 3

Sample of Oasis-C Database Variables

• Gender	• Urinary Incontinence
• Age	• Timing of Urinary Incontinence
• Ethnicity	• Bowel Incontinence
• New or previous patient	• Cognitive Function
• Zip Code	• Confusion
• Insurance	• Anxiety
• DC from SNF in past 14-days	• Memory Deficit
• Fall Risk in past 12 months	• Cognitive/Psyche Behaviors
• Medication Complexity > 5 meds/day	• Disrupt Behavior Frequency
• Fragility Risk	• Grooming
• Living Situation	• Dressing Upper & Lower Body
• Vision	• Bathing Self
• Hearing	• Toilet Transferring
• Understand Verbal Communication	• Toileting Hygiene
• Oral Expression	• Bed to Chair Transfer
• Pain Levels	• Ambulation
• Pain Interferes w/Movement	• Cooking
• Risk of Pressure Ulcer	• Telephone abilities
• Unhealed Pressure Ulcer(s) & Staging	• Fall Risk Assessment
• Dyspnea/SOB	• Drug Regimen Review
• Oxygen or Ventilator	• Self Management of Oral Meds
• UTI in past 14 days	• Frequency of Assistance w/ADLs

Table 4

Demographic and Clinical Data

OASIS C Variables	No Tele Health (N, %)	Tele Health (N, %)	p Value
Tele-Health (TH)	No TH 93%	TH 7%	
Age (mean, Standard Deviation)	81.97 (SD 10.55)	83.75 (SD 8.61)	
Gender	Female 768 (60.2%) Male 508 (39.8%)	Female 48 (60%) Male 32 (40%)	
American Indian	6 (0.5%)	1 (1.2%)	
Asian	51 (4%)	5 (6.2%)	
African American	28 (2.2%)	0 (0%)	
Hispanic/Latino	120 (9.4%)	10 (12.3%)	
Hawaiian/Pacific Islander	11 (0.9%)	0 (0%)	
Caucasian	1066 (83.%)	65 (80.3%)	
Mean # Days on TH	NA	57 days (SD 51, Range 4-270)	
Discharged from SNF in past 14-days	315 (24.7%)	4 (4.9%)	p<.001
Fall Risk	867 (67.9%)	42 (51.9%)	p=.009
> 2 Falls in past 12mos	343 (26.9%)	13 (16%)	p=.032
Smokes Cigarettes	250 (19.6%)	4 (4.9%)	p<.001
Shortness-of-Breath	1095 (79.9%)	75 (92.5%)	p=.043
Use of Home Oxygen	335 (26.3%)	28 (34.6%)	p=.101*
Partially or Severely Impaired Vision	208 (15.6%)	9 (10.1%)	p=.038
Able to Bathe Self	299 (23.5%)	25 (30.9%)	p=.022
Able take Oral Meds if Reminded by Person	231 (18.1%)	23 (28.4%)	p=.041
All-Cause Hospital Readmission during HC Services	264 (20.7%)	7 (10%)	
Hospital Readmission for CHF during HC Services	No Data	3 (4.2%)	

* Not statistically significant

Table 5

TH Sample Case Study

Mrs. B is a 83-year old widower who was hospitalized twice in the past 12-months for exacerbation of CHF. She has struggled with monitoring her weight, medication management, and eating a sodium restricted diet. A home TH monitoring system was installed 3-weeks ago and she now records her weight, B/P, HR and CHF questions each day. Today she notes a 2-pound weight gain and answers yes to the question “Are you having more difficulty breathing today”?

The nurse is prompted to call the patient after noticing the ‘red alert’ and discovers the patient is also having some lower extremity edema. The nurse collaborates with the physician & recommends Mrs. B take an extra diuretic and limit her sodium intake. On the next day, both her weight and edema are better. Mrs. B is learning how to recognize early signs of fluid retention while on TH. Using the teach-back method, the nurse also reinforces education on this topic.

Chapter Three

Health Literacy in Older Adult Heart Failure Patients with Home Telemonitoring:

A Randomized Controlled Feasibility Study

Target Journal: *Journal of Cardiovascular Nursing*

Health Literacy in Older Heart Failure Patients with Home Telemonitoring:

A Randomized Controlled Feasibility Study

Abstract

Aim: To examine the relationships between health literacy, subject demographic variables (age, gender, race, educational level, marital status, and living environment), completion of a 4-month study intervention, and hospital re-admissions between three study groups of heart failure participants.

Background: Many HF patients struggle to understand the written educational materials, home medications, and how to optimize their sodium restricted diet, fluids, and weight management. Health literacy can be a contributing barrier in the ability to read and comprehend patient education materials.

Methods: a feasibility study using a randomized control design was implemented in a large hospital health care agency. Thirty participants were randomized into one of three interventions and followed over four months. Literacy was assessed using the S-TOFHLA instrument.

Results: 26 of the 30 enrolled participants completed the S-TOFHLA; 10 participants (38%) had inadequate or marginal HL. Participants in Group A had higher HL scores than those in Group B and C. No statistical differences were found in socio-demographics and hospital readmission between the three groups. Eighty-three percent of enrolled patients completed the study; literacy levels didn't appear to effect completing the 4-month study.

Conclusions: Knowledge of patient's literacy level should be incorporated into all patient interactions. The S-TOFHLA is one of the most widely used HL assessment tools. Despite its popularity, the practicality of using the S-TOFHLA may not be an ideal instrument for an elderly population.

Introduction

Health literacy (HL) is an increasingly relevant issue for our global public health. Recent federal initiatives from the National Action Plan to Improve Health Literacy emphasize the need for continued efforts to improve HL ("United States Department of Health and Human Services, Office of Disease Prevention," 2010). According to the U.S. Department of Health and Human Services, HL is the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions (Healthy People 2010). Adequate HL is critical for patients who are interpreting treatment information and following recommended treatment plans. It also influences communication with the health care providers and the ability to navigate the health care system. Low HL can be more commonly associated in patients with older ages, limited education, lower income, and chronic diseases (Berkman, Sheridan, Donahue, Halpern, & Crotty, 2011; Herndon, Chasey & Carden, 2011).

Background

Heart Failure. Heart failure (HF) is identified as a leading cause of hospitalizations, morbidity, mortality, and is a rising health care costs for nearly six million Americans (Go, Mozaffarian, & Rodgers, 2013). HF comprises one of the largest groups of chronically ill populations in the United States (US), resulting in 266,000 deaths per year, and \$37.2 billion annually in health care costs (American Heart Association, 2011). There are approximately 1 million HF admissions in the US per year, along with a 30-day re-admission rate of 27% (Rodgers et al., 2011). Costs associated with hospital care are responsible for up to 70% of the annual costs of treating HF

patients within the US (Heidenreich et al., 2013). Given the aging population and growing economic burden, improved management of the patient with HF at home and the prevention of hospital admission have become a national priority.

Self-Care Behaviors. Heart failure patients should ideally commit to performing self-care behaviors such as following self-care management activities, consulting with their healthcare provider, reducing fluid and sodium intake, monitoring blood pressure and weights, while adhering to their customized medication regimes (Chen et al., 2013). In the self-care decision-making process, patients should perform activities to prevent symptoms and/or to respond to symptoms as they occur. Yet, patient adherence to recommended self-care behaviors varies greatly and frequently is lacking (Riegel, Moser, & Anker, 2009). Improving HF self-care is a challenging but promising approach to improving outcomes (Berkman et al., 2011).

Health Literacy. Many patients struggle to understand the written educational materials, home medications, and how to optimize their sodium restricted diet, fluids, and weight management. HL can be a contributing barrier in the ability to read and comprehend patient education materials. According to the National Assessment of Adult Literacy Report, 36% of adult Americans and 59% of adults 65 years or older have below basic or basic HL (Kirsch, Jenkins and Kolstat, 2002). In patients with cardiovascular disease, HL is a predictor of adherence to treatments (Murray et al., 2009). Adequate literacy enhances the patient's access to learning how to self-manage his/her condition at home (i.e. take their medications, follow a low sodium diet, monitor daily weights, and symptoms (Evangelista et al., 2010). In a study conducted with 605 HF patients by Macabasco-O'Connel et al. (2010), participants with adequate HL reported higher self-

care behavior scores than those with low literacy. Participants with adequate literacy reported having a scale at home (58% versus 43%, $p<0.001$) and reported weighing themselves every day (32% versus 16%, $p<0.001$) compared to those with low literacy. More patients with adequate literacy ate foods low in sodium than those with low literacy (84% versus 76%, $p=0.014$) (Macabasco-O'Connel et al., 2010). For HF self-care initiatives to be successful, considerations surrounding HL needs to move to the frontline. Accurate HL assessments followed by customized teaching methods are critical components of this process.

Home Telemonitoring. Daily home telemonitoring may assist in the early detection of HF deterioration, allowing for more prompt and effective interventions (Bui & Fonarow, 2012). Telehealth (TH) is defined as remote patient monitoring which commonly includes measurement of health parameters by the patient followed by the transmission of these data via telephone, mobile phone, or Internet to a telemedical center (Health Resources and Services Administration, 2012). Home TH varies depending on the type of device; however, most systems include a daily weight, heart rate, and blood pressure recordings. These biometric data are then transmitted to a central receiving station, typically within a home care nursing agency or clinic where the data are analyzed by a healthcare professional. Improved HF symptom awareness may result as the patient correlates their subjective symptoms (e.g. shortness of breath) with their objective data (e.g., 3 pound weight gain), thereby, potentially improving self-care awareness and management.

Clinicians face a unique challenge in determining the educational needs of their HF patients. Many healthcare providers may overestimate patients' understanding of

health information, and consequently, not employ appropriate educational strategies (Evangelista et al., 2010). To date, limited studies have examined the assessment of HL as it relates to TH, study retention, and hospital re-admissions in the HF population.

Many strategies and innovations including improved discharge instructions, follow-up appointments, and home TH are being tested to reduce re-admission rates, but additional research in this area is warranted (Bui & Fonarow, 2012). HL may play an important role in customizing strategies and educational approaches to facilitate the adoption of the home TH device.

The purpose of this feasibility study of older adults with heart failure (HF) was to examine:

The relationships between HL, select subject demographic variables (age, gender, race, educational level, marital status, and living environment), completion of a 4-month study intervention, and hospital re-admissions between the 3 study groups.

Methods

Using a randomized control design, this feasibility study recruited HF patients to pilot a new research partnership with physicians and nurses in a large hospital health care agency in the northern San Diego region. Following approval from the hospital's Institutional Review Council and the supporting university's Institutional Review Board, key stakeholders including nursing leaders and physicians were educated on the research study. Potential participants (clinically stable HF patients nearing discharge) were identified and recruited by a research assistant in collaboration with the charge nurses(s) of a HF progressive care unit(s). Participant inclusion criteria included: (a) greater than or equal to 40 years of age; (b) a primary or secondary diagnosis of heart failure; (c) ability

to communicate and read in English; (d) cognitively intact per a screening tool, and (e) having a telephone landline in the home (needed for the specific home telemonitoring device used in this study). Exclusion criteria included: (a) severe renal impairment and/or renal failure requiring hemodialysis; (b) severe visual or dexterity impairment; (c) inability to provide self-care due to depression or cognitive impairment and/or; (d) participation in another research study. If interested in participating, participants were asked to complete the Cognitive Impairment Screening Short Portable Mental Status Questionnaire. This 10- item examination has been found reliable and valid in distinguishing individuals with cognitive impairments (Roccaforte, Burke, Bayer, & Wengel, 1994). Participants needed a score of 8 to be consented into the study. A \$20 gift card to a local retailer was given to all consented participants. Once consented, demographic data were collected and a HL assessment using the Short Test of Functional HL in Adults (S-TOFHLA) was administered. Prior to discharge, all HF participants received standardized discharge education and a written HF education pamphlet provided routinely by the hospital nurse. Enrollment began in December 2013 and was completed in July 2014.

Measurement of Health Literacy using the S-TOFHLA. The S-TOFHLA is a 36-item, 7-minute timed test of reading comprehension. It measures the ability to read and understand actual real-related passages with readability levels of 4.3 and 10.4 grade levels. Reading comprehension is evaluated using a section on x-ray preparation and Medicaid application. The S-TOFHLA employs the Cloze procedure, in which a word in a sentence is omitted and must be chosen from a multiple choice list. The instrument has a maximum score of 36 points; a score between 23-36 indicates adequate HL. Results are

categorized into inadequate (0-16 correct answers), marginal (17-22 correct answers), and adequate HL (23-36 correct answers). The S-TOFHLA has good internal consistency with a Cronbach's $\alpha=0.98$ for all items combined, as well as demonstrated content validity compared to the long version, the TOFHLA ($r=0.91$) (Parker, Baker, Williams, & Nurss, 1995). The S-TOFHLA is widely used to identify the HL level of patients, including HF patients (Robinson et al, 2011).

Participants were asked to complete the paper and pencil S-TOFHLA independently (i.e., no assistance from a spouse or verbal reading of the instrument). To prevent researcher bias, the HL scores were blinded to all research team members. Of the 30 participants consented, four were unable to complete the S-TOFHLA; two were without their reading glasses, one had degenerative vision changes, and one was too fatigued to complete the instrument. In total, 26 participants completed the S-TOFHLA. Data on age, gender, race, level of education, living situation, ability to drive a car, number of discharge medications were also obtained. Research participants were randomized into one of three groups using a statistician-developed randomized table of numbers. Eight participants were assigned to Group A and nine participants were each assigned to Groups B and C.

Three additional instruments (15-item Geriatric Depression Scale; 17-item Telemedicine Perception Questionnaire; 22-item Self-Care of Heart Failure Index); were also completed upon enrollment and again at the conclusion of the study. These findings are described elsewhere (Hawkins et al., forthcoming manuscript).

Interventions

The study intervention lasted for 4-consecutive months. Group A participants received a Foracare home telemonitoring device consisting of a blood pressure cuff and weight scale, which requires a modem or Internet access to transmit the data. Group A participants received home instructions on how to operate the devices, written information, and a contact phone number for future questions was provided by a health care informatics student at the affiliated university. The devices were free of charge and were loaned to the patient for the duration of the study.

All participants in both Groups A and B received a mailed packet of HF patient education materials with a focus on 5 important HF-related topics along with a monthly motivational interviewing (MI) phone call provided by one advanced practice nurse. This method of MI allows for patients to be engaged in discussing topics that are client-centered. If participants in Group B did not own a weight scale, one was mailed to them free of charge to use daily and keep. Participants in Group C also received a mailed packet of five general healthcare topics ranging from flu vaccinations or what to bring to physician appointments (Table 1).

Motivational Interviewing. With each monthly MI telephone call, the participants were asked to select one of the five topics for discussion; calls lasted approximately 10-20 minutes. The MI topics included information on eating a low sodium diet, activity and exercise, managing shortness of breath and fatigue, alcohol and smoking cessation, along with tips for medication management. Participants randomized into Group C, the attentional control group, also received monthly MI phone calls lasting approximately 5-10 minutes. With this phone call, a non-HF topic was discussed.

Participants could select one of the following topics to discuss: vaccinations awareness, what to bring to your primary care provider office visits, senior safety travel tips, along with fall and fire prevention strategies. This attentional control group was established (versus a usual care group only receiving physician office visits) to promote continued engagement with the participants over the 4-month study duration. The average phone call lasted 14 minutes for Groups A and B, and 8 minutes for participants in Group C. At the end of the study, participants were asked to complete the same 3 instruments (no HL assessment was performed at this time), which were conducted over the phone by a trained research associate. Participants who completed the final surveys were given a \$30 gift card to a local retailer.

Analyses

Descriptive statistics and measures of central tendency summarized participant characteristics. One-way ANOVA and Pearson correlations examined relationships between continuous variables; point-biserial correlations and Chi-square tests evaluated relationships between categorical variables. SPSS version 22 was used to analyze the data.

Results

The 26 participants enrolled in the study had a mean age of 74 years (SD 9.76), were male (62%) and white (69%). Fifty-four percent were married, 50% lived with a spouse, 27% lived with an adult child, and 62% of participants did not independently drive a car. Over three quarters had completed high school or some college (77%).

Demographic variables (age, gender, race, educational level, marital status, and living environment) were examined between the 3 study groups. The range of HL scores

varied between 10-36 points. The average HL score of the 26 participants was 25.5 (SD 9.25). Nine participants had inadequate HL, one subject had marginal HL, and 16 participants scored in the adequate HL range. Due to the small sample size in the marginal group, the inadequate and marginal HL category were combined. Thus, 26 participants completed the S-TOFHLA; 10 participants (38%) had inadequate or marginal HL. Participants in Group A had higher HL scores than those in Group B and C. Seventy-five percent of participants in Group A had adequate HL compared to fifty-six percent in Groups B and C (Table 2). No statistical difference in HL was found between those participants who were 74 years or younger (n=9) and participants 75 years or older (n=17).

Levels of education varied greatly; 23% did not complete high school, 50% of participants had completed high school, and 27% completed between 1-4 years of college.

For those with inadequate or marginal HL, 68% had a high school (HS) education or greater. Of those who did not complete HS, only 33% had inadequate/marginal HL. Participants who attended some or completed college had the highest amount of HL (86%) (Table 3).

MI topics for participants in Groups A and B were selected from a list of five heart failure topics. The HF topics most often selected for discussion included the topics on *daily weights measurements* and tips for *sodium and water restricted diets*. Of the five non-HF topics to select from, participants in Group C most often chose to discuss *what to take with them at their next primary care provider visit* (with a focus on bringing a list or bottles of medications along with written questions).

HL and Study Completion. Twenty-one (81%) completed the 4-month study. Participants in Groups B and C were more likely to complete the study ($p=0.05$). Group B participants had a 100% completion rate with a 89% completion rate in Group C participants (one subject expired). Interestingly, only 50% ($n=4$) in Group A completed the intervention. Four in Group A ended the study early: 2 for personal reasons (one did not like using the TH and 1 unexpectedly moved out of state), one related to a decline in their medical condition necessitating hospice care and one due to long-term skilled nursing care needs.

Re-admissions. Nine (35%) of the 26 participants were re-hospitalized within the 4-month study timeframe. Five of the 9 re-admissions (55.5%) were related to a HF diagnosis. Group C participants had the highest re-admission rate ($n=5$) compared to Group A ($n=1$), while Group B had a 33.3% re-admission rate ($n=3$). Participants in Group C had greater numbers of HF-related re-admissions than those in Groups A and B, but were not statistically significant. Of the five Group A participants who completed the 4-month intervention, only one was readmitted for a non-HF diagnosis.

HL did not appear to be related to the re-admissions and no statistical differences in all-cause, or HF-related, re-admissions were found (Table 4). Of those in Group C who were admitted, 60% ($n=3$) had inadequate HL. Although not statistically significant, there was a trend toward those with lower literacy and less intervention (i.e. the attentional control group) to have higher hospital re-admissions ($p=0.65$).

Study Limitations

A slower than expected enrollment occurred due to challenges associated with participants who had cognitive impairment, were non-English speaking and/or had severe

renal impairment. Due to slow enrollment and deadlines, the study ended before the final Group A participant could be enrolled. Another limitation of this study is the small sample size. This study was designed to begin a research relationship with the specific health care organization. The smaller sample size was expected in this feasibility study. Another limitation of this study is the lack of racial diversification as most study participants were Caucasian. Many patients who otherwise met the inclusion criteria were Spanish speaking and did not qualify for the inclusion criteria. All eligible participants were approached for enrollment without consideration of race. The racial demographics of these 26 participants are representative of the patient population admitted to this healthcare agency. Despite these limitations, this feasibility data suggests that participants who receive a monthly HF focused phone call and/or those who use a home TH device have reduced hospital re-admissions, regardless of literacy levels.

Discussion

This prospective randomized controlled feasibility study was conducted to investigate the differences in older adult HF patient literacy levels measured by the S-TOFHLA the relationships of specific patient demographic characteristics, study completion, and hospital re-admissions. Our study population had an inadequate/marginal HL rate of 38%. In previous studies, low or inadequate literacy was common among patients with HF ranging from 27% to 54% (Evangelista et al., 2010; Laramee, Morris, & Littenberg, 2007). Cajita, Cajita, and Han (2013), found 39% of HF patients demonstrated low HL. The HL rate in our study appears to be congruent with these larger studies. HL was not associated with age, gender, race, educational level, marital status, or living environment. These findings were inconsistent with the

literature. In previous studies, age, gender, race, and educational background have been correlated to literacy. As age increases, HL can decline (Cordasco, Asch, Franco, & Mangione, 2009; Wolf, Gazmararian, & Baker, 2005). Gender has been found to be a significant predictor of HL in the HF population with the female gender being associated with higher HL (DeWalt, Schillinger, & Ruo 2012). Hispanic and African American HF have been found to have lower HL (Chaudhry, Herrin, & Phillips, 2011; Morrow, Cark, & Tu, 2006) when compared to Caucasian populations. Educational attainment has been found to have a positive correlation with HL (DeWalt et al., 2012; Wu, Holmes, & DeWalt, 2013). Participants who had less than high school education may be more likely to have lower HL, even after controlling for age, gender, and ethnicity (Laramie et al., 2007). Our study findings did not support these prior literacy studies; age, gender, race, and educational levels were not significantly related to levels of HL. This finding is likely due to our small sample size and lack of racial diversification. Four patients were unable to complete the S-TOFHLA due to impaired vision. Utilizing a HL instrument that allows for verbal self-report would have been helpful for these participants.

Regarding the relationship between HL and completion of the 4-month research intervention, 83% of enrolled patients completed the study; literacy levels didn't appear to effect completing the 4-month study. Participants with adequate HL were only slightly more likely to complete the study (57.1%). Patients with lower HL may have been motivated to complete the study by simply participating in a research study.

Participants in Group A had the highest level of literacy with a mean score of 26.75 (SD 9.66), but ended the study earlier than those in the other two groups. Upon exit phone discussions, only one of the 4 in Group A ended the study early because she did not like

using the home TH device. Two ended the study early related to a medical condition decline and one moved out-of-state unexpectedly for personal reasons. Patients utilizing a home telemonitor may need additional support and encouragement to persist with using the device (Xiang, Li, & Liu (2013). Healthcare providers need to remember there is an adjustment phase to using a home TH device and incorporating the use of this device into the patient's daily routine. Additional supports (e.g. phone calls, text messaging, video conferencing, and/or additional home visits) may be needed during this transition phase toward acceptance and TH adoption.

Participants in Group B had the lowest level of literacy (mean score 24.33, SD 9.72), but had a 100% study completion rate. These participants did not receive a home TH monitor, but did receive a monthly MI phone calls on a HF-related topic. Group C participants had a mean literacy score of 25.50 (SD 9.25), with all participants completing the study with the exception of the one who expired. This may suggest that patient engagement by phone was sufficient to keep these participants involved until to the end study, regardless of one's level of HL. Patient engagement and retention of participants is of concern in any research study. All 26 participants received a monthly phone call from the study nurse; this intervention appears to have been effective for study retention regardless of literacy levels.

Regarding the relationship between literacy levels and hospital re-admissions, 9 participants were readmitted during the 4-month intervention, 5 had adequate HL, and 4 had inadequate HL. Participants in Group A had lower re-admission rates compared to those in Groups B and C. This could be related to the combination of the TH device with the monthly MI HF topic. This finding is consistent with previous studies that have

reported patients utilizing a home telemonitor have a decrease in HF hospital re-admissions (Polisena et al., 2010; Xiang et al., 2013). This population may be at a greater risk and may warrant additional resources (i.e. early assessment of HL, home TH, phone calls) to facilitate self-care management. With an emphasis to reduce the 30-day re-admission rate for HF patients, this information is useful for health care organizations or agencies that are considering developing a new home TH program. With the emphasis to reduce the 30-day re-admission rate for HF patients, this information is useful for health care organizations or agencies that are considering developing a new home TH program.

The S-TOFHLA is one of the most widely used HL assessment tools; however, it was developed for research purposes but has not achieved widespread clinical use (Westlake, Sethares, & Davidson, 2013). Despite its popularity, the practicality of using the S-TOFHLA may not be an ideal instrument for an elderly population with poor vision. Patients can potentially be mis-categorized as having low or marginal HL when the S-TOFHLA time limits are enforced (Robinson et al., 2011). Robinson et al. (2011) argue HF patients may be falsely judged as having low HL when scores rose significantly (25%) when the timing restriction on the S-TOFHLA was removed (2011).

Patients with low HL may use various tactics to minimize embarrassment and exposure to their deficits (Cordasco et al., 2009). Notably, four of the 30 participants refused or were unable to complete the S-TOFHLA (three had vision challenges and one was related to fatigue). Non-completers, or those who refused to answer the HL questions, may have done so to hide their limited HL. Therefore, one could speculate our low HL scores may potentially have been higher than reported using this instrument. The

Single Item Literacy Screener (Morris-Maclean, Chew & Littenberg, 2006) or the “Newest Vital Sign” may be more appropriate for clinical practice with patients when instrument burden may be a challenge. Both instruments require less time and the Single Item Literacy Screener does not require visual reading skills.

Patient Education. Patients with poor HL may require more intensive education with enhanced caregiver involvement as it relates to their home HF and TH programs. Levin, Peterson, Dolansky, and Boxer (2014) found caregivers had better HL than patients, but still had challenges reading labels correctly. Health care providers should examine educational approaches and work collaboratively with each other to improve knowledge among inadequate HL patients and caregivers, especially during outpatient or clinic-based education.

Nurses and other healthcare professionals should recognize low HL is prevalent and start to adopt strategies that potentially mitigate the impact of low HL when communicating with HF patients and caregivers. This includes creating clinical environments that are welcoming, non-judgmental, and tailored to the needs of vulnerable populations. Communication strategies outlined in the Agency for Healthcare Research and Quality (AHRQ) HL Universal Toolkit will be helpful (Dewalt, Callahan, & Hawk, 2010). The use of teach-back method, literacy-sensitive educational materials, videos, and easy to read visual aids are some strategies outlined in the toolkit. On this website, the AHRQ has a downloadable clinical environment assessment which can be used to ascertain if the out-patient environment is friendly, welcoming, and utilizes simplified and colorful visuals aids for person-centered educational materials.

Conclusions/Implications for Nursing

This feasibility study was conducted to test the methods to be used in a larger, more rigorous future study (Polit & Beck, 2012). The findings support modifications in future study designs to include one or more bilingual research team members to provide English and Spanish language interventions. Expansion to include a multi-site study could also facilitate enrollment with greater diversity in racial participation. Indeed, the data obtained from subject's HL assessments should be used in developing educational interventions.

Health care providers should begin by assessing their own knowledge of HL and personal teaching and communication skills followed by making a conscious effort to modify the individual's teaching style if needed. The first step is to engage in a respectful assessment of the individual's needs, skills, and competencies. Knowledge of patient's literacy level should be incorporated into all patient interactions. Addressing and minimizing the barriers to learning is essential and should be done in a manner that promotes self-care with dignity and promotes collaboration with the patient/family to overcome barriers to self-care. Nurses and healthcare workers should keep the language "simple" while incorporating visual aids. Assessing recall by using terms such as "tell me/show me what you understand" can be helpful. Barriers to learning, adherence, and behavior changes should be explored and strategies to counter the barriers should be implemented (Westlake et al., 2013).

HF management requires a high level of patient involvement and self-care. Nurses play a key role in the education, implementation, and monitoring of home TH and need to regularly assess for baseline HL in each patient. Assessment of patient HL can

be critical to tailor educational programs. HL represents a shift from traditional patriarchal models to person-centered approaches (Westlake et al., 2013). By incorporating literacy knowledge, nurses are empowered to customize educational and treatment plans to fit the patients' needs. HL has important implications for all health interventions and clinical outcomes, especially in the HF and home TH patient populations.

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Table 1

Group Interventions

Interventions	Group A	Group B	Group C
Usual Care (Discharge instructions & MD office visits)	X	X	X
Educational materials mailed to home	HF topics	HF topics	Non-HF health topics
Home Telehealth Device (Blood Pressure & Scale)	X		
Manual weight scale mailed to home (if needed)		X	
Monthly M.I. phone call on HF topic (selected by pt)	X	X	
Monthly phone call on non-HF health topic			X

Table 2

Demographics

Variable (N=26)	Mean or % (n)	SD
Age Mean	74 (range 57-91)	9.76
≤74 years	34.6% (9)	
≥74 years	65.4% (17)	
Gender		
Male	62% (16)	
Female	38% (10)	
Ethnicity / Race		
White	69.2% (18)	
Hispanic/Latino	15.4% (4)	
Black/African American	7.7% (2)	
Asian	7.7% (2)	
Years of Education	12.26	1.54
Education (Range 5 th grade thru 16 years)		
Did not Graduate High School	23.1% (6)	
High School Graduate	50.0% (13)	
1-4 Years College	26.9% (7)	
Marital Status		
Married	53.8% (14)	
Single	15.4% (4)	
Widowed	23.1% (6)	
Divorced	7.7% (2)	
Living Environment		
Lives alone in home	3.8% (1)	
Lives w/ Spouse in home	50.0% (13)	
Lives w/adult child in home	26.9% (7)	
Lives w/adult friend in home	7.7% (2)	

Lives alone – Independent Facility	11.6% (3)	
Drives Self in Car		
Yes	38.5% (10)	
No	61.5% (16)	
Number of Medications at DC	12	4.77
Cardiac Function: Ejection Fraction	37%	1.51
Random Group Assignment		
Group A	30.8% (8)	
Group B	34.6% (9)	
Group C	34.6% (9)	

Table 3

S-TOFHLA Scores and HL Demographics

Variable	Inadequate or Marginal HL	Adequate HL	Mean (0-36)	SD	Chi ² Fishers Exact
Group Assignment					
Group A (n=8)	25% (2)	75% (6)	26.75	9.66	
Group B (n=9)	44.4% (4)	56.6% (5)	24.33	9.72	
Group C (n=9)	44.4% (4)	56.6% (5)	25.50	9.25	
Overall S-TOFHLA HL Score (Range 10-36)	38.5% (10)	61.5% (16)	25.50	9.25	
Education					NS
Did Not Complete HS (n=6)	33.3% (2)	66.7% (4)			
High School Graduate (n=13)	53.8% (7)	46.2% (6)			
Some College (n=7)	14.3% (1)	85.7% (6)			
Age	74 (range 57-91)				NS
≤74 (n=3)		(n=6)			
≥75 (n=7)		(n=10)			
Gender					NS
Female (n=10)	40% (4)	60% (6)			
Male (n=16)	37.5% (6)	62.5% (10)			
Race					NS
White (n=18)	38.9% (7)	61.1% (11)			
Hispanic/Latino (n=4)	25% (1)	75% (3)			
Black/African American (n=2)	50% (1)	50% (1)			
Asian (n=2)	50% (1)	50% (1)			
Ethnicity/Race					NS
White	69.2% (18)				
Non-White	30.8% (8)				

Table 4

Study Completions, Hospital Re-admissions and HL

Variable	Group A (n=8)	Group B (n=9)	Group C (n=9)	Total
Completed Study	50.0 % (4)	100.0% (9)	89% (8)	Chi ² 12.31, df 6, p=0.05
Ended Early (Personal Choice)	25.0% (2)	0% (0)	0% (0)	
Ended Early (Medical Condition)	25.0% (2)	0% (0)	0% (0)	
Expired	0% (0)	0% (0)	11% (1)	
Admitted (n=9)	12.5% (1)	33.3% (3)	55.6% (5)	p= 0.176 (NS)
Not Re-Admitted (n=17)	87.5% (7)	66.7% (6)	44.4% (4)	
Readm w/ Heart Failure Diagnosis	0% (0)	66.7% (2)	60% (3)	Total: 55.6% (5)
Readm w/ Non-Heart Failure Diagnosis	100% (1)	33.3 (1)	40% (2)	Total: 44.4% (4)
Re-admissions: Inadequate or Marginal HL	0% (0)	33.3% (1)	60% (3)	Total: 44.4% (4)
Re-admissions: Adequate HL	100% (1)	66.7% (2)	40% (2)	Total: 55.6% (5)

Chapter Four

Telehealth Adoption by Heart Failure Patients: A Concept Analysis

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Abstract

Aim: To report an analysis on the concept of telehealth adoption in the heart failure patient population.

Background: Heart failure patients are one of the largest and most costly cohorts of chronically ill patients. To assist patients with chronic disease self-care management, home telehealth has been integrated into many healthcare services by incorporating information and communication technology. Adoption of the prescribed home technology varies among patients.

Design: Walker and Avant's framework was used to guide this concept analysis.

Data Sources: Sources comprise 38 English language research articles retrieved from the databases from PubMed, CINAHL, and Google Scholar.

Review Methods: Literature published from 2009-2014 was reviewed. Thematic analysis was carried out to identify critical attributes, antecedents and consequences.

Results: Based on the analysis, a definition of telehealth adoption in the heart failure population is proposed. The critical attributes of telehealth adoption are the *perceived benefits* of using the technology, *trust* in oneself, the device and others, along with *acceptance* of the TH device. Adoption of telehealth is demonstrated when the patient (a) incorporates the use of the device into their daily routine; (b) correlates and appraises the biometric data with their symptoms and; (c) makes an emotional commitment to utilize (adopt) the device to facilitate improved self-care management.

Conclusion: The analysis provides an improved understanding of the concept of telehealth adoption in the heart failure patient. This concept analysis provides a forum

for discussion and contributes to the discussions surrounding patient compliance and self-care initiatives when utilizing a home telemonitoring device.

SUMMARY STATEMENTS

Why is this review needed?

- Home telehealth use will likely continue to rise
- Telehealth adoption has not been clearly defined
- Healthcare providers will benefit from increased knowledge and awareness of the key attributes which influence telehealth adoption, and thereby compliance with use.

What are the key findings?

- Perceived benefit, trust, and acceptance are the key patient attributes in telehealth adoption.
- Adoption of telehealth is demonstrated when the heart failure patient incorporates the device into their daily routine, correlates, and appraises the biometric data with symptoms, and makes the cognitive and emotional commitment to utilize the device to improve self-care management.
- Heart failure patients often find improved symptom recognition/control, knowledge, self-care practices, and quality of life when utilizing home telehealth monitoring.

How should the findings be used to influence policy/practice/research/education?

- Careful patient selection, providing adequate training, and length of device utilization are important areas for pre-selection considerations.

- Early in the adoption process, heart failure patients need to understand the personal benefits of use - along with trusting themselves, the equipment, and their health care providers.
- Telehealth adoption can influence decreased mortality and hospital admissions.

KEYWORDS

Concept analysis, telehealth, heart failure, telehealth adoption, telehealth beliefs, telehealth acceptance, nursing

Introduction

Remote patient monitoring for heart failure (HF) management is gaining increasing importance in healthcare. Telemedicine has been defined by the American Telemedicine Association (2012, para. 1), as “the use of medical information exchanged from one site to another via electronic communications to improve a patient’s clinical health status”. Closely associated with telemedicine is the term “telehealth”, which is often used to encompass the broader definition of remote healthcare services including daily measuring of health parameters by the patient and their transmission via telephone, mobile phone, or Internet to a telemedical center (Health Resources and Services Administration, 2012). This definition excludes stand-alone structured telephone support or video conferencing. Home telehealth (TH) has been integrated in many healthcare services worldwide and has become a new way of providing health care incorporating information and communication technology.

Advances in monitoring technology raise questions about the patients’ experiences, particularly the perceived usefulness and adoption of TH. Compliance in using the prescribed home technology varies among patients. Some patients may accept the recommendation to bring the device into their home, but do not follow the recommended guidelines for the prescribed monitoring frequency (i.e. they have accepted the recommendation to have the device installed, but do not adhere to monitoring guidelines). The process of *adopting* the device into the home remains unclear. The patient’s perceptions of TH usefulness and correlations to personal symptoms may result

in adoption and compliance with the prescribed monitoring, or lack of adoption with resulting inconsistent or no use.

Background

Heart failure patients are one of the largest and most costly cohorts of chronically ill patients in the United States (US). The rates of HF have an increased effect on the US healthcare system with 825,000 new cases each year and an estimated cost in 2030 of \$69.8 billion dollars (Go et al., 2013). HF affects 5 million people in the US, attributing to 266,000 deaths annually, and is often characterized by frequent exacerbations requiring hospitalization (American Heart Association, 2014). Current education methods for patients hospitalized with HF may be inadequate for preventing adverse events (Riegel et al., 2011). Managing HF symptoms is complex and often requires changes in patients' diets and daily activities, and consistent use of medications to optimize symptom control and prevent acute decompensation. Home TH represents a promising approach enabling patients with chronic conditions to be followed from outside the hospital setting (Kitsiou et al., 2013). An underlying goal of home TH is to assist doctors and nurses with accurate and timely information necessary to remotely detect abnormal health parameters and avert emergency room visits and admission to the hospital.

Greater use of TH could make it easier to serve remote populations. TH for patients with HF typically consists of patients obtaining daily biometric data (e.g., blood pressure, heart rate, and weight) and may also include answers to questions regarding symptoms or clinical changes (e.g., shortness of breath, fatigue, weight gain, edema) and actions to be taken.

The process of using a home telemonitoring device begins with a physician order followed by the initial equipment installation and instructions. The patient with HF learns how to obtain his or her own biometric data and how to transmit the data to the Telehealth Center. After training, the patient may begin to evaluate the overall usefulness or benefit of obtaining the daily biometric data along with the incorporation of this process into a new daily routine. The patient may begin the cognitive correlation of his/her personal biometric data to daily symptoms (e.g., increased body weight as correlated with increased shortness of breath). Modifications in life style and adherence to HF self-care practices may result (e.g., dietary changes or improved medication adherence).

The concept of TH adoption has not been clearly described in the HF literature and warrants further exploration. According to Rodgers (1989), when the definition or attributes of a concept are not clear, the ability of the concept to assist in health care delivery or research is greatly impaired. A concept analysis, a formal, linguistic exercise used to examine basic elements of a concept and clarify its use in practice and research, can provide this information (Walker & Avant, 2011). Emerging technologies provide opportunities to decrease both the high demands and burdens associated with HF, but more information is needed on the critical attributes, antecedents, and consequences associated with the adoption of home monitoring technology. The concept of TH adoption is analyzed using the steps identified by Walker and Avant (2011).

Data Sources

A comprehensive literature search facilitated the identification of as many relevant meanings of the concept as possible. The literature search, as recommended by

Walker and Avant (2011), was not limited to nursing. To clarify the concept of adoption, set boundaries were applied. A detailed search was conducted using three electronic databases (PubMed, CINAHL, Google Scholar). Reference lists in each article were scanned for additional papers. All data bases were searched for articles published between 2009 and 2014 using the terms “adoption” “benefit”, “trust”, acceptance”, “adherence”, “compliance”, “usefulness”, or “attitudes” combined with “home telemonitor”, or “telehealth” and “heart failure”. Both quantitative and qualitative studies were sought. The initial search resulted in 81 articles with screening by title and abstract. Thirty-two articles were excluded because the interventional methods utilized mobile phone/texting interventions, video conferencing interventions, and/or structured telephone support or behavioral modification interventional methods, which were beyond the focus of the concept analysis. Limiting results to full-text, peer reviewed articles published in English further refined the search and yielded 38 references used in this concept analysis.

In reading and carefully examining data sources, characteristics of the concept that appeared repeatedly were identified and extracted (Walker & Avant, 2011). The data were analyzed thematically to determine the critical attributes of the concept, along with its antecedents, consequences, and empirical referents. Model and additional cases were also developed to further delineate the concept

Results

Uses of the concept

To clarify a concept, it is important to identify as many uses of the term as possible. Conducting a broad analysis will facilitate the comprehensive conceptualization

and development of descriptors that validate the choice of defining attributes (Walker & Avant, 2011).

Adoption

The word adoption is used in numerous settings and has several different meanings. From a legal perspective, a legislative bill that is approved will be *adopted* and put into law. In this setting, *adoption* is the institution of a sequence of steps by which legal judgments are invoked (The Free Dictionary, 2014). When traveling to a foreign country, persons may decide to *adopt* local customs and rituals. Adoption, in this context, is the act or process of beginning to use something new or different; it is the act of giving official acceptance or approval to something. Adoption implies a favorable reception, or acceptance (The Free Dictionary, 2014).

Adoption of a child

The adoption of a child is a legal process that creates a parent-child relation between persons not related to each other. The practice is ancient and occurs in all cultures. Parents may choose to adopt a child when they are unable to have their own children or want to parent children who are in need. In this context, *adoption* is the act of transferring parental rights and duties to someone other than the adopted person's biological parents (Merriam-Webster, 2014).

Adoption of new technology

There has been a technology explosion over the past 20 years. Individuals embrace and adopt technology changes in different ways. In his book, *Diffusion of Innovations*, Rodgers' (2003), described how new ideas and technologies are adopted. In his technology *adoption* lifecycle model, Rodgers described the adoption or use of a new

product or innovation, according to the demographic and psychological characteristics of defined adopter groups ranging from innovators to lagers. Technology adoption will occur quickly for the innovative-type of person (e.g., the leader) and much slower for the late adopters or lagers.

Adoption in healthcare

To promote wellness or to manage an illness, the healthcare provider often prescribes or recommends a treatment plan and the patient with HF is educated on numerous topics. Common educational topics include lifestyle modification (e.g., activity, weight loss, dietary changes, abstaining from smoking and alcohol) and medication adherence. The patient begins an appraisal process and may choose to adopt or reject the treatment plan. In healthcare language, the concept of *adoption* is often discussed in terms of adherence or *compliance*. Patients can be labeled *compliant* or *non-compliant* based on their adoption of the recommended treatments. The patients “compliance rates” are often published in the medical and nursing literature. Compliance will influence adoption. Based on the perceived benefits of the treatment value (e.g., is it helpful), the individual will decide if they are willing to adopt both the new technology and a new daily regimen of utilizing the technology. This will result in personal behavior choices (compliance or noncompliance).

To *adopt* is to “choose or take as one's own; make one's own by selection or assent” (The Free Dictionary, 2014). In the context of TH adoption, the patient makes a cognitive and emotional decision to comply with the medical treatment plan of utilizing the TH monitor.

Defining Attributes

The defining attributes of a concept are the characteristics that appear over and over in the uses of the term; these attributes help differentiate telehealth adoption from other concepts and should be closely associated with the concept (Walker & Avant, 2011). Reviewing the literature facilitated the identification of the key attributes of the concept. The literature suggests the concept of TH adoption in the HF patient population has three major defining attributes. For home TH adoption to be present in the HF patient population, there must be a perceived *benefit*, *trust*, and *acceptance* of the technology. These three attributes are integral to the overall process of TH adoption.

Perceived benefit

Perceived benefit involves an assessment or estimation of worth, value, or quality of a person or thing. Perception is the way you think about or understand someone or something (Perception, 2014). It is the personal interpretation of a situation or how an individual views a situation. Humans assess new situations (e.g., the use of new piece of equipment) for potential threats or benefits, and then determine their response. A benefit is something that enhances well-being and is considered to be an advantage or a helpful result (Benefit, 2014). The defining attribute of a perceived benefit is the cognitive appraisal resulting in a favorable view or perspective. Perceived benefit, in the context of TH adoption, includes two aspects, benefit related to usefulness of the equipment itself and the benefit of obtaining the biometric data.

Equipment. Patients will appraise the equipment ease of use and may begin an adjustment process. Polisen et al., (2014) found high rates of adherence with TH resulted when patients' received individualized training and perceived the equipment to

be simple to use. Appraisal regarding TH benefits can range from positive (helpful) to negative (a waste of time or too disruptive to routine). In a study by Domingo et al., (2012), 65% of the 97 patients who had used home TH wished to continue with home telemonitoring after the monitor was discontinued; the benefits of TH were positively perceived.

Correlation of symptoms with TH data. With repeated use, the patient continues with the process of adoption by correlating the daily biometric data (e.g., blood pressure, pulse, weight measurements) with their symptoms. Due to the chronic nature of HF, patients remember past clinical symptoms and make an evaluation based on past experiences (e.g., when to call their doctor or self-manage their symptoms). Early symptom recognition and earlier communication with the healthcare team can result from regular TH use. In a study by Seto et al. (2012), TH patients had greater awareness of their HF condition and liked the “real time” communication with the health care team on how to modify their lifestyle. Similarly, in a qualitative study of 15 HF patients who were interviewed at 3 and 6 months, Riley et al. (2013) found after 6 months of use, TH patients had improved symptom recognition, felt empowered with self-care decision making, and had improved interactions with both the TH monitor and communication with the TH nurse. In their qualitative analysis of in-depth interviews with 15 HF participants, Hall et al. (2014) found participants receiving home TH reported increased access to care, earlier recognition of worsening condition, increased knowledge, and greater convenience as potential benefits.

Trust

The development of trust is an important defining attribute of TH adoption. The patients must develop trust in three areas. The first area is related to self-trust. The patient must trust he or she is capable of obtaining accurate and meaningful data from the device. If the equipment is too cumbersome or difficult to use, the patient may not adopt the technology. The second area of trust is trust in the accuracy of the technology (e.g., the blood pressure reading is correct and correlates to data derived from personal blood pressure devices). Hall et al. (2014) reported mistrust of the technology precluded the use of home telemonitoring technology. When biometric data discrepancies exist, patients are less likely to adopt the technology. The third area of trust relates to the health care team who receives the biometric data. Patients must trust that the healthcare team members will manage their biometric data accurately, consistently (e.g., call the patient if values are abnormal), and ethically. If the patient perceives a threat to the privacy of his/her data, a lack of consent may result (McLean et al., 2011) along with mistrust of the technology (Hall et al., 2014). Feelings of technology ambivalence and the need for freedom from invasive surveillance may also be common among older persons, many of whom experience HF (Bostrom et al., 2013).

Acceptance

Acceptance, the third attribute of TH adoption, is defined as the act of assenting or believing, being viewed favorably, or receiving approval (Dictionary reference, 2014). Acceptance implies the lack of negative judgment. Within the HF population, acceptance is seen when the patient agrees to the home installation of the device and begins the process of following the prescribed guidelines of use. This overarching defining attribute

influences concept of TH adoption. The evolution from “acceptance” to “adoption” implies the final step in which the patient places an emotional value on the usefulness of the device/data in assisting them with self-care disease management.

The frequency of TH device interaction may influence the choice to accept and comply with recommended device utilization. In a meta-analysis conducted by Nakamura et al. (2014), patients who interacted with their home telemonitor two or more times a week had a lower mortality compared to those who only interacted with their monitor once a week. This may be attributed to higher measurement frequency; the healthcare practitioners were able to detect changes in patient vital signs earlier. Similarly, Mortara et al. (2009) found t home TH was ineffective when measurements were not taken daily, concluding home TH was ineffective when weekly measurements were taken.

In summary, the adoption of a TH regimen is influenced by its perceived benefits, trust, and acceptance. These attributes are the cornerstones in the decisions surrounding the concept of TH in the HF population.

Model and additional cases

Abstract concepts can often be better understood by using case examples. To help illustrate the concept of TH adoption, scenarios in the form of model, borderline, related, and contrary cases are presented (Walker & Avant, 2011).

Model case

According to Walker and Avant, a model case of a concept is an example that displays all of the concept's defining attributes (2011). The following two cases exemplify the defining attributes of perceived benefit, trust, and acceptance in the adoption of the technology.

My weight was fluctuating and I learned that I was using too much salt, making my blood pressure rise. If I eat a lot of sodium it will also show up the next day when my weight will be higher. I'm more aware than before I started this program, and more careful. Using the daily weight function on my home telemonitor has really taught me about my salt intake, blood pressure, and my weights. I trust that if my weight is up more than 2 pounds, I know to cut back on the salt in my foods. This equipment keeps me honest!

In this example of TH adoption, the patient has *perceived a benefit* to using the TH technology and perceives the device as useful in symptom management. She understands the untoward effects of eating too much sodium and the correlation with the weight increases shown on her TH device. As a result, she *trusts* the biometric data and has *accepted* the use of the device. The patient has determined the need to modify her behavior and decrease her sodium intake based on the data, thereby demonstrating adoption.

This second example of a model case of TH adoption involves the perceived benefit, trust, and acceptance of the TH device in the patient's decision-making process:

It took a few weeks, but once I learned how to use the device, I became more confident. I decided to take the telemonitor with me when traveling. It gave me peace of mind when I was in Florida for three months visiting my sister. I knew my doctor and nurse could see my daily blood pressure and weights and this was comforting.

After mastery of the technology, this example demonstrates the patient *perceived the benefits* or the usefulness of the device (which implies *trust*) as the device has

contributed to developing a personal “peace of mind”. As a result, the patient demonstrated *acceptance* and use of TH device. Adoption of TH is demonstrated in the patient’s decision to take the device with him, even when vacationing.

Borderline case

A borderline case is one that contains most, but not all of the defining attributes (Walker & Avant, 2011). In the following case, the defining attribute of acceptance is missing:

I feel like a prisoner. It doesn’t take much to gain three pounds. I like to go out with my friends and have a few beers. One night I drank four or five beers. The next day, my weight is going to be higher. I thought beer is a diuretic, and that my weight would be down. I know this TH box is helpful in managing my heart condition, but I don’t want a phone call (from the nurse or doctor) with that kind of pressures... it’s pressuring me, you know... I don’t need this in my life. I would rather not use the darn equipment!

In this exemplar, the TH patient has (falsely) determined that beer is a diuretic and perceives the phone calls as “pressuring him”. His response is one of frustration. This patient uses the device, which implies a *perceived benefit* and *trust*, but lacks the *acceptance*. The patient lacks the correct knowledge to appropriately evaluate the correlation between excessive fluid volume (e.g., five beers) and weight gain and therefore does not accept using the TH monitor.

Related case

Walker and Avant (2011) state related cases are similar to the concept being analyzed, yet do not contain all of the attributes of the concept being studied or differ in

one or more of the defining attributes. Such cases, however, help us understand how the concept being studied fits into the network of concepts surrounding it, as highlighted in the following patient exemplar:

The doctor recommended I use this monitor at home to check on my heart. When the home health nurse set it up in my home, she explained it to me. I got confused and didn't understand. I nodded my head because I was too embarrassed to admit that I cannot read the buttons. She left some (written) directions, but I don't understand all of the big medical words. I want to use it as I know it can help me, but I gave up and put it in the closet.

This case illustrates the challenges associated with either low literacy or visual impairment. The patient is agreeable to using the device, which implies *perceived benefit* and *trust* of using the home TH monitor, but either literacy or visual impairment barriers impede the acceptance of the device.

Contrary case

Contrary cases are those that are clear examples of what the concept is not. A contrary case does not include any of the defining attributes of the concept (Walker & Avant, 2011). The following narrative illustrates the absence of the three defining attributes of TH adoption:

The 68 year-old male visits his physician who recommends a home telemonitor to help him manage his HF condition. The patient refuses the offer stating he does not like technology and does not want "big brother" looking over his shoulder from home. Despite this, a home health nurse comes to his home. Before

installation and education can occur, the patient refuses the device, instructing the nurse to put the device back into her car.

This example is the opposite of TH adoption. The patient does not *perceive the benefits from the TH device* and does not *trust* the technology, which resulted in non-*acceptance*. Adoption of the technology has not occurred.

Antecedents

Antecedents are circumstances that precede an occurrence of the concept under study (Walker & Avant, 2011). Telehealth adoption by HF patients is preceded by several factors. First, the patient's physical health status must necessitate the allocation of this resource. To address this need, the licensed independent practitioner (e.g. MD, PA, NP) must prescribe or order the device. Second, patients must be open-minded regarding the use of the technology. They must verbalize a willingness to try this monitoring modality and must agree (consent) to use the device. The device must be delivered or mailed to the patient's home, set-up, and instructions provided on its use.

A third antecedent is the careful patient selection considerations, which should occur before allocating the TH monitoring equipment and services. The patient must have the cognitive and physical capabilities to utilize the home telemonitoring device.

Antonicelli et al. (2010) attributed the limited efficacy of home patient monitoring to either physical or cognitive inability to perform daily measurements. Mobility and dexterity constraints, without the support of a home support person, can lead to frustration in working with the equipment. These limitations may lead to disengagement and/or measurement error (McLean et al., 2011). In a recent study by Sanders et al. (2012), patients who refused to participate in the TH research study discussed concerns

about technical competence and special skills that were needed to operate the equipment, but most were based on misunderstanding. The use of TH in the end-stages of heart failure has not been well researched and the use of TH in the palliative setting is considered controversial (Crudall-Goode & Goode, 2014). Patients who are nearing the end-of-life can be inappropriate for home TH; palliative care support services are more important, and the TH device may be perceived as intrusive (Domingo et al., 2012). More research is needed to determine the ideal patient population, technology, parameters, frequency, and duration of telemonitoring.

Consequences

Consequences are the end results or outcomes of the concept being studied (Walker & Avant, 2011). The most cited consequences of TH adoption include improvements in early symptom identification, increased knowledge, improved quality of life, self-care, and decreased hospitalization rates.

Improvements with symptom control, knowledge, self-care, and quality of life

Participants receiving home TH reported benefits of increased access to care, earlier indication of worsening conditions, and increased HF self-care knowledge (Hall et al., 2014). Several studies have also reported improved quality of life (Inglis et al., 2010; Polisena et al., 2010), improved self-care (Lynga et al., 2013), and improved satisfaction (Kraai et al., 2011) when using a home TM. Seto et al. (2012) found HF patients using TH had an improved quality of life based on improved self-care and clinical management.

Decreased Mortality and Re-hospitalization

Several meta-analysis of home TH in HF patients have shown that, compared to usual care, home TH reduces all-cause mortality (Clarke et al., 2011; Inglis et al., 2010; Nakamura, et al., 2013; Polisena et al., 2010; & Xiang et al., 2013). Polisena et al. (2010) reported home TH patients had fewer hospitalizations compared to usual care. Xiang et al. (2013) also reported a reduction in both all-cause hospitalization and length of hospital stay; Klersy et al. (2010) found associations between remote patient monitoring and decreased hospitalization and mortality.

Improved Communication with the Healthcare Team

Another consequence of TH adoption is improved communication. Early symptom recognition and earlier “real time” communication with the healthcare team can result from regular TH use (Seto et al., 2012). Similarly after 6-months of use, TH patients demonstrated improved symptom recognition, felt empowered with self-care decision-making, and had improved communication with the TH nurse (Riley et al., 2012).

Empirical Referents

According to Walker and Avant (2011), empirical referents are the means by which defining attributes are recognized. The concept of TH adoption will be demonstrated by the empirical referents when a patient utilizes the equipment as prescribed, accurately correlates the data findings with personal subjective and objective data, and makes the cognitive and emotional choice to optimize self-care management practice from home. These phenomena demonstrate the occurrence of the concept itself.

Definition

As previously stated, the concept of TH adoption has lacked clarity. The major defining critical attributes of TH adoption are the perceived benefits of using the technology, trust in oneself, the device, and others, in concert with making a choice to accept and utilize the TH device. Based on the synthesis of findings for this concept analysis, the theoretical definition of TH adoption is the cognitive and emotional willingness to appraise, discriminate, and create understanding resulting in the choice to consistently utilize the prescribed home TH technology to improve self-care management. Adoption of the technology is demonstrated when the patient (a) incorporates the use of the device into their daily routine; (b) correlates and appraises the biometric data with their symptoms; and (c) makes an emotional commitment to utilize (adopt) the device to facilitate improved self-care management.

Discussion

This concept analysis makes a contribution to the development of a descriptive analysis of TH adoption. Nursing plays a critical role in the analysis of the defining attributes and facilitating the overall adoption of the TH device. Nurses working in the home care or heart failure clinic settings may recognize and influence the identified antecedents and optimize the appropriate patient selection for a TH device.

As educators, nurses play an integral role in assisting patients with overcoming obstacles and barriers to TH use. The newly proposed definition of TH adoption may also be useful in guiding practitioners working with other adult populations with chronic illnesses (e.g., diabetes, COPD, asthma, hypertension).

Limitations

The purpose of this analysis was to define the concept of TH adoption in the adult heart failure patient population and cannot be generalized to other populations. While the literature was retrieved from the abundant medical and nursing literature, certain limitations are noteworthy. Due to the large volume of literature, research prior to 2010, conducted in other disciplines, or published in languages other than English was not included. Literature on TH adoption in other chronic diseases and from other healthcare disciplines needs to be further explored.

Conclusions

Chronic illness is driving the need to review the organization of health care services and to provide new and more effective interventions. Home TH monitoring may be one solution to help attenuate some of the problems associated with an aging population and increasing rates of chronic illness.

The use of a theoretical framework helps to explore the scope of the multidimensional nature of the symptom experience among HF patients utilizing TH. The Self-Care of Heart Failure Model (SCHFM) is a situation specific theory developed by Riegel and Dickson (2008). The key concepts of this model are self care *maintenance* and self-care *management*. Self-care *maintenance* incorporates behaviors used to maintain physiologic stability with a focus on symptom monitoring and treatment adherence. The selective awareness of personal symptom recognition and interpretation of this experience are critical first steps of this model and align well with the concept of TH adoption. Treatment adherence, a component of self-care, involves following the treatment plan. Self-care *management* refers to the decision-making process in which

patients recognize and respond to their symptoms. Self-care management is an active, deliberative process that is essential in HF if patients are going to control the balance between relative health and symptomatic HF (Riegel & Dickson, 2008). This conceptual framework is useful in exploring the broader concepts of TH adoption in the HF patient population.

Additional research is needed to better understand the concept of TH adoption in patients' lived experiences particularly with respect to variables that facilitate or create barriers to TH adoption. Other areas for study include strategies to overcome barriers, associations between device use, lifestyle modifications, and adoption practices of family members with home device use. Research findings from these potential topics will be useful to health care professionals, patients, families, and telemonitoring industries.

Health care technology holds great potential to improve the quality of care delivery and can improve patient self-efficacy in disease management. TH adoption can influence improved symptom recognition and self-care practices, potentially leading to improved quality of living, patient outcomes and decreased hospital re-admission costs.

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Chapter 5

Discussion of Findings

Chapter one provided a synthesis of key literature findings on self-care management challenges associated with heart failure (HF), home Telehealth (TH) including TH adoption, health literacy (HL) as it relates to telehealth and chronic illnesses, along with the research aims and the conceptual frameworks used to guide this research. The published manuscript in the January 2015 edition of Home Healthcare Now describes the analysis and results from a retrospective database of HF patients participating in a home TH program is provided in Chapter 2. HL data regarding a TH HF sample from a prospective feasibility randomized controlled trial (RCT) with 26 HF patients are discussed in Chapter 3. Using a framework provided by Walker and Avant (2011), a concept analysis on TH adoption is explored extensively as an essential component for conducting TH research and inclusion within practice in Chapter 4. This chapter will discuss the synthesis of study findings, nursing implications, and recommendations for future research.

Synthesis of Study Results

Research Aim #1: Utilizing the first dataset, the purpose of the first study was to explore a secondary home care database of HF patients who did and did not receive home TH services. Socio-demographic variables (age, gender, race, zip code, and living situation) and physiologic and cognitive variables were analyzed. Study results indicated no significant differences in the socio-demographics (age, gender, race, and zip code) were found between the two groups. Both groups were comprised of predominately older adults (82 years non-TH; 84 years TH), Caucasian (83% non-TH; 80% TH), females (60% in both groups). Using the Pearson's Chi Square analysis and Fisher's Exact statistical methods for analysis, those patients who did not receive TH monitoring were more likely to have been discharged to home from a skilled nursing facility within the past 14-days (25% non-TH; as compared to 5% TH, $p < 0.001$). Non-TH patients had a higher fall risk assessment (68% non-TH; 52% TH, $p = .009$) and had a greater history of falling in the past 12-months (27% non-TH; 16% TH, $p = 0.032$). Non-TH patients had greater rates of impaired vision (16% non-TH, compared to 10% TH, $p = 0.038$). TH patients were also more independent in taking daily oral medications if reminded (28% TH; 18% non-TH). Patients who need additional therapies (physical, occupational, and/or speech therapy) are often discharged from the hospital to the short-term skilled nursing facility before being safely sent to their homes. These results indicate that in this particular study population, a healthier and physically stronger subset of HF patients received the TH monitor. In addition, TH patients had better vision, possibly allowing them to interact more easily with the home TH device.

Several differences in pulmonary status were also noted between the two groups. Non-TH patients were more likely to smoke cigarettes (20% non-TH compared to 5% TH, $p<0.001$). On the other hand, despite smoking less, the TH patients had more shortness-of-breath (93% TH compared to 80% non-TH, $p=0.043$) and used more oxygen (35% TH; 26% non-TH). The use of oxygen was not found to be statistically significant between the two groups ($p=0.101$). The shortness of breath clinical variable along with increased use of home oxygen in the TH population was an unexpected finding. Given that pulmonary co-morbidities are common in the HF population (Yancy, Jessup, & Bozkurt, 2013), this may be a useful finding in encouraging healthcare providers to recommend a home TH device for this potentially vulnerable and at-risk HF subset of patients.

Research Aim #2: Using the Pearson's Chi Square analysis to examine for differences in 30-day hospital re-admissions between patients who received home TH compared to non-TH HF patients who received usual care nursing services, the non-TH patients had a 21% all-cause hospital re-admission rate, compared to the TH patients who experienced a 10% all-cause re-admission rate. Upon further analysis, only 3 of the 10 of the TH patients were readmitted due to exacerbation of HF symptoms. Due to limitations in the coding of the OASIS-C database, comparable HF-related hospital re-admission rates were not obtainable. These findings reflect within this 22-month time frame, HF patients who were selected and agreed to participate in this agency's home TH program had a reduced hospital re-admission rate compared to those HF patients who did not receive home TH. The lower re-admission rate findings may be a result of the healthier population who were selected for home TH or a result of the benefits of improved self-

care, symptom recognition, and/or earlier communication with the health team members directly related to TH.

Research Aim #3: Utilizing data from 26-HF patients enrolled in the prospective feasibility RCT, the third study aim was to examine HL levels with demographic variables (age, gender, ethnicity, level of education, and living situation). Of the 26 participants who completed the HL assessment, 38.5% of participants had inadequate/marginal HL. In previous studies, low or inadequate literacy was common among patients with HF ranging from 27% to 54% (Evangelista et al., 2010; Laramée, Morris, & Littenberg, 2007). Cajita, Cajita, and Han (2013) found 39% of HF patients demonstrated low HL. The HL rate in our study population appeared to be congruent with these larger studies.

Participants in Group A had higher HL scores than those in Groups B and C. Seventy five percent of patients in Group A had adequate HL compared to 57% in Group B and C. These findings were not statistically significant, but may have an influence on the study outcomes. There was no statistical significance in HL between those patients who were 74 years or younger (n=9) and participants who were 75 years and older (n=17). Using a Person's Chi Square and Fisher's Exact analysis, HL scores were not influenced by age, gender, marital status, living environment, or race. This may be a result of the small sample size. Levels of education varied greatly; 23% of patients had not completed high school, 50% of patients had completed high school and 27% completed between 1-4 years of college. For those with inadequate or marginal HL, most had a high school (HS) education (54%). Of those who did not complete HS, 33% had inadequate/marginal HL. Seventy-five percent of patients who scored as adequate HL

had completed high school or higher. Surprisingly, 25% of patients who did not complete HS had adequate HL. These findings were not statistically significant.

Study Completion. Of the 26 enrolled HF patients, 81% (n=21) completed the 4-month study. Patients in Groups B and C were more likely to complete the study ($p=0.05$). Group B patients had a 100% completion rate with a 89% completion rate in Group C patients (one subject expired). Interestingly, only 50% of patients in Group A completed the intervention. Four patients ended the study early; two because of personal reasons and two in Group A due to a decline in their medical condition.

Literacy levels were not associated with completing the study. Patients with higher HL were more likely to complete the study (57% compared to 43%), but this finding was not statistically significant. All 26 participants received a monthly phone call from the study nurse. This simple monthly phone call intervention could have been effective for participants, regardless of literacy.

Patients participating in a home TH program may be a greater risk for ending the TH intervention sooner than those patients who received only a monthly MI phone call (e.g. patients in Groups B and C). Patients could be more comfortable with talking with a nurse over the phone each month versus adjusting and adopting to a home TH device into their personal environment and daily routine. This finding may be related to the added burden of using a daily home TH device, the lack of TH adoption, and/or the need for additional and continued education on the potential health benefits that could occur when using a home TH device. The literature remains unclear on which types of interventions are ideal for the low and adequately literate HF population and for what duration of time to truly facilitate self-care practices; future research is needed in this area.

Rehospitalizations. Nine (35%) of the 26 HF participants were re-hospitalized within the 4-month timeframe of this study. Five of the 9 re-admissions (56%) were related to a HF diagnosis. Of the 9 readmitted, those with adequate HL had a higher re-admission rate (56%) versus 44% in the inadequate/marginal HL group. HL did not appear to be related to the re-admissions and no statistical differences in all-cause or HF-related re-admissions and HL were found.

Participants in Group A had a lower re-admission rate compared to those in Groups B and C. This could be related to the combination of the TH device with the monthly MI HF topic. This finding is consistent with previous studies that have demonstrated patients utilizing a home telemonitor have a decrease in HF hospital re-admissions (Polisena et al., 2010; Xiang, Li, & Liu, 2013).

Five of the 9 re-admissions were participants in Group C, and 60% (n=3) of these participants had inadequate HL. Although not statistically significant, there was a trend toward those with lower literacy and less intervention (i.e., the attentional control group) to have higher hospital re-admissions. This population may appear to be at a greater risk and may warrant additional resources (i.e. early assessment of HL, home TH, phone calls) to facilitate self-care management. With an emphasis to reduce the 30-day re-admission rate for HF patients, this information is useful for health care organizations or agencies that are considering developing a new home TH program.

Research Aim #4: Using the concept analysis framework outlined by Walker and Avant (2011), the critical attributes, antecedents, and consequences of TH adoption in the HF population are described in Chapter 4. Early in the TH adoption process, HF

patients need to trust themselves, the equipment, their health care providers, along with understanding the personal benefits derived from device use.

To facilitate this concept, the TH nurse needs to provide regular communication and customized educational approaches with additional support to select patients during the early stages of adjusting to the device and the new home monitoring routine. In the prospective feasibility research study, enrolled HF patients were interviewed throughout the 4-months and shared anecdotal insights into challenges and perceived benefits in using the home device. For example, one patient did not like having the TH scale in her smaller home as she frequently “bumped into it” and felt the scale occupied too much space. Assistance in finding a new space helped solve this challenge. Another patient had difficulty replacing the device batteries and needed additional education. A separate patient had problems with the Internet modem resulting in failure of data transmission. Despite troubleshooting with him over the phone, this problem required an additional home visit to solve the problem. Another patient had new hypertension and increased shortness-of-breath which persisted for 2-days. Using this valuable TH data, the patient contacted her primary care provider resulting in the adjustment of medications possibly averting an emergency room visit or hospital re-admission. Afterward, the patient was given positive feedback and was complimented for using her biometric data combined with her personal symptoms to be proactive in her self-care management. With the above examples, the subject’s literacy levels were not incorporated, as the researchers were blinded to this information. However, in future TH programs HL will be assessed followed by customized educational content and methods.

Implications for Nursing Practice

Nurses play an important role in patient selection for home TH programs, assessing HL, and developing customized education for the HF patient who is participating in a home TH program. Nurses are ideally positioned to provide timely nurse-led interventions that influence HF patients with improved symptom recognition, self-care management, and the prevention of emergency room visits and/or hospitalization. Nurses identify patient needs, facilitate communication, and provide ongoing patient and caregiver education based on literacy comprehension.

Patient Selection, Monitoring Frequency, and TH Adoption. Evidence-based patient selection and HL assessments are important pre-selection considerations for home TH in the HF population. The ideal HF patient profile for selection into a TH program, along with the length and frequency of the TH program, are yet to be answered. From this retrospective data analysis, patients in the TH program were healthier than non-TH patients, were on the home TH device for an average of 53-days, and also had a lower hospital re-admission rates compared to the non-TH patients. In the prospective feasibility RCT, patients used the home TH device for 4-months and those (Group A participants) who completed the program also had a lower hospital re-admission rate compared to the non-TH patients. From these two samples, patients were on the home TH device for an average of 53 to 120 days. Similarly, in a qualitative study of fifteen HF patients who were interviewed at 3 and 6 months, Riley et al. (2013) found 3-months was not long enough, after 6-months of use, TH patients had improved symptom recognition, felt empowered with self-care decision making, and had improved interactions with both the TH monitor and communication with the TH nurse. The ideal

timeframe for utilizing the home TH device to promote improved symptom recognition, self-care, and reduce hospital admissions has yet to be determined, but greater than 3 months may be necessary to embed sustainable self-care practices.

Adoption of the TH device into the daily routine is also an important variable for a HF patient who is new to telemonitoring. Adoption of the technology is demonstrated when the patient (a) incorporates the use of the device into their daily routine; (b) correlates and appraises the biometric data with their symptoms and; (c) makes an emotional commitment to utilize (adopt) the device to facilitate improved self-care management.

Patients in both of these studies were instructed to use the home TH device each morning. The frequency of TH device interaction may influence the choice to adopt and comply with recommended device utilization. In a meta-analysis conducted by Nakamura, Koga, and Iseki (2014), patients who interacted with their home telemonitor two or more times a week had a lower mortality compared to those who only interacted with their monitor once a week. This may be attributed to higher measurement frequency; the healthcare practitioners were able to detect changes in patient vital signs earlier. Similarly, Mortara, Pinna, and Johnson (2009) found home TH was ineffective when measurements were not taken daily, concluding that home TH was ineffective when weekly measurements were taken. In summary, additional research is needed in this area of ideal patient selection criteria, as well as length and frequency of the TH program participation.

Literacy Assessment and Customized Educational Approaches. HL was not significant in this database when analyzed with age, gender, race and educational level.

Although these relationships are well established in the literature, significance was not seen in the RCT. The small sample size and the S-TOFHLA in a senior population were two limiting variables. Nurses and other healthcare professionals should recognize that low HL is prevalent and adopt strategies that potentially mitigate the impact of low HL when communicating with HF patients, especially those who are on a home TH device. The use of teach-back methods, literacy-sensitive educational materials, videos, and easy to read visual aids are some strategies outlined in the toolkit recommended by the US Department of Health and Human Service in the Agency for Healthcare Research and Quality (Agency for Healthcare Research and Quality [AHRQ], February, 2015). Assessment of patient HL should be integrated into routine intake assessments. Nurses and health care providers should begin by assessing their own knowledge of HL followed by making a conscious effort to modify personal teaching styles to meet the needs of low literacy clients.

Future Research

The presented synthesis of literature, analysis of two separate TH databases, and a TH adoption concept analysis highlight the numerous challenges related to the care and management of chronically ill HF patients along with the potential benefits that may result from the use of home TH.

The field of HF home monitoring has many additional avenues to investigate. Home TH is not intended to replace health professional care visits, but rather to enhance the level of care provided to patients, especially those suffering from chronic medical conditions (Polisena et al., 2010). Further studies to identify which patient populations will derive the greatest benefit from home monitoring are needed. Identifying which

variables are best to monitor requires further study (i.e. heart rate, blood pressure, pulmonary artery pressures). Monitoring alone, without adequate follow-up and feedback to the patient is unlikely to be the solution that prevents HF deterioration and re-admissions (Bui & Fonarow, 2012). Successful approaches to managing this complex population will likely need to be multimodal (i.e. home visitations, structure telephone support, TH monitoring).

Additional research is needed to better understand the concept of TH adoption in patients' lived experiences particularly with respect to variables that facilitate or create barriers to TH adoption. Continued exploration is needed with TH adoption in various ethnic and cultural groups. Culturally tailored interventions have been shown to improve risk factors and disease management (Ravenell et al., 2011). Additional areas for future study include the role of the family member or caretaker in home TH programs, their adjustment and adoption to the device, and the role HL may play in this adoption process. Research findings from these potential topics will be useful to health professionals, patients, families, and device manufactures.

Summary

The growing rate of chronic illness and our aging population are driving the need to review the organization of health care services and provide more effective interventions. Nurses and healthcare providers are challenged to think in novel and creative ways to improve the coordination of patient care, facilitate self-care, and reduce hospital re-admission. Home TH monitoring may be one solution to help attenuate some of the problems associated with an aging population and increasing rates of chronic illness.

Through the lens of baseline literacy, research on TH and TH adoption in the HF population is lacking. The SMCM and the SCHFM are two conceptual frameworks that guided the research aims, analysis, and interpretation of data. Findings from these two research studies and concept analysis will add to the scientific body of knowledge on the topic of home TH and HL with home telemonitoring. Given the considerable resource burden of HF, the nurse is a key health team member to optimize home TH programs while incorporating patient literacy into customized educational approaches to facilitate optimal patient outcomes.

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Appendix A: USD IRB

Institutional Review Board Project Action Summary

Action Date: February 21, 2014 *Note: Approval expires one year after this date.*

Type: ☐ New Full Review ☒ New Expedited Review ☐ Continuation Review ☐ Exempt Review
☐ Modification

Action: ☒ Approved ☐ Approved Pending Modification ☐ Not Approved

Project Number: 2014-02-171

Researcher(s): Shelley Hawkins, PhD Fac SON
Tanna Thomason, MSN Doc SON
Carl "Fritz" Steen, BSN Arch Health Partners, San Diego, CA
Dr. Dale Glaser Fac SON
Dr. Jonathan Mack Fac SON
Laura Custis, RN Masters SON

Project Title: Feasibility of a Telehealth Motivational Interviewing Heart Failure Self-Care Program for Older Adults

Note: We send IRB correspondence regarding student research to the faculty advisor, who bears the ultimate responsibility for the conduct of the research. We request that the faculty advisor share this correspondence with the student researcher.

Modifications Required or Reasons for Non-Approval

None

The next deadline for submitting project proposals to the Provost's Office for full review is N/A. You may submit a project proposal for expedited review at any time.

Dr. Thomas R. Herrinton
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SIGNATURE PAGE

All applicable signature lines **MUST** be signed. If any required lines are left blank, the application will be returned to the principal investigator.

Skelley Y Hawkins Nursing 12/19/2013
 Researcher (signature) Department/School and Date

Skelley Y Hawkins shawkins 7607
 Researcher (printed) REQUIRED: email Phone

N/A
 Faculty Advisor (signature) Department/School and Date
 (Only required if PI is a **USD Student**.)

N/A
 Faculty Advisor name (printed) REQUIRED: email Phone

N/A
 USD Sponsor (signature) email Phone
 (Only required if PI is **NOT** a **USD student/faculty**. The USD sponsor must be a full-time employee of USD).

N/A
 USD Sponsor name (printed) Department/School and Date

Jane M. Gray 2/18/14
 School/College IRB Representative Date
 (ALL applications must obtain this signature, whether your unit has a designated IRB representative or not. Contact the IRB Chairperson if you need guidance.)

Sally Brock Harding Ph.D., R.N., F.A.A.N. 2/19/14
 Dean or His/Her Representative (signature) Date

APPLICANT: THE FOLLOWING WILL BE SIGNED AFTER YOU SUBMIT YOUR APPLICATION TO THE PROVOST'S OFFICE.

The project described above has been approved by the USD Institutional Review Board.

Dr. Thomas R. Hinton 2/21/14
 Chair or Administrator to IRB (signature) Date