Factors Associated with Telehealth Initiation Among Heart Failure Patients at Home

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Abstract

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This dissertation aims to examine factors associated with telehealth initiation among heart failure patients in home care settings using a mixed methods study design. Chapter One identifies the current gap in the literature on telehealth adoption and the significance of this study in filling this gap. Chapter Two provides an integrative review of the literature on factors affecting heart failure patients' decision making to accept telehealth services in a home setting. Chapter Three presents a quantitative analysis of data from the Outcome and Assessment Information Set (OASIS) on 2,832 heart failure patients referred to telehealth services using a modified Unified Theory of Acceptance Use of Technology (UTAUT) framework, to identify patient-related factors or characteristics associated with telehealth initiation. Chapter Four describes the findings of a qualitative study using individual telephone interviews with heart failure patients at home to explore reasons for telehealth initiation. Finally, in Chapter Five, the findings of all three studies are summarized and overarching conclusions are reported with a discussion of their relationship to previous research. This chapter concludes with a consideration of the strengths and limitations of the study, and implications for practice, policy, and research.

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사랑하는 가족: 부모님, 언니들, 그리고 두 아들, 이채 이도,에게 감사의 인사를 드립니다. 특별히 부인의 박사과정을 위해 많은 것을 희생하고 두 아이를 돌봐 준 남편 안다에게 말로 형헌할 수 없는 감사의 마음을 전하는 바입니다.

Dedication

To my husband, Anda, who is called Dr. Anda by his colleagues and friends despite not having a Ph.D., because of his broad knowledge about everything in life.

실제 박사 학위은 없지만 아는 것이 너무 많아 안다 박사라는 닉네임으로 불리는 남편에게 이 논문을 바칩니다.

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전쟁 후 세대로 한국에서 태어나 가족을 위해 희생하느라 위대한 학자 겸 교육자가 되는 꿈을 접어야 했던 사랑하는 아버지께 이 논문을 바칩니다.

Chapter One: Introduction

In this chapter I discuss the problem of low initiation of telehealth, which has been demonstrated as helping heart failure patients manage their symptoms at home. I describe increasing HF prevalence and the self-management issues among HF patients, and discuss the relevance of addressing these issues in home health care using telehealth as an intervention. Then, I explain the significance of research on this topic, highlighting the existence of a gap in current research on factors affecting patients' decision-making on telehealth initiation and the importance of identifying the reasons for non-initiation to promote better self-management of HF symptoms at home. Finally, I will explain the theoretical and conceptual underpinnings of my work and state the aims and organization of this dissertation.

Background

Heart failure (HF) affects about 5.7 million adults in the United States (US), costing the nation an estimated $30.7 billion each year. It is estimated one in 9 deaths in 2009 had HF as a contributing cause, approximately half of people with HF die within 5 years (DHDSP, 2016), and HF-related deaths have been increasing since 2012 (NCHS, 2015). It is also estimated that 26% of HF patients have a 30-day re-hospitalization – this is a concern because re-hospitalization is associated with high health care expenditures (Madigan et al., 2012) and may also indicate poor HF management after discharge from hospital.

The American Heart Association recommends providing education on self-management to all HF patients on discharge from hospital, as the self-care regimen is complex and multifaceted. For proper management, patients need to understand how to monitor their symptoms and weight fluctuations, restrict their sodium intake, take their medications as prescribed, and stay physically active (Yancy et al., 2013). Several studies reported self-

management was found to decrease HF readmissions (Glasgow et al., 2002; Jovicic, Holroyd-Leduc, & Straus, 2006; McAlister, Stewart, Ferrua, & McMurray, 2004). As such, self-management plays great role in preventing re-hospitalization and it is supported by the evidence found from research.

Home health care has been increasingly used to bridge the gap between acute care settings and the home to alleviate patients' care burden and assist with disease self-management. Home health care is a Medicare benefit provided to homebound individuals who are ill or injured and require intermittent (part-time) skilled nursing services or skilled therapy (CMS, 2017a), serving about 3.7 million beneficiaries and resulting in $18.2 billion in total Medicare payments in 2015 (CMS, 2015). Of the Medicare beneficiaries discharged from post-acute care to use other services, 37.4% are sent home with home health services (Gage, 2009) and 69% of individuals who received formal home care services were over age 65 (NAHC, 2010). Moreover, HF is one of the most common primary diagnoses for home health recipients (NAHC, 2010). However, patients with HF are also at risk of increased re-hospitalization. One intervention that has been shown to assist with reducing this rate is telehealth.

Telehealth is the use of electronic information and telecommunications technologies to support clinicians and patients at a distance (NAHC, 2013) and has the potential to help with monitoring of illness for individuals with chronic disease. Various types of telehealth are under use currently, such as video-consultation, mobile telemonitoring, automated device-based telemonitoring, interactive voice response, and Web-based telemonitoring (Kitsiou, Paré, & Jaana, 2015). Unlike other direct management from health care professionals, self-management helps patients by enabling them to assume the primary role in managing their condition: monitor symptoms, adjust medications and determine when additional medical attention is necessary. In

doing this, telehealth can play a great role particularly in the home setting where frequent and direct access to providers is difficult. For example, in a study with HF patients in home health care, HF patients were asked to measure their weight, blood pressure, heart rate, and oxygen saturation daily using provided monitoring device. Then the data were transtelephonically transmitted via the monitor's modem and patients were telemanaged accordingly. A designated nurse manages the patient by calling the patient to check and provide education or call the physician for further instructions (Bondmass, Bolger, Castro, & Avitall, 2000).

Telehealth has been studied with several chronic diseases in home care, such as HF, diabetes, Asthma/COPD, and hypertension (Polisena, Coyle, Coyle, & McGill, 2009) and has been shown to improve patient outcomes and reduce care costs (Kathryn H. Bowles & Baugh, 2007; Paré, Poba-Nzaou, & Sicotte, 2013). A recent meta-analysis of 15 systematic reviews published between 2003 and 2013 indicated that telehealth reduces HF-related hospital admissions compared to usual care (Kitsiou et al., 2015). In addition, a more recent study reported a significant reduction, from 19.3% to 5.2% in three years, in all-cause 30-day readmission for HF patients using telehealth (O'Connor et al., 2016).

A key factor in the success of telehealth interventions is patient adoption of the technology and its use to assist with monitoring of their symptoms. Given the proven benefits of telehealth as an intervention, it is a concern that the reported initiation or usage rate of telehealth is low. Studies suggest that between 24% and 70% of patients asked to try telehealth refuse the service or discontinue it prematurely (Achelrod, 2014; K. H. Bowles et al., 2011). However, very few studies exist that have explored the reasons why patients may refuse or not-initiate telehealth, and those have small sample sizes and have been unable to fully explain factors that may be associated with patients' initiation of telehealth. These studies suggest that concerns over

technology or equipment, concerns over service change, or ease of use may impact patients' decision making (Demiris, Speedie, & Finkelstein, 2001; Rahimpour, Lovell, Celler, & McCormick, 2008; Sanders et al., 2012). Therefore, it is still unclear what factors may influence whether or not patients with HF decide to accept telehealth services in a home care population; this is important to understand given the current efforts to expand telehealth benefit coverage among Medicare recipients (CMS, 2016).

Significance

The significance of this study lies in its ability to provide information on what factors are associated with and can affect HF patients' decision-making on telehealth initiation upon referral to the service at home. By filling the gap in research, the results of this work can potentially boost HF patients' symptom self-management at home through increased telehealth uptake and tailored interventions. The lack of evidence for related factors of telehealth acceptance creates barriers to more widespread adoption of telehealth services not only among HF patients, but also general home care patients who self-manage their chronic diseases at home. Therefore, this study can provide valuable insights related to the use of telehealth for patients' self-management of their disease within a home care setting.

Aims

The study addressed the following aims:

Aim 1: **To examine the literature on heart failure patients' decision making to accept telehealth services in the home.**

An integrative review was conducted to synthesize existing evidence on factors affecting heart failure patients' decision making to accept telehealth services in the home.

Aim 2: To determine the factors associated with initiation of telehealth services at the point of referral among home care patients with heart failure admitted to a large home care agency.

Hypothesis: Heart failure patients who initiate telehealth services at the point of referral have unique factors such as demographic, disease and activity characteristics compared to patients who did not initiate telehealth.

A retrospective observational study was performed using secondary data analysis. Data from the Outcome and Assessment Information Set (OASIS) initial assessment was analyzed with 2,832 HF patient samples from one of the largest home care services in the New York City area. A multivariable logistic regression model was developed assessing associations between selected variables based on the conceptual framework and statistical significance to telehealth adoption.

Aim 3: **To explore the reasons for telehealth initiation in patients with heart failure admitted to a large home care agency**.

Research question: What factors do heart failure patients feel are important for informing their decision to initiate or not-initiate telehealth services?

Patients' reasons for initiation or non-initiation of telehealth services at the point of referral were examined qualitatively using individual telephone interviews. 20 HF patients who had either adopted or not-adopted telehealth services at initial referral were recruited using purposive sampling. A mixture of deductive and inductive coding was used in data analysis by two researchers. A software program (NVivo) was used to help coding. Several strategies, such as triangulation and member checking, were implemented throughout the research process to enhance procedural rigor.

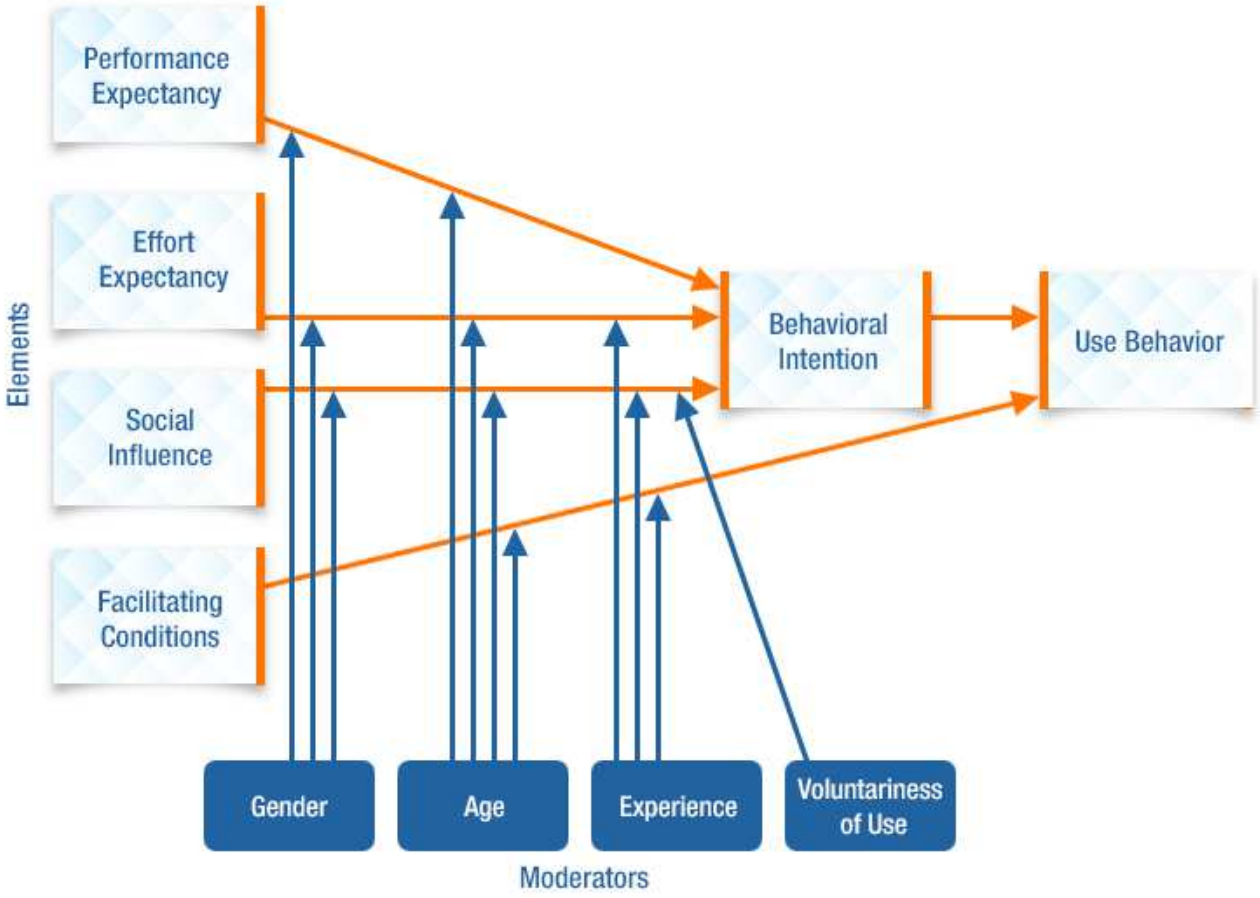
This study addresses the research gap in understanding decision-making factors among HF patients who either initiated or non-initiated telehealth when referred to home health services. Finding from this study will facilitate the development of tailored nursing interventions to assist self-management of HF symptoms at home. Furthermore it will provide important guidance on what are the key factors to address to promote telehealth adoption, which is particularly important given CMS's proposal to expand services eligible for Medicare reimbursement for the fiscal year 2017 to telehealth (CMS, 2016).

Conceptual Framework

The Unified Theory of Acceptance Use of Technology (UTAUT) model was used as a framework for this study. The UTAUT was developed by Venkatesh et al. (2003) to explain user acceptance of technology (Figure 1.1). This model was developed after a review of eight models that were frequently used to explain information systems usage behavior (theory of reasoned action, technology acceptance model, motivational model, theory of planned behavior, a combined theory of planned behavior/technology acceptance model, model of personal computer use, diffusion of innovations theory, and social cognitive theory). The theory identifies four key determinants that explain individuals' acceptance and use of technology; Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), and Facilitating Conditions (FC). Venkatesh, Morris, Davis, and Davis (2003) defined each construct as follows: PE is the degree to which using a technology is expected to help in performing certain activities; EE is the expected degree of ease associated with the use of the technology/system; SI is the degree to which an individual believes that important others think the patient should use the technology/system; FC is the degree to which an individual believes that technical and organizational infrastructure exists to support their use of the technology/system. There also four

moderators that play a role on the relationship between each construct and an individual's behavioral intention to use the technology; Gender, age, experience, and voluntariness of use (Venkatesh et al., 2003).

Figure 1.1 The UTAUT model by Venkatesh et al. (2003)



The UTAUT was used to determine variable selection for inclusion in the analysis in Aim 2 and to guide the interview questions in Aim 3. For Aim 2, the four moderators, including demographics, were analyzed together with a range of factors that may influence the relationship

between each model construct and a patient's behavioral intention to use telehealth. In addition, other potential moderators or confounders were explored such as co-morbidities and functional ability/mental status that can explain patients' capability to use telehealth systems. Factors associated with Effort Expectancy (EE), such as a patient's physical dexterity/function and mental status were included in the model, alongside factors such as resources supporting telehealth use (e.g., family support) to explain Facilitating Conditions (FC) in more detail.

Organization of this Thesis

The three aims were addressed in three separate studies. The first chapter following this introduction contains a report of the first study. Chapters three and four contain the reports from the other two studies. The first paper (Chapter Two: Factors Affecting the Acceptance of Telehealth Services by Heart Failure Patients: An Integrative Review) was published in Telemedicine Journal and E-Health in August 2017. The second paper (Chapter Three: An analysis of factors associated with initiation of telehealth services at the point of referral among home care patients with heart failure admitted to a large home care agency) is currently under review in Home Health Care Services Quarterly. The third paper (Chapter Four: Factors Affecting the Decision-making of Home Care Patients with Heart Failure regarding Initiation of Telehealth Services) is planned for submission in the Journal of Advanced Nursing. The final chapter, Chapter Five, summarizes and discusses the findings from the three papers and makes recommendations for practice, policy, and research.

Chapter Two: Integrative review

Factors Affecting the Acceptance of Telehealth Services by Heart Failure Patients: An Integrative Review

Chapter two will address Aim 1, to examine the literature on heart failure patients' decision making to accept telehealth services in the home. This manuscript was published in Telemedicine Journal and E-health in August 2017.

Abstract

Background: Whilst Telehealth has been shown to improve heart failure patients' health outcomes, patients' acceptance of telehealth at the point of referral is reported to be low. Little is known about the factors related to patients' initial acceptance or refusal of telehealth services. The aim of this review was to synthesize evidence on the factors affecting heart failure patients' decision making to accept telehealth services in a home setting.

Methods: An integrative literature review was conducted. Six electronic databases and three grey literature sites were searched. Two reviewers independently reviewed papers for inclusion. Papers were included if they reported original data related to the acceptance of telehealth services among heart failure patients at home.

Results: Five studies met the inclusion criteria and were included in the review. Key findings indicated that patients generally hold positive views about telehealth. Factors that may affect the adoption of telehealth include concerns over equipment or technology, concerns over service change, ease of use, knowledge of the benefits of telehealth, access to care, cost, and privacy.

Conclusion: Despite evidence of effectiveness for telehealth, there is a high rate of telehealth refusal among patients. Understanding factors associated with heart failure patients' decisions regarding telehealth can help health care organizations structure education programs and other interventions to improve acceptance rates.

Key words: *Telehealth acceptance, Heart failure, Patients' decision-making, home health care*

Introduction

Heart failure (HF) affects about 5.7 million adults in the USA, costing the nation an estimated $30.7 billion each year and contributed to one in 9 deaths in 2009 (DHDSP, 2016). About half of people who develop heart failure die within 5 years of diagnosis (DHDSP, 2016), with HF–related deaths on the rise since 2012 (NCHS, 2015). Early diagnosis and treatment can improve the quality and length of life for people who have heart failure (DHDSP, 2016). Home health care has been increasingly used to bridge the gap between acute care settings and the home thus alleviating the patient care burden and assisting with disease self-management. Of the Medicare beneficiaries discharged from post-acute care to use other services, 37.4% are sent home with home health services (Gage, 2009). HF is one of the most common primary diagnoses for home health recipients (NAHC, 2010). However, patients with HF are also at risk of increased re-hospitalization. One intervention that has been shown to assist in reducing this rate is telehealth.

Telehealth is the use of electronic information and telecommunications technologies to support clinicians and patients at a distance (NAHC, 2013). Telehealth has the potential to help monitor the illness of individuals with chronic disease and has been studied in patients with several chronic diseases managed at home, such as heart failure, diabetes, asthma/ Chronic Obstructive Pulmonary Disorder (COPD), and hypertension (Polisena et al., 2009). The use of telehealth has been shown to improve patient outcomes and reduce care costs (Kathryn H. Bowles & Baugh, 2007; Paré et al., 2013). A recent meta-analysis of 15 systematic reviews published between 2003 and 2013 indicates that telehealth reduces HF-related hospital admissions compared to usual care (Kitsiou et al., 2015). In addition, a more recent study reports

a significant reduction, from 19.3% to 5.2% in three years, in all-cause 30-day readmissions for HF patients using telehealth (O'Connor et al., 2016).

A key factor in the success of telehealth interventions is patient acceptance of the technology and its use in monitoring symptoms. Given the proven benefits of telehealth as an intervention, the low reported acceptance or usage rate of telehealth raises a concern. One review of telehealth studies summarizing multiple trials reports that up to 70% of patients asked to try telehealth refused to participate or prematurely discontinue utilization (Achelrod, 2014). However, few studies have examined the reasons for acceptance or refusal of telehealth, especially among HF patients who need daily symptom management at home. Research addressing this question is important given the current efforts to expand telehealth benefit coverage among Medicare recipients (CMS, 2016).

The purpose of this integrative review was to synthesize the evidence from studies that have explored HF patients' decision making to accept telehealth services in the home.

Methods

The review followed the five stage integrative review process described by Whittemore and Knafl (2005): (1) problem identification, (2) literature search, (3) data evaluation, (4) data analysis, and (5) presentation.

Search

Six electronic databases (Medline, CINAHL, Cochrane Library, Embase, Scopus, and Web of Science) and three grey literature databases (OpenGrey, The Grey Literature Report, and ClinicalTrials.gov) were searched using both medical subject headings (MeSH terms) and key words (Table 2.1). Studies that were published in English after the year after 2000 were included in the review. This date threshold was set in recognition of the technological limitations prior to

that time (Brewster, Mountain, Wessels, Kelly, & Hawley, 2014). Reference list and citation searching were used to identify further articles.

Table 2.1 Search terms and structure

#1	Telehealth or "telemedicine" or telecare or telemonitor*
#2	"Heart Failure" or congestive heart failure
#3	#1 AND #2
#4	"Patient acceptance of health care" or patient acceptance of technology or "attitude to computers" or "attitude to health" or "decision making" or "patient participation" or "behavior" or "health behavior"
#5	#3 AND #4
#6	Limit #5 to English language
#7	Limit #6 to 2000-current

MeSH terms in inverted commas: wildcard operators represented by *.

Study Selection

Inclusion criteria: Studies reporting original data related to the acceptance of telehealth among HF patients in home care.

Exclusion criteria: Studies only using telephonic interventions (which were not considered to be telehealth), studies conducted in settings outside the home setting (e.g. hospital or primary care physician offices) or not with HF patients as part of the sample were excluded.

Two researchers independently screened titles and abstracts to identify articles that potentially met the inclusion criteria. Full text articles that were potentially relevant for the review were retrieved and reviewed independently by two authors with articles selected for final review selected by consensus.

Quality Assessment of Included Studies

Due to the variety of methods used in the included studies, the Mixed Methods Appraisal Tool (MMAT) (Pluye et al., 2011) was used to assess the quality of included studies.

Data Analysis

A constant comparison method was used to group and sub-group the extracted data by themes (Whittemore & Knafl, 2005). This approach to data analysis for the integrative review is compatible with research using a variety of data and diverse methodologies for not only qualitative but also quantitative or mixed method studies, as the approach allows for interactive comparisons across primary data sources (Whittemore & Knafl, 2005). To facilitate analysis, data were extracted from the studies and placed into an evidence table. Next the data were compared item-by-item and similar data were categorized and grouped together.

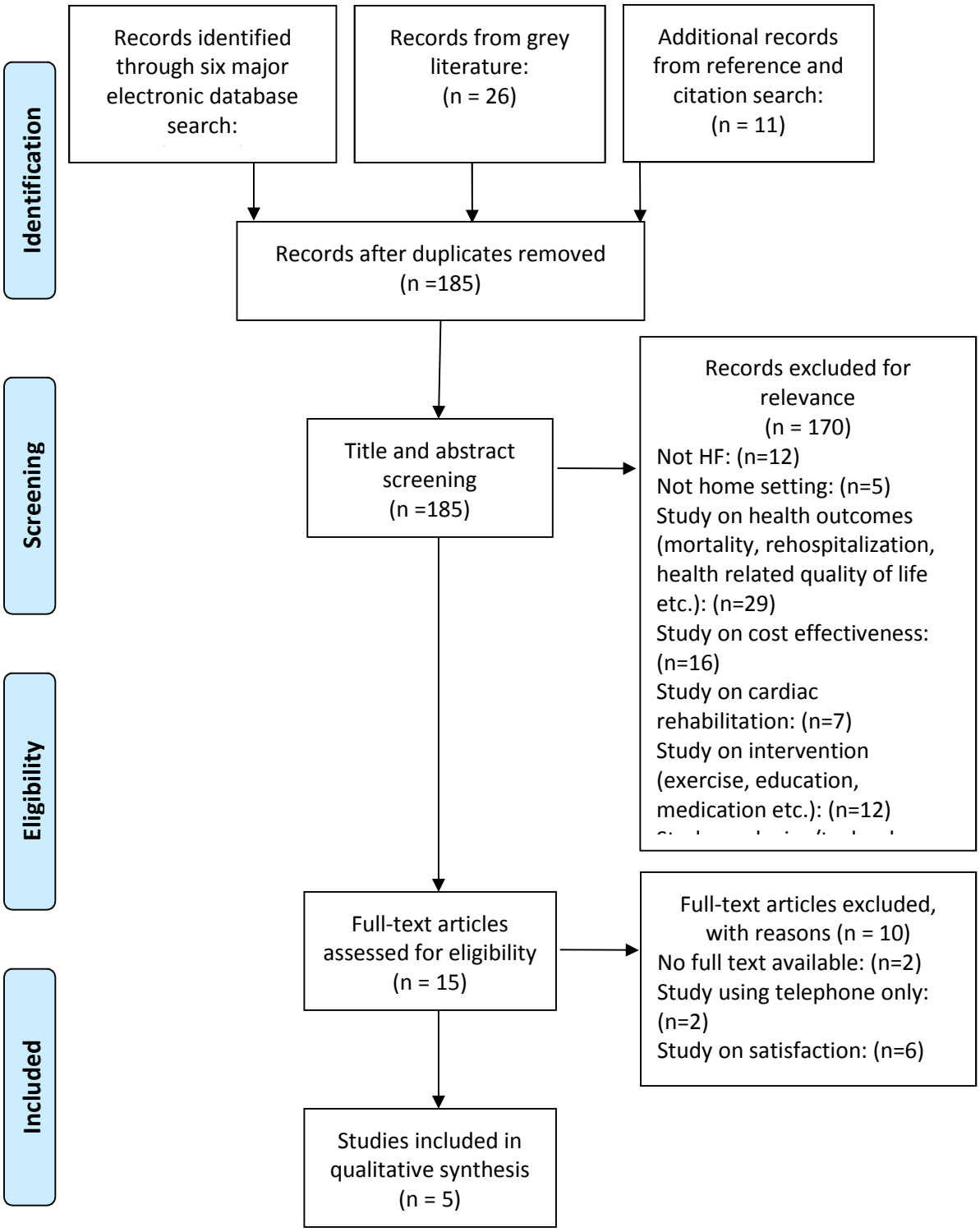
Results

The initial search yielded 208 articles. After duplicates were removed 185 remained for title and abstract screening. After screening and full text review 5 studies were included in the final review (Fig. 2.1).

Study Characteristics

Two studies were qualitative using individual interviews and focus groups (Rahimpour et al., 2008; Sanders et al., 2012). Another study was a part of a randomized control trial and used questionnaires to measure perceptions of telehealth (Demiris et al., 2001) and the remaining two studies used mixed methods (Hall et al., 2014; Seto et al., 2010).

Figure 2.1 PRISMA Flow diagram



Sampling Method

Two of the included studies were conducted in the USA (Demiris et al., 2001; Hall et al., 2014) and the others were carried out in Australia (Rahimpour et al., 2008), the United Kingdom (Sanders et al., 2012), and Canada (Seto et al., 2010). Except for one study, the HF diagnosis of all the participants were identified through various ways, such as checking the medical records of the participants or by clinician verification of the patients' HF diagnoses. Although participants were primarily recruited from hospitals, cardiology clinics, and community groups, one study used patients' self-reported HF diagnosis (Hall et al., 2014). One study purposely recruited participants from different ethnic groups to reflect the diverse ethnic backgrounds of the study area in Australia (Rahimpour et al., 2008). Two studies focused on patients with HF only and three used patients with mixed chronic conditions (COPD, diabetes, and wound care). These three studies did not provide findings for HF patients separately; so the results of these studies were analyzed together and compared to studies that reported findings from HF patients only.

Sample Characteristics

The average age of the patients included in the studies ranged from 54.6 to 74.3, with the majority of participants being male and white (Hall et al., 2014; Sanders et al., 2012; Seto et al., 2010). Two studies reported the education level of their sample, with 49% to 60% of participants reporting some college level education (Hall et al., 2014; Seto et al., 2010). One study also analyzed the chronic condition status of participants in addition to their HF, and reported hypertension as having the highest comorbidity at 73.3%, followed by coronary artery disease (26.7%) and diabetes (20%) (Hall et al., 2014).

Quality of Included Studies

Overall, the quality of qualitative studies (Rahimpour et al., 2008; Sanders et al., 2012) was good meeting 3 out of 4 criteria (Table 2.2). However, the quality of the mixed methods (Hall et al., 2014; Seto et al., 2010) and RCT (Demiris et al., 2001) studies were low meeting 1 out of 4 criteria.

The two mixed method studies (Hall et al., 2014; Seto et al., 2010) showed weaknesses in different design categories. The study by Hall et al. (2014) had weaknesses associated with clarity in sampling strategies and appropriateness of measurements used for the quantitative element of the study. In contrast, the study by Seto et al.(2010) was judged to be weak in the qualitative component of the study, failing to adequately describe how findings related to the context or researchers' influence.

For the RCT both the original study (Finkelstein et al., 2004) and the included article, which was a part of the RCT study that used questionnaires to analyze HF patients' perception of telehealth (Demiris et al., 2001) were appraised. In both papers, authors failed to provide adequate details about domains of study design such as sequence generation and allocation concealment. In addition it reported a drop out rate of 22%.

Table 2.2 Quality appraisal results of all included studies using MMAT

Author (Year)	Components	Quality criteria	Yes	No	Can't tell
Seto (2010)	Qualitative	1.1. Are the sources of qualitative data (archives, documents, informants, observations) relevant to address the research question (objective)?	X		
		1.2 Is the process for analyzing qualitative data relevant to address the research question (objective)?		X	
		1.3. Is appropriate consideration given to how findings relate to the context, e.g., the setting, in which the data were collected?			X
		1.4. Is appropriate consideration given to how findings relate to researchers' influence, e.g., through their interactions with participants?			X
	Quantitative descriptive	4.1. Is the sampling strategy relevant to address the quantitative research question (quantitative aspect of the mixed methods question)?	X		
		4.2. Is the sample representative of the population understudy?	X		
		4.3. Are measurements appropriate (clear origin, or validity known, or standard instrument)?		X	
		4.4. Is there an acceptable response rate (60% or above)?	X		
	Mixed methods	5.1. Is the mixed methods research design relevant to address the qualitative and quantitative research questions (or objectives), or the qualitative and quantitative aspects of the mixed methods question (or objective)?	X		
		5.2. Is the integration of qualitative and quantitative data (or results*) relevant to address the research question (objective)?		X	
		5.3. Is appropriate consideration given to the limitations associated with this integration, e.g., the divergence of qualitative and quantitative data (or results*) in a triangulation design?		X	

Hall (2014)	Qualitative	1.1. Are the sources of qualitative data (archives, documents, informants, observations) relevant to address the research question (objective)?	X		
		1.2 Is the process for analyzing qualitative data relevant to address the research question (objective)?	X		
		1.3. Is appropriate consideration given to how findings relate to the context, e.g., the setting, in which the data were collected?	X		
		1.4. Is appropriate consideration given to how findings relate to researchers' influence, e.g., through their interactions with participants?		X	
	Quantitative descriptive	4.1. Is the sampling strategy relevant to address the quantitative research question (quantitative aspect of the mixed methods question)?		X	
		4.2. Is the sample representative of the population understudy?		X	
		4.3. Are measurements appropriate (clear origin, or validity known, or standard instrument)?		X	
		4.4. Is there an acceptable response rate (60% or above)?	X		
	Mixed methods	5.1. Is the mixed methods research design relevant to address the qualitative and quantitative research questions (or objectives), or the qualitative and quantitative aspects of the mixed methods question (or objective)?		X	
		5.2. Is the integration of qualitative and quantitative data (or results*) relevant to address the research question (objective)?	X		
		5.3. Is appropriate consideration given to the limitations associated with this integration, e.g., the divergence of qualitative and quantitative data (or results*) in a triangulation design?		X	

Rahimpour (2008)	Qualitative	1.1. Are the sources of qualitative data (archives, documents, informants, observations) relevant to address the research question (objective)?	X		
		1.2 Is the process for analyzing qualitative data relevant to address the research question (objective)?	X		
		1.3. Is appropriate consideration given to how findings relate to the context, e.g., the setting, in which the data were collected?	X		
		1.4. Is appropriate consideration given to how findings relate to researchers' influence, e.g., through their interactions with participants?		X	
Sanders (2012)	Qualitative	1.1. Are the sources of qualitative data (archives, documents, informants, observations) relevant to address the research question (objective)?	X		
		1.2 Is the process for analyzing qualitative data relevant to address the research question (objective)?	X		
		1.3. Is appropriate consideration given to how findings relate to the context, e.g., the setting, in which the data were collected?	X		
		1.4. Is appropriate consideration given to how findings relate to researchers' influence, e.g., through their interactions with participants?		X	
Demiris (2001)	Quantitative randomized controlled (trials)	2.1. Is there a clear description of the randomization (or an appropriate sequence generation)?		X	
		2.2. Is there a clear description of the allocation concealment (or blinding when applicable)?		X	
		2.3. Are there complete outcome data (80% or above)?	X		
		2.4. Is there low withdrawal/drop-out (below 20%)?		X	

Factors Related to Patient Telehealth Acceptance

Overall, four out of the five included studies reported positive patient attitudes toward the use of telehealth (Demiris et al., 2001; Hall et al., 2014; Rahimpour et al., 2008; Seto et al., 2010). Regardless of study population (whether with HF only patients or with mixed chronic conditions) the themes derived from a synthesis of study findings related to decision making regarding acceptance of telehealth were the same and are therefore reported together. Common factors arising from the synthesis were: concerns over equipment or technology, concerns over service change, ease of use, access to care, knowledge of telehealth and its benefits, cost, and privacy (Table 2.3 and 2.4).

Concerns over equipment or technology. Most studies addressed patients' concerns over operating the equipment itself or potential issues with technology. This theme was divided into two sub-themes according to whether the concerns were related more to the features of the device or to the abilities of the patient. Concerns identified regarding the device or technology itself encompassed device malfunction or issues with access to the device or services. Demiris et al. (2001) reported that several telehealth eligible candidates refused to participate because of concerns over the equipment. Sanders et al. (2012) also found that technological aspects of the equipment were a primary concern expressed by patients, which was not mitigated by explanations from healthcare providers. Additionally patients also expressed concerns regarding inappropriate automated instructions from the telehealth device that might cause unnecessary ER visits in another study (Seto et al., 2010). Issues involving access to technology such as mode of connection to internet was also mentioned as a concern related to telehealth use (Hall et al., 2014).

Concerns associated more with the patients were more complex and related to low self-efficacy, anxiety or technical competency. In a study by Rahimpour et al. (2008), patients expressed low levels of confidence in using telehealth, although they thought they could use the system (direct quotes are displayed in table 2.4). Hall et al. (2014) also indicated low computer-use self-efficacy as a barrier to telehealth use. Both studies also reported patient anxiety, with one more specifically finding that patients perceive telehealth as a computer and expressed their computer anxiety (Rahimpour et al., 2008). Technical competency was another barrier identified in the studies. Those patients who expressed lack of technical competency tended to indicate their estrangement from modern technologies and cite generational differences to explain diverging levels of technical abilities (Sanders et al., 2012).

Concerns over service change. Satisfaction with other current services was also identified as a barrier to telehealth use in some studies (Hall et al., 2014; Sanders et al., 2012; Seto et al., 2010). Adding telehealth to current services was regarded as a threat to relationships with existing health care providers (Hall et al., 2014; Sanders et al., 2012) or patients had concerns about creating an excessive burden for their clinicians by using telehealth (Seto et al., 2010). Patient preference for maintaining their daily routines without disruption was also identified as a barrier to acceptance of telehealth in their HF management.

Ease of use. For ease of use, user-friendly interfaces and physical dexterity were mentioned as device- and patient-centered factors respectively (Demiris et al., 2001; Seto et al., 2010). Patients' motor skills and vision can be a barrier to telehealth acceptance. Patients with limited physical dexterity cannot use the telehealth device properly without someone's help at home. Hand tremors or limited vision were examples of physical constraints that can affect

patients' acceptance of telehealth. However, help from outside or a user-friendly interface can address these concerns. If the patients live with a family member or formal caregiver who can assist them in using the telehealth device, the physical limitation was no longer an issue.

Knowledge of telehealth and its benefits. Three studies mentioned that having knowledge of telehealth and its benefits facilitates telehealth acceptance among HF patients (Demiris et al., 2001; Rahimpour et al., 2008; Seto et al., 2010). Having used telehealth previously or hearing of it before being referred to telehealth seems to increase acceptance. A pre- and post- telehealth use study by Demiris et al. (2001) reported that the experience with telehealth leads to change of perception in more positive way. The potential benefits of telehealth perceived by patients were increased access to care, earlier indication of a worsening condition (in other words monitoring conditions well), increased knowledge, saving both nurses' and patients' time, and greater convenience Hall et al. (2014). Regardless of whether these benefits are proven to the patients or not, awareness itself of the potential benefits of telehealth can be a facilitator for increased acceptance of telehealth.

Access to care. Positive perceptions of telehealth in regards to access to service or care was displayed in two studies (Demiris et al., 2001; Hall et al., 2014). Patients expressed expectations that the use of telehealth will make it easier to contact nurses, therefore increasing access to care they needed. However, in the same study, Hall et al. (2014) also reported concerns over access to care due to issues involving access to technology.

Cost. Cost was mentioned in three studies (Demiris et al., 2001; Hall et al., 2014; Rahimpour et al., 2008). Demiris et al. (2001) reported that most patients believed telehealth would reduce care cost whereas the other two studies (Hall et al., 2014; Rahimpour et al., 2008)

expressed cost as a concern to patients. Costs associated with telehealth include technical and clinical maintenance support expenses and the price of the device itself.

Privacy. Seto et al. (2010) reported that in general, patients did not have major security concerns about using the monitoring system as long as reasonable measures were taken to protect the confidentiality of their information. However, Demiris et al. (2001) reported that from their pre-test before using telehealth, about 50% patients in the control group and 40% in the experimental group agreed that use of telehealth can violate their privacy.

Table 2.3 Summary table of included studies

First author	Year	Country	Study design	Sample	Disease conditions	Types of telehealth used	Key findings
Demiris	2001	USA	RCT	28 patients: 17 in experimental group, 11 in control: eligible for skilled nursing home care with primary or secondary diagnosis of one of the three clinical areas of interest	CHF, COPD, chronic wound-care	BP, pulse oximeter, spirometer, electronic diary using television, telephone, and web page	Most positive attitude toward telehealth use: saving time for nurses and patients, convenient, monitor condition well, easier contact to nurse, addition to regular care, reduce cost. Concern over privacy, difficulty to use, and device malfunction
Hall	2014	USA	Mixed method (Individual interviews and questionnaires)	15 patients: adult HF patients recruited from hospitals, cardiology clinics, and community groups	CHF	Home monitoring devices (ex. BP machine, weight scale)	Increased access to care, earlier indication of a worsening condition, increased knowledge, and greater convenience; financial cost, access issues, satisfaction with current self-care routine, mistrust of technology, and reliance on routine management by their current healthcare provider
Rahimpour	2008	Australia	Qualitative (focus groups)	77 patients :over 40 years old; primary diagnosis of CHF, class II to IV of NYHA, or COPD, or both	CHF, COPD	Weight, BP, ECG, Spirometer, pulse oximeter	Cost, ease of use, clinical support, low self-efficacy and anxiety

First author	Year	Country	Study design	Sample	Disease conditions	Types of telehealth used	Key findings
Sanders	2012	UK	Qualitative (Individual interviews)	22 patients who refused telehealth trial: recruited from the three areas (Cornwall, Kent, east London)	HF, DM, COPD	BP, blood glucose, blood oxygen level, weight, peak flow	Requirements for technical competence and operation of equipment; threats to identity, independence and self-care; expectations and experiences of disruption to services
Seto	2010	Canada	Mixed method (Individual interviews and questionnaires)	94 patients with questionnaires, 20 with interview: older than 18 years, not being on the heart transplantation list, and being expected to survive more than 1 year	HF	Weight, BP, ECG using Mobile phone	Providing a system that was easy to use with clear tangible benefits, maintaining good patient-provider communication; difficulty of use for some patients due to lack of visual acuity or manual dexterity, overburden to clinicians, inappropriate automated instructions, security/privacy

Table 2.4 Data analysis table

Common factors	Origin (patient vs. device)	Details including "quotes" (author, year)
Concern over the equipment or technology	Device-centered	Device malfunction (Demiris, 2001; Sanders, 2012; Seto, 2010)
		Access to device or service (Demiris, 2001: Sanders, 2012; Seto, 2010)
	Patient-centered	Low self-efficacy and anxiety (Hall, 2014) " ...we need to know how to operate it..." or " ...I couldn't even turn it on.... I am at this stage of my life where I am not going to learn it... I think it is impossible for older people to understand how the system works...." (Rahimpour et al., 2008)
		Technical competency "... younger people obviously that are computer wise..." (Sanders et al., 2012)
Concerns over change to current services		Satisfaction with current services (self-care or physician) (Hall, 2014; Sanders, 2012)
		Overburden to clinicians (Seto, 2010)
Ease of use	Patient-centered	Physical dexterity (Seto, 2010)
	Device-centered	User friendly interface (Demiris, 2001)
Knowledge		Knowledge about telehealth (Demiris, 2001; Hall, 2014; Rahimpour, 2008; Seto, 2010)
		Knowledge about telehealth benefits: convenience, saving time, motor symptoms well (Demiris, 2001; Hall, 2014; Rahimpour, 2008; Seto, 2010)
Access to care		Easier to contact nurses (Demiris, 2001; Hall, 2014)
		Access to device (Demiris, 2001; Hall, 2014)
Privacy/Security		Reasonable measures will be taken (Seto, 2010)
		Violation of privacy (Demiris, 2001)
Cost		Device price (Hall, 2014; Rahimpour, 2008)
		Maintenance, care cost (Demiris, 2001;Rahimpour, 2008)

Discussion

The results of this review indicate that most HF patients have positive attitudes towards home use of telehealth and there are some key factors that affect their decision making on accepting or refusing telehealth services at home. These factors include concerns over the equipment or technology, concerns over service change, ease of use, access to care, knowledge of telehealth and its benefits, cost, and privacy. The factors affecting patients' decision making regarding acceptance or refusal of telehealth were consistent irrespective of patient diagnosis.

A number of studies have explored patients' satisfaction with telehealth after they have actually used the technology, rather than reasons for initial acceptance/refusal (as discussed in this paper). A study with HF and COPD patients who enrolled in telehealth service revealed that motivation, security, relevancy of content, and communication are major factors related to patients' participation in telehealth (Hunting et al., 2015). Another study examining HF and arrhythmia patients identified security, freedom and increased awareness of their own symptoms as factors that affected patients' telehealth adoption (Dinesen, Nohr, Andersen, Sejersen, & Toft, 2008). Although there appear to be common factors from these studies that also impact on patients' initial decisions to accept or refuse telehealth services such as security, other factors such as relevancy of content (for example, the advice given daily while using telehealth) were only identified by studies exploring views after telehealth has been used. This suggests that there are specific issues that need to be addressed by staff at the point of referral that may not be identified if we only rely on evidence from studies exploring successful telehealth users.

Understanding factors affecting HF patients' acceptance of telehealth can be considered as relevant to the broader field of technology acceptance. According to the Unified Theory of Acceptance and Use of Technology (UTAUT) developed by Venkatesh et al. (2003), four major

concepts play a role in user's behavioral intention to use technology. Among these four concepts, Performance Expectancy (PE) includes constructs of perceived usefulness and relative advantage; both factors that are related to knowledge on telehealth benefits which affects patients' telehealth acceptance. In addition, another concept, Effort Expectancy (EE), is defined as 'the degree of ease associated with the use of the system' and directly linked to ease of use factors in the results of this review. Whilst the UTAUT can provide some theoretical underpinnings to explain patient's acceptance or refusal to accept telehealth, we have identified unique factors (concerns over changes to current services and privacy) that specifically relate to this specific decision.

Future research could explore telehealth acceptance more broadly across healthcare consumers. To our knowledge this is the first integrative review to focus on telehealth acceptance; so factors influencing decisions on telehealth across all patients with different diagnoses or particular disease groups is lacking. Extending the patient population to other chronic diseases, in order to identify if there are unique characteristics associated with HF patients decision-making surrounding telehealth could also provide additional insights. Finally, future reviews that examine studies of patients with specific disease conditions other than heart failure could also provide valuable insights as the high patient refusal identified in our review may be related to disease complexity as well as severity.

Limitations

The findings in this review are based on relatively few studies and the quality of several of the included studies was poor. Only five papers met all the inclusion criteria and although all five had common factors related to patients' decision making of telehealth acceptance, the

limited number of articles, together with the overall study quality means the results have to be treated with caution.

Conclusions

Despite evidence of effectiveness for telehealth, up to 70% of patients are reported to refuse telehealth services (Achelrod, 2014). Given the Centers for Medicare and Medicaid Services (CMS)'s proposal to expand services eligible for Medicare reimbursement for the fiscal year 2017 to telehealth (CMS, 2016), understanding factors associated with HF patients' decisions on acceptance is important. This review highlights the limitations in our current understanding of the factors that may impact a patients' decision to accept or refuse telehealth on initial referral. Further studies with a more rigorous methodological approach, with larger samples of HF patients would help to develop interventions to improve telehealth acceptance rates in the patient populations that may benefit from the service.

Chapter Three: Quantitative study

An analysis of factors associated with acceptance or refusal of telehealth services at the point of referral among home care patients with heart failure admitted to a large home care agency.

Chapter three will address Aim 2, to determine factors associated with acceptance or refusal of telehealth services at the point of referral among home care patients with heart failure admitted to a large home care agency. This aim was completed through a retrospective observational study using a secondary data analysis. This manuscript has been submitted and is currently under review in t Home Health Care Services Quarterly.

Abstract

Background

Heart failure (HF) affects 5.7 million adults in USA and HF-related deaths are increasing. Telehealth is one intervention that can assist mostly older and frail home care patients with HF to manage their symptoms at home and has been shown to reduce re-hospitalizations. However, it has been reported that between 24-70% of eligible patients do not receive telehealth services.

Objective

To explore patient related factors associated with initiation of telehealth services among home care patients with HF.

Methods

A cohort study using the Outcome and Assessment Information Set (OASIS) data of eligible adult patients with HF (N = 2,832) initially referred for telehealth services from April 2016-March 2017 from a large not-for-profit homecare agency in the Northeast USA. A modified Unified Theory of Acceptance Use of Technology (UTAUT) model was used to guide the study. Data were analyzed using multivariable logistic regression to examine factors associated with telehealth initiation.

Results

Patients who received education related to high-risk drugs (e.g. anticoagulants) by the visiting nurse had an 80% increase in the odds of receiving telehealth (OR 1.80 95% CI: [1.03-3.16]) compared to those without education, and patients who received no assistance from caregivers had a 46% decrease in the odds compared to those who were assisted at least daily (OR: 0.54 95% CI: [0.32-0.91]).

Conclusions

This study highlights factors that are associated with whether or not telehealth is initiated when a HF patient is referred to the program. Knowledge of such associations can inform referral processes and care planning to improve the efficiency and utilization of telehealth services.

Key words: *heart failure, home care, telemedicine, self-care, decision making*

Introduction

Heart failure (HF) is one of the most common diagnoses among Medicare home health care recipients. According to the 2012 statistics from Centers for Medicare and Medicaid Services (CMS), diseases of the circulatory system (Major Diagnostic Classifications 7) was the most frequent diagnosis in home care patients and HF was the number one with 7.5 % (about 0.3 million) of patients diagnosed within the circulatory diseases. As a single diagnosis, HF was the second most common diagnosis among home health care patients after diabetes with a rate of 9.5% (CMS, 2013).

Ensuring that patients with HF are able to manage their symptoms can reduce readmissions and improve a patient's quality of life (Jovicic et al., 2006; Koelling, Johnson, Cody, & Aaronson, 2005; Musekamp et al., 2017; Tung et al., 2013). The American Heart Association recommends providing education on self-management to all HF patients on discharge from hospital, as the self-care regimen is complex and multifaceted (Yancy et al., 2013). When self-management is adequately performed the readmission rates for patients with HF are reduced by 56% (pooled data from three studies with total of 381 HF patients at 3 months, 6 months, and 1 year periods) (Jovicic et al., 2006). Particularly in persons aged 65 and older, cardiovascular disease (including HF) risk factors and disorders predict and account for the greatest causes of mortality and loss of function (Applegate & Ouslander, 2017).

Home health care has been increasingly used to bridge the gap between acute care settings and the home to alleviate patients' care burden and assist with disease self-management. Of the Medicare beneficiaries discharged from post-acute care to use other services, 37.4% are sent home with home health services (Gage, 2009) and 69% of 7.2 million individuals who received formal home care services in 2000 were over age 65 (NAHC, 2010). Moreover, HF is

one of the most common primary diagnoses for home health recipients (NAHC, 2010). However, patients with HF are also at risk of increased re-hospitalization. Diverse strategies adopted to assist HF patient's self-management include providing educational programs, setting self-management guidelines for patients, and mailing out education materials to encourage self-management (McAlister et al., 2004). One intervention that has been shown to assist with reducing this rate is telehealth.

Telehealth is the use of electronic information and telecommunications technologies to support clinicians and patients at a distance (NAHC, 2013) and has the potential to help with monitoring of illness for individuals with chronic diseases. The use of telehealth has been shown to improve patient outcomes and reduce care costs (Kathryn H. Bowles & Baugh, 2007; Paré et al., 2013). A meta-analysis of 15 systematic reviews indicated that telehealth reduces HF-related hospital admissions compared to usual care (Kitsiou et al., 2015). In addition significant reductions in all-cause 30-day readmission for HF patients using telehealth have been reported, from 19.3% to 5.2% in three years, (O'Connor et al., 2016). However, 24-70% of eligible patients do not receive telehealth (Achelrod, 2014). As one of the critical factors of telehealth interventions is patient acceptance and initiation of the technology, identifying the factors that influence eligible patients' initiation of telehealth services is crucial.

The purpose of this study was to explore patient related factors associated with initiation of telehealth services in HF patients' receiving home health services. The study addressed the following research question: what patient related factors (e.g. socio-demographic, functional, mental, and disease characteristics) are associated with initiation of telehealth services at the point of referral among home care patients with HF?

Methods

Conceptual Framework

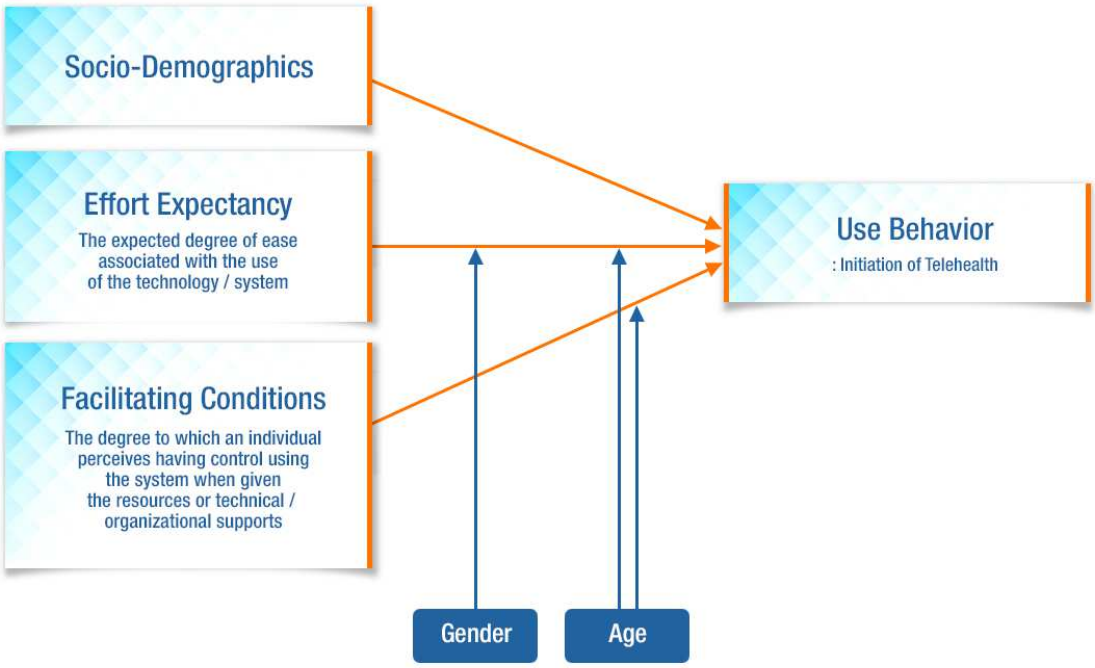
A modified Unified Theory of Acceptance Use of Technology (UTAUT) model was used as a framework for this study (Figure 3.1). The UTAUT was developed by Venkatesh et al. (2003) to explain user acceptance of technology(Venkatesh et al., 2003). The theory identifies four key determinants that explain individuals' acceptance and use of technology; Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), and Facilitating Conditions (FC). Each construct is defined as follows:

- PE is the degree to which using a technology is expected to help in performing certain activities;
- EE is the expected degree of ease associated with the use of the technology/system;
- SI is the degree to which an individual believes that important others think the patient should use the technology/system;
- FC is the degree to which an individual perceives having control using the system when given the resources or technical/organizational supports.

There are four moderators that play a role on the relationship between each construct and an individual's behavioral intention to use the technology; gender, age, experience, and voluntariness of use (Venkatesh et al., 2003). This study is part of a mixed-method study exploring technology (telehealth) acceptance among patients. Thus the choice of UTAUT is considered the best option. However, due to data limitations, we were only able to analyze two main constructs and two moderators of the model. For this study we examined EE and FC; categorizing patient's sensory and neuro/emotional/behavioral status as EE and caregiver support

and functional status as FC. Age and gender were tested as moderators and initiation of the technology were measured as the outcome 'use behavior'.

Figure 3.1. A modified UTAUT model



Study Design

A cohort study of adult patients (N = 2,832) with a diagnosis of HF (primary or secondary) referred for telehealth services in the period April 2016-March 2017, from one of the largest not-for-profit home care agencies in the US. The organization serves an ethnically diverse patient population across the 5 boroughs of New York City and Nassau, Suffolk, and Westchester counties. It currently has a Bundled Payment for Care Improvement (BPCI) program for patients with HF and heart attack. Patients eligible for the program receive care from trained Population Care Coordinators over a 90-day period post discharge from hospital.

Eligible patients in the program are also referred for telehealth services to assist with the self-monitoring of their condition.

Data Source

The Outcome and Assessment Information Set (OASIS-C) was used for all patients referred for telehealth services. OASIS is the standardized home healthcare assessment dataset for home care recipients mandated by Centers for Medicare and Medicaid Services to be used for Medicare-certified home health agencies since 1999 (NAHC, 2010) and the OASIS-C version was introduced in 2010 (CMS, 2017b). It is a comprehensive data set designed to collect information on nearly 100 items related to a patient's demographic information, clinical status, functional status, and service needs. Overall reliability of the data collected using OASIS is good and it has been used successfully in a number of studies of home care (Kang, McHugh, Chittams, & Bowles, 2016; O'Connor & Davitt, 2012). The OASIS admission data for all eligible patients were used for analysis.

Power analysis. Sample size was based on the following assumptions: a two-sided x^2 test with α less than or equal to 0.05; a 30 percent baseline probability of event (telehealth initiation rate in HF patients); and the percentage difference between female and male patients in telehealth initiation (4 percent) (Foster et al., 2015). A sample of 1021 subjects would achieve 80 percent power. The projected sample size for this study was over 2,800 subjects, thus it was anticipated that the study would have adequate power to detect a significant deviation in telehealth initiation. G*power statistical software were used to calculate power and sample size (Faul, Erdfelder, Lang, & Buchner, 2007).

Measures

Independent variables. Initially 44 variables from the OASIS that were consistent with the UTAUT model were selected (Table 3.1). One additional item, language, in the socio-demographic domain that was not assessed in OASIS was added from the specific data collected for the organization. After operationalization of sub-variables from the items selected for analysis, a total of 63 variables - 5 from socio-demographic, 13 from EE, and 45 from FC- were analyzed for the association with telehealth initiation. In each variable, categories with small cell number ($n \leq 20$) were combined to an adjacent category for an accurate estimation.

Telehealth initiation outcomes. Telehealth initiation or non-receipt of telehealth was the binary outcome variable in this study.

Data Analysis

Descriptive statistics were performed to examine sample characteristics. Bivariate analyses were conducted for all variables with the outcome variable (telehealth initiation) and correlates with $p \leq 0.25$ were entered into a pre category model. A multivariable logistic regression analysis was conducted based on the UTAUT framework for each category (Demographics, EE, and FC) to analyze the association between independent variables and telehealth use. The variables that had a p value less than 0.05 in relationship with the outcome variable were selected for the final multivariable logistic regression model. Covariates in each stage of model building as well as the final model were checked for collinearity using a variance inflation factor. The Hosmer–Lemeshow test was used to examine the goodness- of-fit of models. Stata 14 software was used for all analyses.

Table 3.1. OASIS items incorporated in analysis (organized according to UTAUT framework)

1. SOCIO-DEMOGRAPHICS INCLUDING GENDER AND AGE

OASIS Item cat.	OASIS Item No.	Title	Type
Patient Tracking	M0066	Age	Continuous
	M0069	Gender	Binary
	M0140	Race/Ethnicity	Binary
	M0150	Current Payment Sources	Binary
Special items		Language	Binary

2. EFFORT EXPECTANCY

OASIS Item cat.	OASIS Item No.	Title	Type
Sensory Status	M1200	Vision	Categorical
	M1210	Ability to Hear	Categorical
	M1220	Understanding of Verbal Content	Categorical
	M1230	Speech and Oral Expression of Language	Categorical
	M1240	Pain Assessment done	Categorical
	M1242	Frequency of Pain	Categorical
Neuro/Emotional/ Behavioral Status	M1700	Cognitive Function	Categorical
	M1710	When confused	Categorical
	M1720	When Anxious	Categorical
	M1730	Depression screening (PHQ-2)	Categorical
	M1740	Cognitive, behavioral, and psychiatric symptoms	Binary
	M1745	Frequency of Disruptive Behavior	Categorical
	M1750	Psychiatric Nursing Service	Binary

3. FACILITATING CONDITIONS

OASIS Item cat.	OASIS Item No.	Title	Type
Living Arrangements	M1100	Patient Living Situation	Categorical
Care Management	M2102	Types and Sources of Assistance	
	M2102a	ADL assistance	Categorical
	M2102b	IADL assistance	Categorical
	M2102c	Medication administration	Categorical
	M2102d	Medical procedures	Categorical
	M2102e	Management of Equipment	Categorical
	M2102f	Supervision and safety	Categorical
	M2102g	Advocacy or facilitation	Categorical
	M2110	How Often ADL/IADL assistance	Categorical
ADL/IADL	M1900	Prior Functioning ADL/IADL	
	M1900a	Self-Care	Categorical
	M1900b	Ambulation	Categorical
	M1900c	Transfer	Categorical
	M1900d	Household tasks	Categorical
History and Diagnoses	M1021	Primary Diagnosis	Nominal
	M1021a_ sev	Primary Diagnosis Severity	Categorical
	M1023	Other Diagnoses	Nominal
	M1034	Overall Status	Categorical
Respiratory Status	M1400	Short of Breath	Categorical
	M1410	Respiratory Treatments	Categorical

ADL/IADL	M1800	Grooming	Categorical
	M1810	Ability to Dress Upper Body	Categorical
	M1820	Ability to Dress Lower Body	Categorical
	M1830	Bathing	Categorical
	M1840	Toilet Transferring	Categorical
	M1845	Toileting Hygiene	Categorical
	M1850	Transferring	Categorical
	M1860	Ambulation/Locomotion	Categorical
	M1870	Feeding or Eating	Categorical
	M1880	Ability to Plan and Prepare Light Meals	Categorical
	M1890	Ability to Use Telephone	Categorical
Medications	M2000	Drug Regimen Review	Categorical
	M2002	Medication follow-up	Binary
	M2010	Patient/Caregiver High-Risk Drug Education	Categorical
	M2020	Management of Oral Medication	Categorical
	M2030	Management of Injection Medication	Categorical
	M2040a	Prior Medication Management: oral	Categorical
	M2040b	Prior Medication Management: injectable	Categorical
Therapy Need and Plan of Care	M2200	Therapy Need	Continuous
	M2250	Plan of Care Synopsis	
	M2250a	Patient-specific parameters	Categorical
	M2250b	Diabetic foot care	Categorical
	M2250c	Falls prevention	Categorical
	M2250d	Depression intervention	Categorical
	M2250e	Pain intervention	Categorical
	M2250f	Pressure ulcers intervention	Categorical
	M2250g	Pressure ulcers treatment	Categorical

Results

Sample

A total of 2,832 patients who were deemed eligible for the program were referred for telehealth and included in the analysis (Table 3.2). The telehealth initiation rate was 29.5% (N=834). The sample consisted of mostly older adults (mean age 74, (SD = 13.5), range 22 to 104 years). Patients were primarily Black or African-American (35.9%), female (56%) and Medicare beneficiaries (65%, all types). They were primarily English speaking (57%). The most common comorbidities in this sample were type 2 Diabetes Mellitus (6%), and essential hypertension (6%).

Table 3.2. Characteristics of the cohort sample

		All	**Initiated**	**Not Initiated**	***p*[d]**
		N=2,832	**N=834**	**N=1,998**	
		n (%)[a]	**n (%)[a]**	**n (%)[a]**	
Age, y[b]	Mean (SD)	74 (13.5)	73 (13.3)	74 (13.5)	0.008
	Median	76	75	77	
Gender	Male	1,246 (44.0)	383 (46.0)	863 (43.2)	
	Female	1,586 (56.0)	451 (54.0)	1,135(56.8)	
Race/Ethnicity[c]	Asian	143 (5.0)	47 (5.6)	96 (4.8)	
	Black or African American	1,022 (35.9)	281 (33.7)	741(37.1)	
	Hispanic or Latino	848 (29.8)	276 (33.1)	572 (28.6)	0.018
	White	806 (28.3)	223 (26.7)	583 (29.2)	
	Others (American Indian or Alaska Native or Native Hawaiian or Pacific Islander)	29 (1.0)	11 (1.3)	18 (0.9)	
Payer Sources[c]	Medicare (traditional fee-for-service)	1201 (38.5)	363 (43.5)	838 (41.9)	
	Medicare (HMO/managed care/Advantage plan)	829 (26.6)	248 (29.7)	581 (29.1)	
	Medicaid (traditional fee-for-service)	114 (3.7)	49 (5.9)	65 (3.3)	0.001
	Medicaid (HMO/managed care/Advantage plan)	554 (17.8)	155 (18.6)	399 (20.0)	
	Private	336 (10.8)	86 (10.3)	247 (12.4)	
	Others	87 (2.6)	21 (2.5)	67 (3.4)	
Language	English	1622 (57.3)	468 (56.1)	1,154(57.8)	
	Spanish	601 (21.2)	184 (22.1)	417 (20.9)	
	Others (Unknown, Russian, Italian etc.)	609 (21.5)	182 (21.8)	427 (21.3)	
Comorbidities	Type 2 Diabetes Mellitus	954 (6.0)	276 (5.9)	678 (6.0)	
	Essential Hypertension	954 (6.0)	263 (5.6)	629 (6.2)	
	Atherosclerotic Heart Disease	912 (5.7)	294 (6.3)	618 (5.5)	

Note. [a] All percentage may not add up to exactly 100 percent due to the rounding.
[b] Age is reported as years with standard deviation. All other data are number of patients (%).
[c] Mark all that apply item: The total number and percentage may not add up exactly the same as total number in each group or 100 percent due to multiple entries.
[d] p values for significant difference between Accepted and Refused groups ($p \leq 0.05$).

Bivariate Analysis

OASIS variables with p ≤0.25 from the bivariate analysis with telehealth initiation are presented in Table 3.3 together with how the variables were operationalized. 7 socio-demographic variables, 9 variables in EE, and 25 variables in FC were found to have p value ≤0.25. These variables were used as inputs for the pre-category analyses.

Multivariable Analysis

Variables that had a p value ≤0.05 in association with telehealth initiation in the pre-category multivariable logistic regression models were selected to be entered in the final model. They included 3 from the socio-demographic domain (age, gender, payer source-Medicaid traditional fee-for-service), 1 from the EE domain (anxious) and 5 from the FC domain (respiratory treatment, grooming, prior function-household tasks, high-risk drug education, and frequency of ADL/IADL assistance by caregivers other than home health aide).

The variables included in the final logistic regression model are shown in Table 3.4 Patients who received education related to high-risk drugs (e.g. anticoagulants) by the visiting nurse had an 80% increase in the odds of initiating telehealth compared to those without education (OR 1.80 95% CI: [1.03-3.16]). Patients who did not receive assistance on Activities of Daily Living (ADL) from caregivers other than a home health aide (M2110) had a 46% decrease in odds compared to those who were assisted at least daily (OR: 0.54 95% CI: [0.32-0.91]). In addition, compared to those with other types of insurance, the odds to initiate telehealth services was 73% higher (OR=1.73 95% CI [1.18, 2.56]) among patients with traditional fee for service type of Medicaid as a payer source of their home health care and telehealth service.

Other factors associated with telehealth initiation included anxiety (less often than daily OR=1.31 95% CI [1.05, 1.62]), specific functional abilities (the amount of assistance needed with grooming (OR=0.37 95% CI [0.20, 0.68]), and household tasks such as light meal preparation, laundry, or shopping) (Need some help: OR=0.63 95% CI [0.49, 0.82] and Dependent: OR=0.55 95% CI [0.42, 0.71]) and if they were receiving any type of respiratory treatment (oxygen, ventilator, or continuous/Bi-level positive airway pressure) (OR=1.27 95% CI [1.02, 1.58]).

Moderation effects of both gender and age were examined. Age and prior functional level on household tasks were found to have a statistically significant interaction (X^2 (21, N=2,832) = 85.55, p = <001). This can be interpreted as the effect of patients' prior functional level on performing household tasks on telehealth initiation is stronger for patients' whose age is greater or equal to 76 than for those younger than 76.

Goodness-of-fit tests showed that this selected model had adequate model fit (p value in Hosmer-Lemeshow test = 0.26). No significant collinearity was found among covariates (all VIF<10).

Table 3.3. Independent variables for Telehealth Initiation with $p \leq 0.25$ in bivariate analysis

Category	Title	Operationalization	*p*
Socio-demographic	Age	Binary (76<, ≥76)	0.042
	Gender	Male	0.156
	Race/Ethnicity	Black or African American	0.086
		Hispanic or Latino	0.018
		White	0.190
	Payer source	Medicaid traditional fee-for-service	0.001
		Private	0.123
Effort Expectancy	Vision	3 categories	0.042
	Ability to Hear	4 categories	0.140
	Speech and Oral Expression of Language	4 categories	0.008
	Cognitive Function	4 categories	0.025
	When confused	4 categories	0.011
	When Anxious	4 categories	0.113
	Cognitive, behavioral, and psychiatric symptoms	Pt has memory deficit	0.010
		Pt has none of the above behaviors	0.004
	Frequency of Disruptive Behavior	3 categories	0.079
Facilitating Conditions	Patient Living Situation	3 categories	0.132
	ADL assistance	5 categories	0.011
	IADL assistance	5 categories	0.012
	Medical procedures	5 categories	0.129
	Management of Equipment	5 categories	0.058
	Advocacy or facilitation	5 categories	0.021
	How Often ADL/IADL assistance	6 categories	0.246
	Household tasks	3 categories	<0.001
	Respiratory Treatments	Pt is utilizing respiratory treatment at home	0.211
	Grooming	4 categories	<0.001
	Ability to Dress Upper Body	4 categories	0.001
	Ability to Dress Lower Body	4 categories	0.005
	Bathing	7 categories	0.001
	Toilet Transferring	5 categories	<0.001
	Toileting Hygiene	4 categories	<0.001
	Transferring	5 categories	<0.001
	Ambulation/Locomotion	6 categories	<0.001
	Feeding or Eating	3 categories	0.014
	Ability to Plan and Prepare Light Meals	3 categories	0.144
	Ability to Use Telephone	6 categories	0.004
	Drug Regimen Review	Problems found during drug regimen review	0.095
	Patient/Caregiver High-Risk Drug Education	3 categories	0.102
	Management of Oral Medication	5 categories	0.078
	Pressure ulcers intervention	3 categories	0.001
	Pressure ulcers treatment	3 categories	0.213

Table 3.4. Final Multivariable Logistic Regression Model for Telehealth Initiation

Category	Covariates	Reference	*OR*	*AOR*	95% CI	*p*
Socio-demographic	Age ≥76	<76	0.85	1.01	[0.85, 1.19]	0.951
	Male	Female	1.12	1.09	[0.92, 1.29]	0.304
	Payer source (Medicaid traditional fee-for-service)	Other than Medicaid TFFS	1.86	1.73	[1.18, 2.56]	0.005
Effort Expectancy	Anxious	None				
	Less often than daily		1.22	1.31	[1.05, 1.62]	0.015
	Daily, but not constantly		0.96	1.04	[0.80, 1.70]	0.751
	All of the time		0.51	0.55	[0.19, 1.39]	0.191
Facilitating Conditions	Respiratory treatment	No	1.14	1.27	[1.02,1.58]	0.030
	Grooming	Independent				
	Utensils must be placed		0.91	0.94	[0.74, 1.20]	0.612
	Someone must assist		0.72	0.77	[0.58, 1.01]	0.063
	Dependent entirely		0.33	0.37	[0.20, 0.68]	0.001
	Prior function: Household tasks	Independent				
	Need some help		0.65	0.63	[0.49, 0.82]	<0.001
	Dependent		0.52	0.55	[0.42, 0.71]	<0.001
	High-risk drug education	No				
	Yes		1.79	1.80	[1.03, 3.16]	0.039
	Not taking high-risk drugs		1.66	1.73	[0.94, 3.18]	0.078
	Frequency of ADL/IADL assistance by caregivers other than HHA	Daily				
	Three or more times per week		0.93	0.83	[0.61, 1.14]	0.262
	One to two times per week		1.21	1.01	[0.71, 1.44]	0.973
	Received, but less often than weekly		0.84	0.66	[0.39, 1.10]	0.111
	No assistance received		0.64	0.54	[0.32, 0.91]	0.021
	Unknown		0.44	0.46	[0.13, 1.61]	0.226

Note. N=2,832. *OR*=odds ratio; *AOR*=adjusted odds ratio; CI=confidence interval; ADL=activities of daily living; IADL= instrumental activities of daily living; HHA=home health aide.

Discussion

The purpose of this study was to explore patient-related factors associated with HF patients' initiation or use of telehealth services in a home setting. It identified a number of factors associated with initiation, including functional status, level of anxiety, education provision by the home care nurse, care giver support and sociodemographic factors.

Functional disability is common in patients with HF, reportedly 60% HF patients have limitations in one or more ADLs (Dunlay et al., 2015). In association with these functional limitations and HF self-management, functional limitations and dependency linked to HF have been reported as serious barriers to self-care in patients with HF (Siabani, Leeder, & Davidson, 2013). In our study, grooming and prior ability to perform household tasks, may relate to physical dexterity, which was identified as a main issue with ease of use of telehealth in previous studies (Demiris et al., 2001; Seto et al., 2010). The direction of relationship between telehealth initiation and functional status indicated that the more the patients needed help in household tasks prior to their referral to telehealth services, the less likely they were to have telehealth initiated.

Level of anxiety was also found to be associated with telehealth initiation. Patients who reported being anxious less often than daily had a 31% increase in the odds of initiating telehealth services compared to those had no anxiety. Attitudes towards technology, including anxiety, were tested in the original UTAUT model. This suggested that computer anxiety was not significant factor related to behavioral intention of technology use (Venkatesh et al., 2003). However, computer anxiety has been identified as being significantly associated with negative attitudes towards telehealth (Radhakrishnan et al., 2013). Since all these findings were about anxiety related to technology use not the general anxiety level in daily life, further research

needed on examining the exact relation that was found in our study.

We also found an association between telehealth initiation and provision of education by the home care nurse. A systematic review of HF self-management education found that evidence-based patient education in 4 categories- knowledge and self-management (including medication review and discussion of side-effects), social interaction and support, fluids management, and diet and activity- can significantly improve patients' health outcomes (Boren, Wakefield, Gunlock, & Wakefield, 2009). Another study specifically for telehealth with Veteran patients with chronic conditions including HF reported that patient education including self-management of their conditions was an essential element of their telehealth program success (Darkins et al., 2008). In our study, patients who received education on high-risk drugs were more likely to have telehealth services initiated compared to those without education. The differences in telehealth use between those who are not taking any high-risk drugs and those taking high-risk drugs but did not receive education were not statistically significant. The reasons why a patient did not receive education although they were taking high-risk drugs are neither reported in the dataset nor found in prior studies.

Caregiver support has also been identified as an essential element of telehealth program success along with patient education (Darkins et al., 2008). Caregiver support factors can contain complex elements including the measure of general day-to-day monitoring of well-being and changes in health status as well as other aspects of HF self-management such as supporting adherence to dietary restrictions, planning and pacing of daily activities and a complex medication regime, and taking emergency measures such as knowing when to call a doctor (Wingham et al., 2015). In our study, the frequency of caregiver support was associated with telehealth initiation. Patients who did not receive assistance on ADLs from caregivers other than

a home health aide were less likely to be using telehealth services. There was no dose-response relation found in this association.

Finally, some socio-demographic factors were shown to be related to telehealth initiation. Patients with traditional fee for service type of Medicaid as a payer source of their home health care and telehealth service were more likely to initiate telehealth services compared to those with other types of insurance. Cost, which is a factor previously associated with telehealth acceptance (Rahimpour et al., 2008; Seto et al., 2010) would not be an issue for this study group as they are all in a BPCI program that covers the telehealth service regardless of their payer source. Further research with more socio-demographic related variables such as income or education is needed to explain this association better.

The study has a number of limitations that need to be acknowledged. Firstly the data used for the analysis was from one organization. Although the agency involved in this study is one of the largest home health service providers in the US, there is the possibility that the sample might not represent the wider HF population as the agency serves primarily urban population resides within five boroughs of NYC.

Secondly, the independent variables in this study were restricted to data available from the OASIS assessment dataset. This meant that not all key elements of the theoretical framework were evaluated. In addition other factors that may impact on patient initiation such as the eligibility screening or referral process, frontline staff acceptance, and implementation processes (Taylor et al., 2015) were also not explicitly measured. While the study could only measure two of the four elements of the UTAUT, it did highlight patient-related factors within the critical determinants investigated. Besides, ongoing qualitative research exploring patient's initiation factors uses all four determinants of the UTAUT model.

In conclusion, this study adds to the limited body of knowledge on the patient-related factors associated with telehealth initiation among HF patients receiving home care services. Using data from the standardized OASIS, we found that some elements appear to be related to HF patients' telehealth initiation. Knowledge of such associations and attention to some modifiable factors can inform care planning; for example, the coordination of formal/informal caregiver support and providing additional high-risk drug education for individuals who are referred for telehealth services. Through such approaches it may be possible to improve the efficiency and utilization of telehealth services.

Chapter Four: Qualitative study

Factors Affecting the Decision-making of Home Care Patients with Heart Failure regarding Initiation of Telehealth Services

Chapter four addresses Aim 3, to explore reasons for telehealth initiation in patients with heart failure admitted to a large home care agency. This aim was addressed through a qualitative descriptive study using individual telephone interviews with heart failure patients in the home. This manuscript is planned for submission to the Journal of Advanced Nursing.

Abstract

Aim: To explore factors associated with heart failure patients' decisions to initiate telehealth at home.

Background: Telehealth has been reported to be effective in helping heart failure patients manage their symptoms at home. Despite this, the initiation rate for telehealth among home care patients is low and there is limited research on reasons for this among older heart failure patients receiving home care services.

Design: A qualitative descriptive study underpinned by the Unified Theory of Acceptance Use of Technology (UTAUT) model.

Method: Semi-structured interviews were conducted with heart failure patients (n=20) who were referred for telehealth services at the time of home care admission in one home care agency. Interviews were recorded, transcribed, and analyzed using a mixture of deductive coding based on the UTAUT and inductive coding.

Findings: Three main elements of the UTAUT model were identified as being associated with heart failure patients telehealth initiation at home: Performance Expectancy, Facilitating Conditions, and Social Influence. Effort Expectancy (perceived ease of use of the technology) did not appear to be associated with telehealth initiation. Other factors such as experience with actually using the telehealth, knowledge of heart failure and telehealth, confidence in self-management and use of technology, satisfaction with current services with visiting nurses, and attitude toward life and technology, may also be associated with the decision.

Conclusion: The findings of the study identified overall perceived benefit as key while ease of use was not a contributing factor for telehealth initiation. Building upon these findings, healthcare providers can create and implement practices that further promote the use of telehealth in HF patients.

Key words: *Telehealth, Heart Failure, Older Adults, Home care, Decision-making, Initiation, Adoption*

Introduction

Although telehealth has been shown to be an effective intervention to help heart failure (HF) patients manage their symptoms at home, patients' initiation rates across the globe for telehealth care services are still lower than desirable (Achelrod, 2014; Taylor et al., 2015). Building on previous studies to identify determinants of telehealth adoption, the aim of this study is to explore the factors associated with decision-making of telehealth initiation in patients with heart failure admitted to a large home care agency in the USA.

Background

Previous evidence of use of telehealth

Telehealth is the use of electronic information and telecommunications technologies to support clinicians and patients at a distance (NAHC, 2013) and has the potential to help with monitoring of illness for individuals with chronic disease. Telehealth has been reported to reduce re-hospitalization and related expenses among HF patients in several studies (Kathryn H. Bowles & Baugh, 2007; Paré et al., 2013). However, the initiation of telehealth has been reported low in many countries. For example in the UK, the overall uptake of telehealth has been slower than anticipated although the mainstreaming of telehealth is supported by UK government policy (Taylor et al., 2015). In Germany, up to 70% of eligible HF patients fail to initiate telehealth services (Achelrod, 2014). In the US studies have reported refusal rates around 22-23% from randomized controlled trials (K. H. Bowles et al., 2011; Finkelstein, Speedie, & Potthoff, 2006).

HF management remains a key challenge in older adult care in both Europe and the US. HF is one of the leading causes of hospitalization among people above 65 years of age in many European countries, costing almost 2% of the total health care budget (Jaarsma, Larsen, & Strömberg, 2013). In the US, increasing care costs (average program payment increased by 8%

from 1997 to 2012) related to HF patients in Medicare home care service (CMS, 2013) have been reported. Provision of care at home, using home health care services, is increasingly being used to bridge the gap between acute care settings and the home to alleviate patients' care burden and assist with disease self-management. In Europe, in an effort to find effective solutions, home-based care has been reported to be associated with a reduction in hospital stay; for example Stewart et al reported a 37% decrease in cardiovascular-hospitalization days for patients cared for at home, compared with clinic-based management (Stewart et al., 2012). In the US, home health care is a specific Medicare benefit provided to homebound individuals who are ill or injured and require intermittent (part-time) skilled nursing services or skilled therapy (CMS, 2017a). Home health care agencies serve approximately 3.7 million individuals, resulting in $18.2 billion in total Medicare payments in 2015 (CMS, 2015). Of the Medicare beneficiaries discharged from hospital into other care services, 37.4% are sent home with home health services (Gage, 2009) and among all individuals who received formal home care services, 69% were over age 65 (NAHC, 2010). Given the fact that HF is one of the most common primary diagnoses for home health recipients (NAHC, 2010) in the US, assisting HF self-management at home can be crucial for this population.

Factors associated with initiation of telehealth

There is little existing research that explores the factors associated with patients' decision making related to the initiation of telehealth services. The majority of existing studies have focused on patients' views of the usability of telehealth systems (Gund et al., 2008; Prescher et al., 2013) or their satisfaction after use of telehealth (Metzger, 2012; Whitten, Bergman, Meese, Bridwell, & Jule, 2009) rather than their decision regarding whether to use the service or not in the first place. A recent review by Woo & Dowding (2017) found only five studies that have

been conducted to explore the factors associated with patients' decision-making regarding telehealth initiation for HF patients at home. Furthermore, it is reported that less information is available on those who have refused to use telehealth services (Kavita, Cynthia, & Joan, 2012).

The few studies that do exist that have explored factors associated with telehealth initiation in patients who have a number of chronic conditions such as HF and diabetes or asthma, thus it is difficult to separate out HF patients from other patients who have received telehealth. These studies suggest that concerns over technology or equipment, concerns over service change, or ease of use may impact patients' decision making (Woo & Dowding, 2017)). However, it is still unclear what factors may influence whether or not patients with HF decide to initiate telehealth services in a home care population.

Conceptual Framework

The theoretical basis for examining barriers and facilitators to telehealth initiation for this study was informed by the Unified Theory of Acceptance Use of Technology (UTAUT) model (Venkatesh et al., 2003) (Figure 4.1). This framework is one of the most comprehensive frameworks to examine decision making related to technology acceptance and has been used effectively in many studies examining individuals' technology acceptance (Cimperman, Makovec Brenčič, & Trkman, 2016; Hoque & Sorwar, 2017; Kavita et al., 2012). The four main constructs of UTAUT are Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions. Details of root constructs and definitions of each element are shown in Table 4.1. In brief, Venkatesh et al. (2003) defined each construct as follows: Performance Expectancy is the degree to which using a technology is expected to help in performing certain activities; Effort Expectancy is the expected degree of ease associated with the use of the technology/system; Social Influence is the degree to which an individual believes that important

others think the patient should use the technology/system; Facilitating Conditions is the degree to which an individual believes that technical and organizational infrastructure exists to support their use of the technology/system.

Figure 4.1 The UTAUT model by Venkatesh et al. (2003)

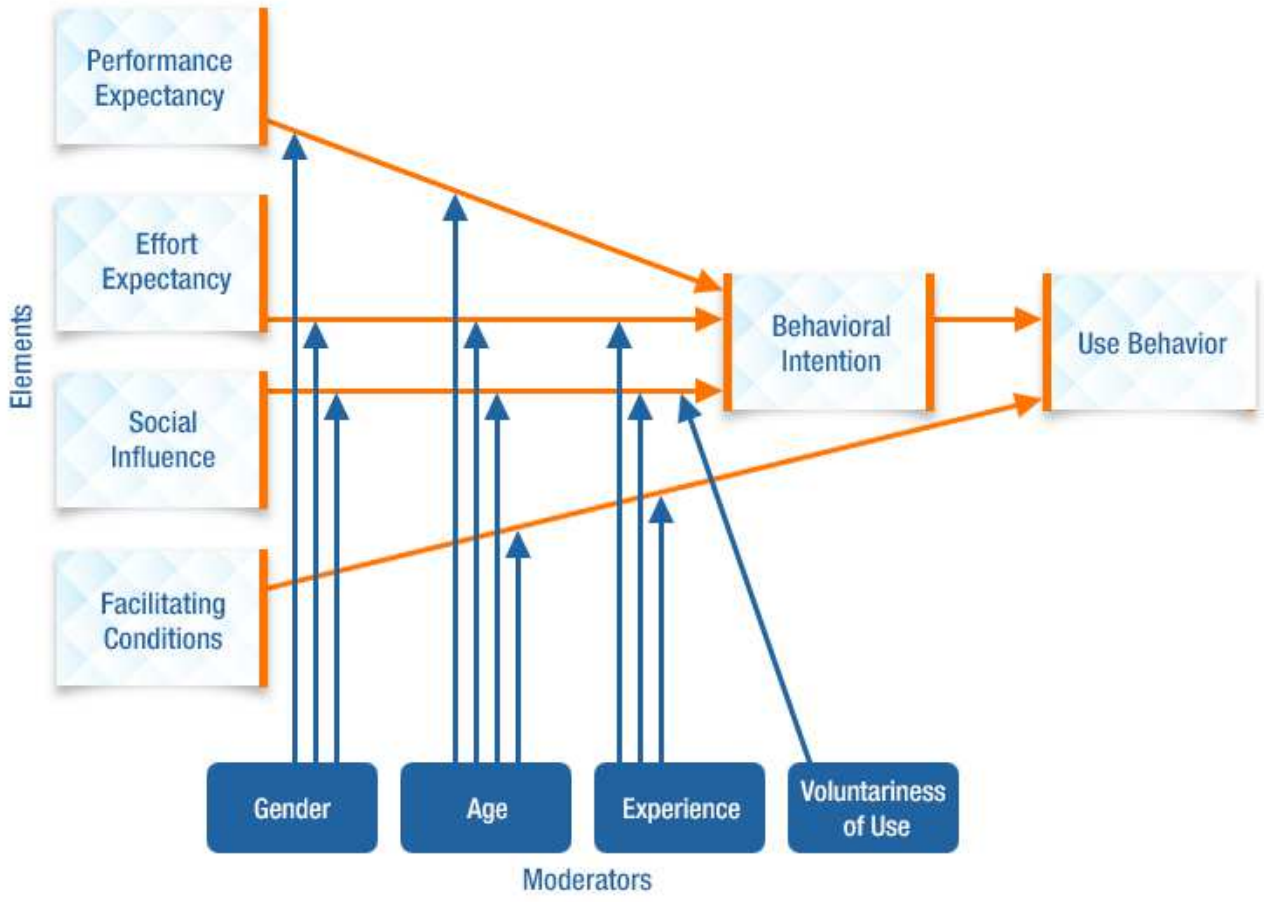


Table 4.1 Description of the UTAUT elements

Main Element	Root Construct	Definition
Performance Expectancy	Perceived usefulness	The degree to which a person believes that using a particular system would enhance his or her job performance.
	Extrinsic motivation	The perception that users will want to perform an activity because it is perceived to be instrumental in achieving valued outcomes.
	Job-fit	How the capabilities of a system enhance an individual's job performance.
	Relative advantage	The degree to which using an innovation is perceived as being better than using its precursor.
	Outcome expectations	Outcome expectations related to the consequences of the behavior whether using the system would increase quality and quantity of output.
Effort Expectancy	Perceived ease of use	The degree to which a person believes that using a system would be free of effort.
	Complexity	The degree to which a system is perceived a relatively difficult to understand and use.
	Ease of use	The degree to which using an innovation is perceived as being difficult to use.
Social Influence	Subjective Norm	The individual's internalization of the reference group's subjective culture, and specific interpersonal agreements that the individual has made with others, in specific social situations.
	Social Factors	The degree to which use of an innovation is perceived to enhance one's image or status in one's social system.
	Image	The degree to which use of an innovation is perceived to enhance one's image or status in one's social system.
Facilitating Conditions	Perceived behavioral control	Reflects perceptions of internal and external constraints on behavior and encompasses self-efficacy, resource facilitating conditions, and technology facilitating conditions.
	Facilitating conditions	Objective factors in the environment that observers agree make an act easy to do, including the provision of computer support.
	Compatibility	The degree to which an innovation is perceived as being consistent with existing values, needs, and experiences of potential adopters.

The study

Aim

The aim of this study was to explore factors associated with telehealth initiation in HF patients receiving care at home.

Design

A qualitative descriptive study utilizing individual patient interviews was conducted. This approach was chosen because it is a valid method of inquiry for nursing and health sciences research to seek a precise account of the experiences, events, and process that most researchers and participants would agree is accurate (Sandelowski, 2000).

Participants

The sample population was drawn from patients from one of the largest not-for-profit home care agencies in the US. The organization serves an ethnically diverse patient population across the 5 boroughs of New York and Nassau and Westchester counties and provides telehealth services for HF and heart attack patients. Eligible patients who have a heart failure diagnosis and are at risk for hospitalization, who are functionally able to, and are agreeable to, participating in telehealth (see Figure 4.2 for the full eligibility criteria) are referred for telehealth services, to assist with the self-monitoring of their condition. (see Figure 4.3 for the actual telehealth equipment used for the study). Participants were recruited from those who were referred for telehealth services with HF in their diagnosis between September 2017 and December 2017. The telehealth referral and initiation process is illustrated in Figure 4.2. Purposive sampling was used to sample HF patients who were categorized as initiating or non-initiating telehealth services. Maximum-variation sampling was used to ensure the sample had a wide range of perspectives to capture the broadest set of information and experiences (Kuper, Lingard, & Levinson, 2008).

Figure 4.2 Flow Chart of Home Care Telehealth Referral and Initiation

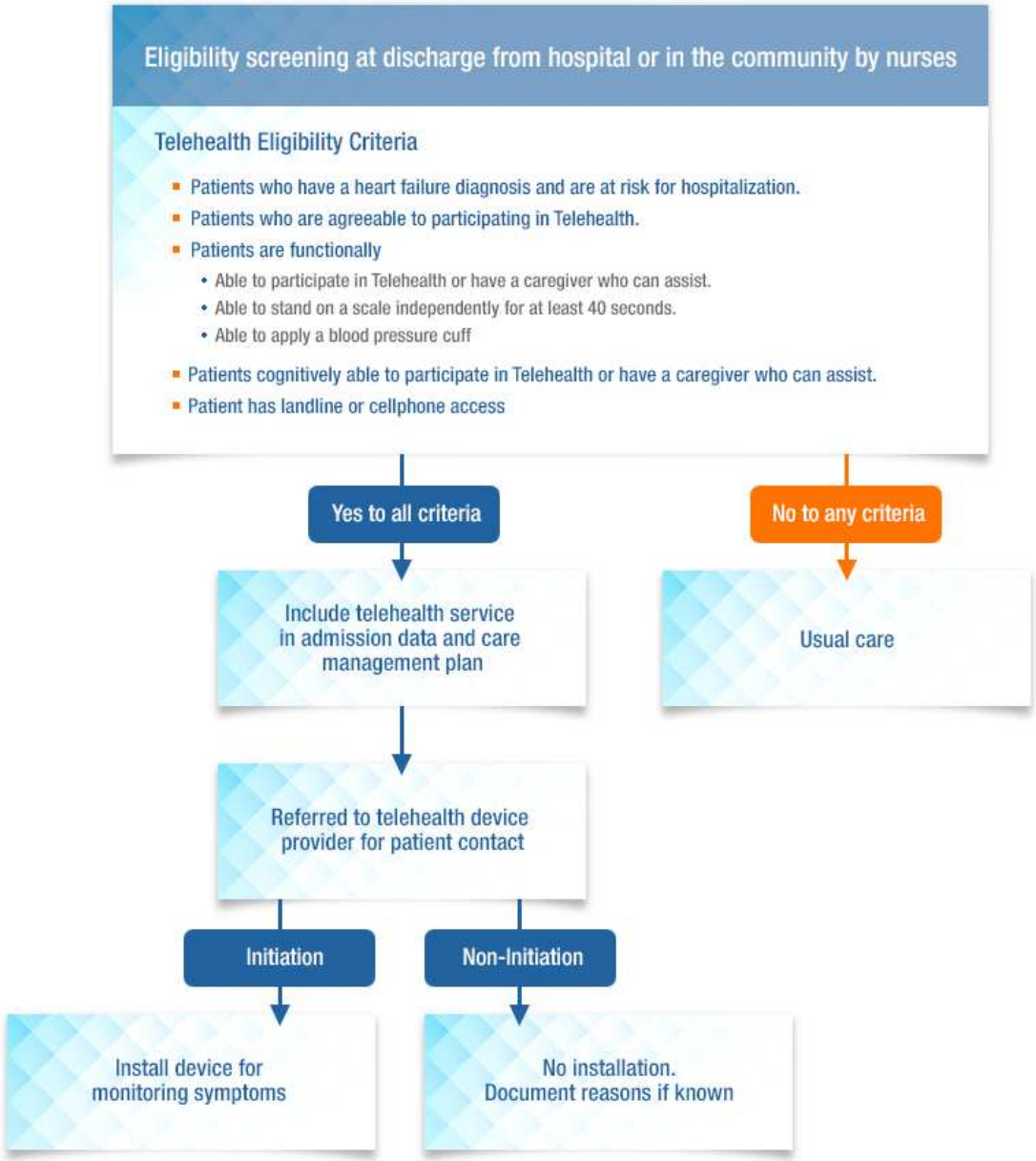


Figure 4.3 Telehealth Equipment

- Wireless equipment
- The Telehealth Monitor is connected to a standard home electrical outlet

Sample sizes of 20-30 cases are typical, but a qualitative sample can be even smaller under some circumstances (Wu, Thompson, Aroian, McQuaid, & Deatrick, 2016). It has been suggested that saturation of data may indicate the optimal sample size. As recommended by Elo et al. (2014) and to make sure data saturation was achieved, a preliminary analysis was started after 2-3 interviews had been conducted and stopped after data saturation was met. Data saturation is often used to judge information adequacy and defined as the point at which no new information, categories, or themes emerge (Wu et al., 2016). A total of 20 individuals were interviewed, 13 categorized as initiating telehealth and 7 who were identified as non-initiators. The characteristics of participants are shown in Table 4.2. The mean age of participants was 72.6 (S.D. 13.4) years with a median of 72.5 years. There were slightly more females (55%) than males, and the sample was ethnically diverse; White (45%), African-American (45%), and Hispanic-other (10%).

Table 4.2 Participant characteristics

		Participants N=20
		n (%)
Age (years)		
	Mean (SD)	72.6 (13.4)
	Median	72.5
Gender		
	Male	9 (45)
	Female	11 (55)
Race/Ethnicity		
	Hispanic-other	2 (10)
	Non-Hispanic, African American	9 (45)
	Non-Hispanic, White	9 (45)
Telehealth initiation status		
	Initiated	13(65)
	Non-Initiated	7(35)

Data collection

Potentially eligible patients, (patients with HF who were referred for telehealth and either initiated or non-initiated the service) were identified from telehealth referral lists and contacted by a research assistant independent of the study investigators. A recruitment grid was constructed that outlined the key variables for purposive sampling (e.g., patient initiation status, age, location), which was used to map patient characteristics to inform the sampling procedure. Once potential participants had been identified, they were contacted by the staff member, who a) conducted a cognitive screening to ensure that the patient was able to consent to participate in the study and in a telephone interview (Callahan, Unverzagt, Hui, Perkins, & Hendrie, 2002), and b) obtained verbal consent from them for the PI to contact them further about the study. The patient's name and contact details was given to the PI only after eligible patients had passed the cognitive screening and provided verbal consent to be contacted. Recruitment was conducted simultaneously with the interviews and stopped once data saturation had been achieved.

Telephone interviews were conducted with all consenting patients. Many point to logistical conveniences and other practical advantages of telephone interviews, such as enhanced access to geographically dispersed interviewees, reduced costs, increased interviewer safety, and greater flexibility for scheduling (Drabble, Trocki, Salcedo, Walker, & Korcha, 2016). Since this research aimed to recruit patients within the home care agency across a geographically diverse region (covering the 5 boroughs of New York, Nassau and Westchester counties) a telephone interview was considered to be a suitable method of data collection within the limited budget and time.

A non-directive style of interviewing using semi-structured and open-ended questions was used allowing the participants the freedom to control pacing and subject matter of the

interview. Interview questions and probes were based on the four predictors in the UTAUT (Performance Expectancy, Effort Expectancy, Facilitating Conditions, and Social Influence) (Figure 4.1). Probes were used for answers that were vague or ambiguous when the researcher felt a need for more specific or in-depth information (Table 4.3). All interviews were recorded and subsequently transcribed for the purpose of analysis. All participants were given a $20 gift card via mail in appreciation for their time. Interviews were conducted until data saturation was met. A total of 20 participants were interviewed, of whom 13 were initiators and 7 were non-initiators. Interviews ranged from 11 to 24 minutes with average 15 minutes.

Ethical considerations

Approval was received from both the home care organization and the University IRB committees prior to recruitment. The participants received an information sheet describing the purpose of the study and the study was also explained verbally before they provided consent prior to the interviews.

Data Analysis

Data were analyzed using a mixture of deductive and inductive coding. As a conceptual framework with four constructs was guiding this study, a deductive approach (categorizing guided by conceptual constructs used) was used for coding. In addition, pertinent data derived from the data that were not explained by the conceptual framework were derived using inductive coding. All records were transcribed and were then be coded by two researchers separately (K.W. and D.D.). Codes were grouped using an iterative process in order to identify similar categories and themes, using constant comparative analysis methods (Glaser, 1965). A qualitative analysis software program (NVivo V11) was used to assist the coding process. Once coded and

categorized, themes and coded data were compared between the two researchers for any discrepancies and consensus was reached.

Table4 4.3. Interview Guide (using the UTAUT model)

Domain	Questions	Probes
Performance Expectancy	Could you tell me about your decision to use telehealth monitoring in more detail? Do you think that using telehealth systems would help to manage your health at home?	Initiated: Why did you decide to use the telehealth monitoring systems? Not-Initiated: Why did you decide not to use the telehealth monitoring systems?
Effort Expectancy	How easy or difficult do you think using the telehealth system is (would be) at home? Why?	Initiated: Can you talk me through how you have learned to use the system? What things have you found easy or difficult about using the system? Not-Initiated: Can you talk me through how or why you think you would learn to use a telehealth system?
Social Influence	Could you tell me what your family/friends/caregivers think about you using the telehealth system?	Initiated: Can you tell me about reactions or opinions of your family/friends/caregivers in using telehealth monitoring? How much does their opinion matter to you in using telehealth system? Not-Initiated: Can you tell me how your family/friends/caregivers react or reacted regarding using the system? How much does their opinion matter to you in using telehealth system?
Facilitating Conditions	How easy or difficult do you think it would be/is to get guidance or support using the telehealth service at home? Why?	Initiated: Can you talk me through your experience of getting necessary support to use the system? Not-Initiated: Can you talk me through how or why you think you would or would not get assistance to use a telehealth system?

Rigor

Trustworthiness of qualitative research is determined by credibility (internal validity), transferability (external validity), dependability (reliability), and confirmability (objectivity) (Devers, 1999; Guba, 1981). To achieve credibility in this study, an established theory was used for the interview guide and provided a framework for the data analysis. In addition, two researchers carried out coding independently. Probes were utilized to enhance the production of detailed context during the interview, and interviewer notes were added to the transcribed interview context for transferability. To ensure dependability in this study, the researcher kept detailed documentation of the coding schemes and the data analysis process (Devers, 1999; Guba, 1981; Wu et al., 2016). The use of NVivo assisted in clarifying and objectifying these processes. In order to enhance the confirmability of the study, the PI kept a reflective journal to ensure that she reflected on how her personal characteristics, feelings, and biases may be influencing the work (Devers, 1999; Guba, 1981).

Findings

Three main constructs from the deductive analysis using UTAUT were found to influence HF patients' initiation decisions; Performance Expectancy, Facilitating Conditions, and Social Influence. Effort Expectancy, which is the expected degree of ease associated with the use of the technology/system, was not identified as factor influencing telehealth initiation. In addition several themes were derived from the inductive analysis; experience using telehealth, knowledge of HF and telehealth, confidence in self-management and use of technology, satisfaction with current visiting nurse services, and attitudes toward life and technology. Experience using telehealth technology, which was previously identified as a moderator in the UTAUT model, appeared to be positively associated with initiation.

UTAUT factors

Overall, three of the four elements of the UTAUT were evident in reasons for initiation or non-initiation of telehealth services. The findings are further described below in terms of the UTAUT elements. Respondents are identified according to the telehealth initiation status for the quote.

Performance Expectancy

Performance expectancy, which is the degree to which using a technology is expected to help in performing certain activities, appeared to be the main factor driving either initiation or non-initiation of telehealth services. Where a participant had positive views of the benefits of the service, such as it being useful to help manage their symptoms and live longer, they were more likely to initiate the service. However, if they had negative perceptions of the service, such as telehealth is for very sick people and would not be useful if only for a few weeks while under home care, then they were less likely to initiate the service.

" If this is going to help, this installation, then I should do it...It will help me, keep me alive a little longer" (Initiated1035)

"I think it's a smart thing to do ...wise thing to do...to have multiple people able to look at your vitals in real time...somebody to help you immediately in real time, that is very important" (Initiated 1124)

" I told them to go to people who are really sick and need them..." (Not-Initiated1013)

" I'm not going to have the scale and the blood pressure machine, so what's the point of having it (telehealth) for a month, month and a half and that's it?" (Not-Initiated1122)

Effort Expectancy

All participants regardless of their initiation status reported positive Effort Expectancy, which is the expected degree of ease associated with the use of the technology/system. Thus Effort Expectancy was not viewed as necessarily leading to patients' decision-making regarding initiation of telehealth.

"I don't think that would be difficult" (Not-Initiated1016)

"No. It will not be difficult for me. I know..." (Not-Initiated1013)

"I don't have a problem with doing that because it's just a matter of just putting it on..." (Initiated 1004)

"It's common sense, I dare to say...it's very easy" (Initiated 1124)

Facilitating Conditions

In addition to the association of Performance Expectancy with telehealth initiation, Facilitating Conditions, which is the degree to which an individual believes that technical and

organizational infrastructure exists to support their use of the technology/system, was also found to play a significant part in telehealth initiation. Technical or clinical support for telehealth system use was a facilitator, whereas personal assistance by family or a home health aid were seen to be barriers.

" They would contact me and you know, have me take it again. They would try to figure out if there was a reason why the blood pressure was going up." (I1057)

" They called me once... because once I forgot for two days to go on it, and they wanted to make sure I was okay...once because it was a little high..." (I1109)

"My nephew helped me...I did not do it by myself" (Not-Initiated1119)

"My sister comes everyday to...give me my insulin and stay with me most of the day. I'm not here alone. (when asked " do you mean that you don't need the help (telehealth) because...you have help around?") that's correct. " (Not-Initiated1122)

One of the root constructs of Facilitating conditions, Compatibility, defined as the degree to which the system fits well with the way patient's like to work, was also an element that might affect patient's initiation of telehealth at home.

" I don't know what it looks like, or how big it is or where I would keep it..." (Not-Initiated1046)

" It's on the floor...because I had it on the floor...I had no place to put it...I did not like the second one...I sent it back" (Initiated 1018)

Social Influence

Unlike other elements of UTAUT, Social Influence was found to be the least frequently mentioned factor related to telehealth initiation. Only a few of the interviewees discussed or had an opinion from others regarding telehealth services, so the influence of Social Influence related to telehealth initiation appeared to be minimal. However, those who talked with others about telehealth services stated the others opinion mattered to their initiation decision.

Most participants either never discussed with others or had seen anyone using the telehealth system. Only one person from initiation group stated that they had discussed using telehealth with others (healthcare professionals) and their opinion mattered to her.

From the Not-Initiated group, two participants mentioned discussing using telehealth with others and only one was directly related to telehealth initiation.

"My sister. We talked about it...I asked her... and she agreed that I don't need it" (Not-Initiated1122)

The other one reported that everybody who he spoke to had thought telehealth was good when he previously used it but he was not informed of the service this time so did not initiate the service.

"Everybody thought it was a good thing. My family, the nurse, the doctor...no negative feedback. Everything was positive. " (Not-Initiated1184)

Themes arising from inductive analysis

Alongside factors associated with the UTAUT a number of other factors appeared to influence whether or not patients initiated telehealth services. Factors that arose from inductive analysis are presented according to themes, with supporting quotes where appropriate (Table 4.4).

Experience using telehealth

Previous experience using telehealth services was identified as a factor related to telehealth initiation. This factor is one of the four moderators in UTAUT model that influences the magnitude of the relationship and appeared to strengthen the initiation activity if participants have used it before.

" I had had it many years ago...then now, we put it back on just for my peace of mind" (Initiated 1109)

There was also evidence of experience having a positive influence on telehealth initiation even in those patients who had not actively initiated telehealth services. One patient who was not informed about telehealth on this admission to home health care stated he would have accepted it if it were offered based on his positive previous experience with telehealth.

" As far as my experience is concerned, it was a great experience. I had no, you know, I had no problem with it (telehealth)" (Not-Initiated1184)

Knowledge of HF or telehealth

Knowledge of HF was identified as a factor related to the initiation of telehealth. Patients who recognized their lack of knowledge on HF initiated telehealth hoping it would help with the management of their symptoms at home.

"I really don't know too much about it (HF)...hardly anything I know. (When asked by the interviewer: you think that using telehealth would help to manage your health at home?) That's why I accepted." (Initiated 1004)

"I'm not too acquainted with heart failure. This is first time…my knowledge about what this heart failure is…hardly anything I know…that's why I accepted (telehealth)" (Initiated 1026)

Knowledge of telehealth was also related to experience, as patients who experienced telehealth knew what using the technology entails. Particularly in this study, the lack of knowledge on telehealth appeared to be related to non-initiation.

"I'd like to know about what is it. What's the service?...I don't know anything about it" (Not-Initiated1011)

"No, I don't. (when asked whether s/he knows what telehealth is)" (Not-Initiated1013)

Confidence in use of technology and self-management

Personal competency with use of any kind of technology was related to telehealth initiation. Patients who initiated telehealth expressed technology competency, when asked, using smart phones or emails in daily life.

"I have my personal iPhone… I would say so (when asked whether s/he thinks technically savvy)…I think it's a basic feel that most people have today (when asked whether s/he is aware of and using technology daily)" (Initiated 1124)

"… I have an iPhone and I use that for my email and things…these smart system with the weight, and that is very, very easy…" (Initiated 1044)

On the contrary, those who did not initiate telehealth expressed non-familiarity or non-usage of recent technologies.

"I live in the 20th century, not the 21st. I have no computer. I have no cell phone. I have no connection with any 21st century digitation." (Not-Initiated1046)

"I don't do emails. I don't do none of that. I just still use a regular phone to do what I have to do." (Not-Initiated1183)

So long as patients recognize telehealth as a 'technology' rather than a part of 'routine service,' technology competency would affect patients decision-making whether to initiate telehealth or not.

Confidence in self-management was reported to contribute to telehealth non-initiation. Patients who expressed the ability of taking care of their own health were reluctant to engage with telehealth. However, whether lack of confidence in self-management enables initiation was not clearly revealed from the interview.

"…I can do it (checking weight and blood pressure) by myself. I do it myself all the time, so far…Like I said, I have my own (weight scale and BP machine)…" (Not-Initiated1003)

"I did not need it (telehealth). I could take care of myself" (Not-Initiated1013)

Satisfaction with current service with visiting nurses

Expression of satisfaction with current services was reported in both initiated and non-initiated groups. However, the theme was evident in driving forward telehealth non-initiation.

"I go to seven doctors…they take very good care of me…it's always being monitored,... I'm always on safe ground." (I1109)

"I have my own scale, my own blood pressure machine. I'm breathing fairly all right, so I don't need that oxygen now…(when asked whether s/he has been managing symptoms well so far) Yeah, so far…visiting nurse came to my house, they talk to me about it (telehealth) and I

explained to them that I'm fairly well so far, but you know, I don't need that(telehealth)…(when asked whether she is happy with current services) Yeah, So far." (Not-Initiated1003)

"The doctor call, the nurse is coming… if I have a problem, I appreciate your services, but I believe any problem I have, my sister will be able to take care of me." (Not-Initiated1122)

As a component of their satisfaction with their current service, patients reported a preference for having human contact through the nurse home visits.

"I enjoy visiting nurse coming… if there was something going wrong with me, I would rather get in touch with the nurse service and have a human being come, rather than depend on the machine" (Not-Initiated1046)

Attitude toward life and technology

Attitudes towards technology was tested in the original UTAUT model as a potential construct for technology acceptance and determined not to be a direct determinant of intention to use technology (Venkatesh et al., 2003). However, in this study attitudes toward technology appeared to be associated with telehealth initiation. Patients who had not initiated telehealth appeared to have negative attitudes toward technology in general.

"I think it (technology) would cause me more trouble" (Not-Initiated1013)

One's beliefs and values combined with other factors also appeared to be a barrier to telehealth initiation. Patients who viewed themselves and independent were more likely to refuse telehealth services.

"I'll just die and then it's over with, but I do not want anyone telling' me what to do." (Not-Initiated1013)

"I live here by myself... I do everything by myself in my house. I live alone." (Not-Initiated1122)

Table 4.4 Factors from inductive analysis

Factors	Definition	Quotes
Experience using telehealth	Patients have previously used telehealth offered by home care service.	" I had had it many years ago...then now, we put it back on just for my peace of mind" (Initiated1109) "As far as my experience is concerned, it was a great experience. I had no, you know, I had no problem with it (telehealth)" (Not-Initiated1184)
Knowledge of telehealth and heart failure	Patients know what heart failure means and symptoms of heart failure. Patients know what telehealth means and specification of the services.	"I really don't know too much about it (HF)...hardly anything I know. (When asked by the interviewer: you think that using telehealth would help to manage your health at home?) That's why I accepted." (Initiated1004) "I'm not too acquainted with heart failure. This is first time…my knowledge about what this heart failure is…hardly anything I know…that's why I accepted (telehealth)" (Initiated1026) "I'd like to know about what is it. What's the service?...I don't know anything about it" (Not-Initiated1011) "No, I don't. (when asked whether s/he knows what telehealth is)" (Not-Initiated1013)
Competency/confidence	Patients express competency in using any technology and in self-managing heart failure symptoms.	"I have my personal iPhone… I would say so (when asked whether s/he thinks technically savvy)…I think it's a basic feel that most people have today (when asked whether s/he is aware of and using technology daily)" (Initiated1124) "… I have an iPhone and I use that for my email and things…these smart system with the weight, and that is very, very easy…" (Initiated1044) "I live in the 20th century, not the 21st. I have no computer. I have no cell phone. I have no connection with any 21st century digitation." (Not-Initiated1046) "I don't do emails. I don't do none of that. I just still use a regular phone to do what I have to do." (Not-Initiated1183) "…I can do it (checking weight and blood pressure) by myself. I do it myself all the time, so far…Like I said, I have my own (weight

		scale and BP machine)…" (Not-Initiated1003) "I did not need it (telehealth). I could take care of myself" (Not-Initiated1013)
Satisfaction with the visiting nurse service	Patients express satisfaction with current service home care services	"I go to seven doctors…they take very good care of me…it's always being monitored, anyhow, throughout the week, you know by one or the other professionals that come in. I'm always on safe ground." (Initiated1109) "I have my own scale, my own blood pressure machine. I'm breathing fairly all right, so I don't need that oxygen now…(when asked whether s/he has been managing symptoms well so far) Yeah, so far…visiting nurse came to my house, they talk to me about it (telehealth) and I explained to them that I'm fairly well so far, but you know, I don't need that(telehealth)…(when asked whether she is happy with current services) Yeah, So far." (Not-Initiated1003) "The doctor call, the nurse is coming… if I have a problem, I appreciate your services, but I believe any problem I have, my sister will be able to take care of me." (Not-Initiated1122) "I enjoy visiting nurse coming… if there was something going wrong with me, I would rather get in touch with the nurse service and have a human being come, rather than depend on the machine" (Not-Initiated1046)
Attitudes towards life and technology	Patients value independence. Patients express positive or negative attitudes toward use of technology.	"I enjoy visiting nurse coming… if there was something going wrong with me, I would rather get in touch with the nurse service and have a human being come, rather than depend on the machine" (Not-Initiated1046) "I think it (technology) would cause me more trouble" (Not-Initiated1013)

Discussion

This study aimed to explore factors associated with HF patients' decisions to initiate telehealth services when discharged from the hospital to home. The study found that patient's decisions could be in part explained by three main constructs in the UTAUT model; Performance Expectancy (perceived benefits), Facilitating Conditions (perceived control and technical/clinical support), and Social Influences (opinion from important others). The construct Effort Expectancy (perceived ease of use) was found to be unrelated to telehealth initiation. This study has also highlighted how other factors such as previous experience using telehealth, having knowledge of HF and telehealth, showing confidence in self-management and use of any kinds of technology, expressing satisfaction with current visiting nurse services, and valuing independence in life, may also be associated with the decision.

Overall the benefits patients' perceived to be associated with telehealth were key for telehealth initiation. This finding is very well supported by other studies that have explored HF patients' telehealth adoption at home (Demiris, Speedie, & Finkelstein, 2001; Hall et al., 2014; Rahimpour, Lovell, Celler, & McCormick, 2008; Seto et al., 2010). One study particularly identified the potential benefits of telehealth perceived by HF patients; increased access to care, the earlier indication of a worsening condition (in other words monitoring conditions well), increased knowledge, saving both nurses' and patients' time, and greater convenience (Hall et al., 2014). In our study, the perceived benefits were expressed as useful managing patients' HF symptoms and helping them live longer.

While Social Influence is one of the central concepts of the technology acceptance model we employed, very few interviewees discussed telehealth services with others, thus suggesting that Social Influence has a minimal influence on telehealth initiation. This finding may be due to

the particular circumstances of home HF patients. As described earlier in the sample, the interviewees are primarily homebound, with multiple chronic conditions, and are on average 72 years old, thus limiting their contact and information sharing with other people.

Patients' perceptions of the ease of use of telehealth technology did not appear to be an influencing factor in this study. Mixed findings have been reported on telehealth usability from various studies depending on the different types and versions of telehealth devices. Some studies have identified telehealth as easy to use (LaFramboise, Woster, Yager, & Yates, 2009; Sandberg et al., 2009) while others identified usability as a barrier (Demiris et al., 2001; Seto et al., 2010). In our study, the patients uniformly expressed perceived ease of use for telehealth. This phenomenon can be explained due to the fact that the telehealth device used in this study is very simple (see Figure 4.3) involving only three units: a blood pressure cuff, pulse oximeter, and weight scale (with the glucometer only for diabetic patients). Those studies that reported ease of use as a barrier to telehealth adoption used more complex technology, such as ECG monitoring using a mobile phone or a web page (Demiris et al., 2001; Seto et al., 2010).

Experience previously using telehealth was found to be associated with telehealth initiation in our study. Findings from previous telehealth studies that compared pre- and post-telehealth use also found that experience using telehealth leads to favorable changes in perception (Demiris et al., 2001). With consideration of these findings, promoting a trial use of telehealth to HF patients before or when they are discharged from the hospital would possibly increase telehealth adoption (Karahanna, Straub, & Chervany, 1999). Increased telehealth initiation may be in part attributable to patient familiarity with technological features that were preferred by the patients interviewed in the initiation group. For patients without previous experience with telehealth, its system features such as digital voice instruction and reading back

results can be described when referring patients to the service to promote knowledge of telehealth. Experience, knowledge, and knowing telehealth features are all closely related and can be important factors that can be considered in advance of referral, boosting initiation.

How the individual feels about using any technology at home was found to be associated with telehealth initiation. These feelings regarding technical competency was also reported in other studies to be related to telehealth acceptance (Hall et al., 2014; Middlemass, Vos, & Siriwardena, 2017; Nguyen et al., 2017; Rahimpour, Lovell, Celler, & McCormick, 2008; Sanders et al., 2012). Hall et al. (2014) used the term "self-efficacy" and indicated low computer use self-efficacy as a barrier to telehealth use. Sanders et al. (2012) identified technical competency as a barrier, describing patients who expressed estrangement from modern technologies who refused telehealth. Confidence in HF symptom self-management was also found to be related to telehealth initiation in the current study. Contrary to Nguyen et al. (2017), who found in older HF patients high confidence levels in managing their conditions at the time of hospital discharge, in the present study very few patients reported confidence in HF symptom self-management. And those who did express this confidence were less likely to initiate telehealth.

Strengths and Limitations

There are a number of limitations to the study that need to be acknowledged. It was conducted in one home care agency located in New York City, where the population and services available to patients may be different from other areas of the US. In addition, the interview was limited to only for those English speakers, and as with all qualitative studies the sample may not be representative of the broader patient population. However, the study utilized a number of strategies, such as having two researchers conducting data analysis, and the use of a theoretical

model to provide conceptual underpinnings to the study findings to increase study credibility. In addition, information regarding the characteristics of the study participants is provided to enable an evaluation of the transferability of the findings to other settings.

Conclusion

This study provides new insights on the factors associated with HF patients' decisions to initiate telehealth services at home. Employing the UTAUT model, we found that patient perceptions of telehealth benefits, the availability of clinical/technical support, and the opinion of significant others were related to HF patient telehealth initiation in a home care setting. However, patients' perceived ease of use of telehealth was not a contributing factor. Other factors such as experience using telehealth, knowledge of telehealth, and knowledge of HF also appeared to influence patients' decision making. Based on the findings, future telehealth policies and implementation strategies can focus on communicating the benefits and specific features of telehealth. This can be done through healthcare professionals reinforcing the benefits of telehealth to patients, providing patients with hands-on experience before discharge, and ensuring necessary clinical and technical support.

Chapter Five: Conclusions

This chapter summarizes and discusses the key findings of this dissertation, describes strengths and limitations in the research, and discusses implications and recommendations derived from the findings for clinical practice, policy, and research.

This dissertation examined factors related to the initiation of telehealth services by HF patients receiving home care services. The thesis comprises of three papers; the first paper is a literature review examining factors affecting the decision of heart failure patients to accept telehealth services in the home. The second paper is a quantitative analysis of a cohort sample to identify patient-related factors or characteristics associated with telehealth initiation among heart failure patients using the Outcome and Assessment Information Set (OASIS). The third and final article draws upon in-depth individual patient interviews to explore reasons for telehealth initiation. The findings of the three studies shed light on various factors that influence HF patients' decision making in either initiating or not initiating telehealth services when referred. Some of those factors could be addressed by policy makers and healthcare professionals in advance in establishing policies, developing detailed implementation strategies, and increasing effective communication to achieve higher initiation.

Results summary

The integrative review indicated that most HF patients have positive attitudes toward telehealth in general, although individuals have diverse concerns that may act as barriers to accepting telehealth at the time of discharge from hospital to home. Common factors found through the literature review could be summarized as either concerns related with use of equipment or technology, or concerns related to patient knowledge, costs, and privacy. Patients

concerns regarding change in current services or access to care by using telehealth were also identified as related to telehealth adoption.

The quantitative study using OASIS data found that certain patients' conditions or unique characteristics appeared to be associated with initiation of telehealth services at the point of referral. The findings indicate receiving high-risk drugs education by visiting nurses increased the odds of initiation while not receiving assistance from caregivers decreased the odds of telehealth initiation. Types of insurance also appeared to be associated with telehealth initiation, with the odds of initiation greater among patients with traditional fee for service Medicaid compared to other types of payment mechanism. Other factors, such as level of anxiety and respiratory treatment conditions were also associated with telehealth adoption. Patients who reported being anxious on a less than daily basis had increased odds of initiation compared to those who had no anxiety. Patients receiving any type of respiratory treatment at home also increased the odds of initiation compared to those without respiratory treatment. Some functional abilities such as requiring assistance for grooming or household tasks (light meal preparation, laundry, or shopping) were some other factors that decreased the odds of telehealth initiation among HF patients.

Some factors found in the qualitative study were found to be consistent with those found in the literature review, but this study provided new insights as well. Out of the four main elements of the UTAUT model, three (Performance Expectancy, Facilitating Conditions, and Social Influence) appeared to be associated with heart failure patients' telehealth initiation at home. Performance Expectancy can be described as perceived telehealth usefulness, and was found to affect telehealth adoption, which corroborates previous findings in the literature (Demiris et al., 2001; Rahimpour et al., 2008; Seto et al., 2010). Having an informal caregiver

around to support use of telehealth can be considered a defining characteristic of Facilitating Conditions, while the opinions of these caregivers characterizes Social Influence, and both constructs were found to impact telehealth initiation decisions. In contrast with the literature review, Effort Expectancy (perceived ease of use of the technology) did not appear to be associated with telehealth initiation, as all patients, regardless of initiation decision, appeared to think the technology would be easy to use. Other factors such as experience actually using telehealth, knowledge of HF and telehealth, confidence in self-management and use of technology, satisfaction with current services with visiting nurses, and attitude toward life and technology, may also influence telehealth adoption decision-making.

Understanding reasons for HF patients' telehealth initiation

The findings of this dissertation study shed additional light on potential reasons for telehealth initiation or non-initiation among HF patients receiving care at home. The findings from the integrative review indicate that although the majority of patients expressed positive attitudes towards the use of telehealth to manage their HF symptoms at home, there are still some factors such as concerns about the device or technology, and about service change that act as barriers that limit patients' adoption of telehealth at the time of referral. Findings from the mixed method study using quantitative and qualitative data analysis indicate that various patient related factors classified as elements in the UTUAT model, such as performance expectancy and facilitating conditions, might affect patients' decision to initiate telehealth.

Performance Expectancy

Performance Expectancy is the degree to which using a technology is expected to help in performing certain activities. Perceived usefulness is one of the root constructs of this element and patient interviews confirmed that it is related to telehealth adoption. Several studies

mentioned perceived telehealth usefulness and benefits as facilitators of telehealth initiation (Demiris et al., 2001; Rahimpour et al., 2008; Seto et al., 2010). The potential benefits perceived by patients were increased access to care, earlier indication of HF symptoms, and saving time and greater convenience (Hall et al., 2014). In this study, assisting with monitoring conditions and enhancing health were the benefits identified from patients. HF patients perceptions of the usefulness or benefits of telehealth in helping them monitor their condition and manage their health were associated with telehealth initiation activity. Likewise, if patients perceived that using telehealth would enhance their health or life expectancy, which is explained as outcome expectancy under the performance expectancy element of the UTAUT model, they were more likely to initiate telehealth.

Effort Expectancy

Effort Expectancy is the expected degree of ease associated with the use of telehealth. Although ease of use was one of the findings from the integrative literature review (Chapter 2), perceived ease of use of telehealth was expressed by all participants of this study, thus eliminating it as a contributing factor specifically for telehealth initiation among HF patients at home. As discussed in Chapter 4, the device used in this study was very simple compared to the technologies utilized in other studies that identified ease of use as a factor associated with telehealth initiation (Demiris et al., 2001; Seto et al., 2010). In contrast, general daily anxiety, not specific to technology, was found to be associated with telehealth decision-making. General daily anxiousness measured in the present study includes expressions such as worry that interferes with learning and normal activities, feelings of being overwhelmed and having difficulty coping, or symptoms of anxiety disorder (CMS, 2009). Patients, who reported experiencing general anxiety, though less often than daily, had increased odds of initiation

compared to those who reported no anxiety. Unlike computer anxiety, to our knowledge, general daily anxiety does not appear to have been studied and documented as well in the existing literature in relation to technology acceptance. Computer anxiety is defined as an individual's apprehension, or even fear, when she/he is faced with the possibility of using computers (Michael, Matthew, Mary, & Mary, 1987). In the UTAUT model computer anxiety was deemed a determinant of perceived ease of use and was reported having a negative affect toward computer use in an earlier model of technology acceptance (Venkatesh, 2000). However, it was removed from the current UTAUT model after further testing (Venkatesh et al., 2003). Nonetheless, computer anxiety has been reported in many studies to be a barrier to telehealth adoption (Hall et al., 2014; Rahimpour et al., 2008). It has also been reported as a factor related to early termination of telehealth use (Kavita et al., 2012).

Facilitating Conditions

Facilitating conditions is the degree to which an individual believes that technical and organizational infrastructure exists to support their use of the technology/system and perceives they have behavioral control when support is given. In this study, care availability was interpreted as a support that enhances patient behavioral control, and found to be associated with telehealth adoption decision-making. Not having informal care givers other than a home health aide was associated with lower likelihood of initiation in the quantitative analysis (Chapter 3), whereas the patient interviews indicated that having family and friends around to help was also associated with telehealth non-initiation (Chapter 4). Elements of caregiver support is discussed in more detail in Chapter 3, involving various aspects of support such as day-to-day monitoring of changes in health, adherence to dietary restrictions and medication regime, and taking emergency measures (Wingham et al., 2015). The item analyzed in the quantitative study only

addressed ADL assistance from the informal caregivers and therefore might not completely reflect the full range of caregiver support received at home. On the contrary, the qualitative study finding that having informal caregivers around was associated with telehealth non-initiation may be explained alongside anxiety findings from the quantitative study. Being anxious less often than daily was a factor increasing telehealth initiation compare to no anxiety. Having informal caregivers around may reduce the anxiety level therefore decreasing likelihood of telehealth initiation. Further research clarifying the relationship between informal caregiver support and telehealth acceptance would be useful.

The perceived availability of technical or clinical support from the provider was identified as a facilitator of telehealth adoption in this study group. Compatibility, which identifies how well patients see the device fitting in with the current home environment and is one of the root constructs of the Facilitating Conditions element, was also found to influence patient telehealth initiation. If the device were not compatible to the home environment where patients are using the system daily, e.g. no tables to put on the blood pressure cuffs and place arms, patients would not consider initiating telehealth. Home environment has been described to influence quality and safety of home health care services patients receive(Gershon et al., 2008; Henriksen, Joseph, & Zayas-Caban, 2009). Telehealth systems would be considered as a part of home environment once installed, therefore, it has to fit in to the current patients home environment to deliver quality and safe care at home.

Social Influence

Social influence is the degree to which an individual believes other people that are important in their life, such as their family or formal/informal caregivers or healthcare professionals, think that the patient should use the technology/system. Social influence was

found not to be a major factor that influenced HF patients' decision-making for telehealth initiation. This finding can be explained in part due to the special circumstances of HF patients receiving home care services. One of the eligibility criteria for home care is that a patient is homebound, which means most patients primarily stay at home other than going out for medical appointments. Considering that most patients interact with a limited number of people, they may not have many opportunities to discuss or exchange opinions with others regarding telehealth use. However, those few who did have an opportunity to discuss telehealth with others reported that the opinions of people they considered important in their lives mattered to them in making decisions.

Strengths and limitations

The key strength of this dissertation is the mixed method study design that allowed for the triangulation of methods and thus provides complementary evidence addressing the research questions. The quantitative study (Chapter 3) that was conducted prior to the qualitative study (Chapter 4) was able to provide some guidelines for purposive sampling of the interviewees to minimize potential biases. Another strength of this study is its analysis of both patients who did or did not initiate telehealth, in contrast to previous research that has only focused on patients who initiated telehealth. Use of a comprehensive theoretical framework (the UTAUT model) enabled this study to interpret findings in a more integrated way.

This dissertation has some limitations. Data for both studies were limited to one home care organization. Although it is one of the largest home care providers in the US, the population they serve largely resides in an urban area. Purposive sampling was used to balance the location of interview participants to minimize potential regional bias. While the UTAUT model was useful in selecting appropriate variables for the quantitative study, not all elements of the model

could be quantitatively evaluated due to data limitations. However, the qualitative study was able to address all four key elements of the theoretical framework, therefore enabling synthesis of the data based on the model. The literature review and the qualitative study were limited to the English language, thus the sample may not be representative of the broader patient population. However, the quantitative study included all other languages in the analysis and found that the language was not a significant factors associated with telehealth adoption in HF patients at home.

Implications

Despite the limitations highlighted, the findings of this dissertation study have direct implications for practice, policy, and future research.

Implications for practice

The study's findings indicate that intensive communication between healthcare professionals and HF patients at the time of referral and at the point of telehealth adoption could be a key success strategy to improve initiation rates. Communication has been identified as one of the factors affecting patient participation in telehealth (Hunting et al., 2015). However, the findings from this study suggest that not enough communication/education is done during the discharge and referral process to deliver telehealth benefits. Close communication with healthcare staff addressing telehealth benefits and features, including assurances that using telehealth would not change other current services nor the contact person, could help to remove some barriers identified in the present study. Telehealth has been used to increase communication with patients with different disease conditions and might increase access and convenience for patients with cardiovascular disease (Baker, Johnson, Macaulay, & Birnbaum, 2011). Explaining the specifics of telehealth benefits as a way to increase access to care and promote communication, especially through the more efficient sharing of quantitative biometric

data, could ease patients concerns about access to care and change to current established service, thus facilitating telehealth adoption by HF patients. To do so, adequate training for health care professionals are needed to deliver right messages at right time.

Implications for policy

Since CMS (CMS, 2016) announced the expansion of Medicare coverage for telemedicine use in healthcare settings, it is critical to discuss strategies to improve its adoption and usage. A policy statement from the American Heart Association categorized current barriers to implementation of telehealth into three main areas: legal/regulatory, technological, and financial (Schwamm et al., 2017). Although technology usability has been consistently documented as an influential factor in telehealth adoption and also reported in the literature review of this study (Chapter 2), our qualitative study found that it was not an influencing factor (Chapter 4). As discussed previously, instead of device ease of use, patients' feelings about their own ability to deal with technology was closely related to HF patients' telehealth initiation at home. Based on these findings, policy makers should focus on strategies to enhance patients' competencies in using telehealth devices while introducing simple technologies from the start. Building up patients' technology competency is a very complex issue needing interdisciplinary action, therefore the telehealth policy making process should involve not only doctors and IT professionals, but also nurses, social services staff, and formal/informal caregivers to more comprehensively capture the spectrum of patient needs.

One of the barriers to an interdisciplinary approach to making telehealth implementation policy and eventually achieving the Triple Aims of policy making that are cost, access, and quality is lack of a comprehensive organizational implementation model across the healthcare system including home health care. Under the triple aim, organizations accept responsibility for

all three aims for the population they serve. The organizations role, in this case the home care agencies, includes partnership with individuals and families, redesign of financial management, and delivery system integration (Berwick, Nolan, & Whittington, 2008). In the current environment of health care transformation in the US, telehealth can play a significant role through efficiently providing patient measured results to the interdisciplinary care team. They are able to respond to patients conditions in real time. However, as suggested by our study findings, patients need to be aware of the benefits of telehealth and have competency of using telehealth systems to adopt and use it. Thus, well-designed implementation processes that can address the communication and education needs of patients and build up patients' self-confidence involving various specialized health care professionals at the right point alongside the telehealth implementation process is necessary.

Financial issues were also identified in the literature review of this dissertation (Chapter 2) as a contributing factor to telehealth adoption, but were not an issue in the current study. This could be due to the study population having telehealth services paid for through the Bundled Payments for Care Improvement (BPCI) program. The BPCI program is an initiative with payment arrangements that include financial and performance accountability for episodes of care by the contracted organizations, with the aim of leading to higher quality and more coordinated care at a lower cost to Medicare (CMS, n.d.). As indicated by the American Heart Association, cost burden should not act as a barrier to patient adoption of telehealth services.

Implications for research

This study assisted in addressing a knowledge gap on the factors associated with HF patient telehealth initiation at home and also found areas that need further examination. In relation to patients' decision-making factors, additional research could be conducted to explore

other contributing factors, for example, whether patients' readiness for discharge is associated with telehealth acceptance. Beyond the patient level, as discussed in the limitations section of the quantitative study (Chapter 3), future research is needed to encompass a broader range of dimensions, from communication between patients and healthcare professionals to organizational processes and polices. Very few studies investigate perceptions of telehealth held by staff and referring providers, which could also work as a significant barrier to telehealth adoption. Examining organizational implementation processes, as a whole from referral to initiation would also be useful for identifying associated factors beyond the individual patient level. Finally, it is important to assess the impact of detailed policies and procedures for the initiation process and documenting reasons for refusal on telehealth initiation for HF patients at home.

In summary, this dissertation examined a variety factors that may influence HF patient telehealth initiation upon referral at home. Several key factors, such as patient perceptions of the usefulness and benefits of telehealth, the availability of technical/clinical support, and the favorable opinions of important people in a patient's life, were found to boost telehealth initiation. Informed by these findings, telehealth providers, policy makers, and researchers can improve communication between healthcare professionals and patients as well as develop tailored interdisciplinary policies and procedures to ultimately address potential disparities among older adult home care populations using technology.

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