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Justin Palmer
Rhode Island College, jpalmer_7065@email.ric.edu

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By

Justin Palmer

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HOMECARE NURSES' EXPERIENCES WITH HOME TELEMONITORING SYSTEMS

An Undergraduate Honors Project Presented

By

Justin Palmer

To

The Department of Nursing

Approved:

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Project Advisor   Date

_____   _____

Honors Committee Member   Date

_____   _____

Department Chair   Date

Abstract

To reduce healthcare costs and to better serve an aging population suffering from chronic disease, advancements in telemedicine like home telemonitoring are being used to improve the effectiveness of outpatient and homecare services. The purpose of this study was to expand upon the telemonitoring qualitative literature to describe home care nurses' lived experiences with a home telemonitoring program. Separate interviews with four homecare nurses currently employed by a visiting nurse service and working directly with home telemonitoring were conducted. The interviews were analyzed using a phenomenological framework to identify common themes. For these nurses the benefits of home telemonitoring were the same as the ways through which home telemonitoring works. These included early detection of signs and symptoms of disease exacerbation especially for congestive heart failure patients, improved coordination of care, improved disease self-management, and early detection of educational and self-care deficits from frequent contact with the telehealth nurse. Barriers to the effectiveness of telemonitoring included patient anxiety, patient physical or cognitive deficits, and technical limitations of the system. These findings increase the understanding of home telemonitoring from the perspective of nurses involved with its implementation and have implications for future research.

Keywords: home telemonitoring, telehealth, homecare, nurse perceptions, lived experiences

Homecare Nurses' Experiences with Home Telemonitoring System

In an effort to reduce the cost of healthcare and to better serve an increasingly aged population suffering from chronic disease an emphasis is being placed on improving the effectiveness of outpatient and homecare services through the use of advancements in telemedicine like home telemonitoring. What makes these types of programs effective or not, for whom these programs are effective, and what distinguishes an effective home telemonitoring program from an ineffective one is still undefined.

The Affordable Care Act requires most Americans to have health insurance or face financial penalties (Centers for Medicare and Medicaid Services, 2014). Under the law individual States are required to participate in the Federal Health Benefit Exchange or create their own. In these exchanges, individuals who could not otherwise afford coverage can purchase it at a reduced cost. Medicaid coverage was expanded to 133% of the federal poverty level. In addition, Section 3025 of the Affordable Care Act requires Medicare and Medicaid to reduce payments to hospitals with excess readmissions via a predetermined algorithm. The law defines a readmission as an admission to the same or different hospital within 30 days of discharge (Centers for Medicare and Medicaid Services, 2014).

This expanded coverage places additional stress on the healthcare system to provide care. This challenge is compounded by current trends toward an aging population and the accompanying increasing prevalence of chronic disease. A report issued jointly by the National Institute on Health, National Institute of Aging, World Health Organization, and U.S. Department of Health and Human Services estimated that in 2010 8% of world's population was aged 65 or older, and that percentage is expected to reach 16% by 2050 (2011). In the U.S. the number of adults aged 65 and over is also expected to increase dramatically. In 2012 the number of older adults was estimated to be 43.1 million; the U.S. Census Bureau projects this number to increase to 83.7 million by 2050 (Hogan, Ortman, & Velkoff, 2014). This dramatic surge in the number of older adults will challenge national infrastructures, particularly healthcare systems, to meet the unique needs of this demographic. Associated with this demographic shift is the rise in the prevalence of chronic diseases. In

2005 such diseases already affected 133 million Americans, and by 2020 that number is expected to increase to 157 million. The cost of treating chronic disease is already $277 billion annually (National Conference of State Legislatures, 2013). In response, chronic disease management programs are being developed and implemented.

Although individual chronic disease management programs vary, most promote one or more of the six primary components identified in the Chronic Care Model (CCM). The CCM was developed to improve the outcomes of patients with chronic disease by outlining a systematic approach to the creation of partnerships between the health system and the community (Dipnarine, Stellefson, & Stopka, 2013). The CCM is comprised of six primary components: the health care system and leadership environment that supports and encourages chronic illness care, interventions that support patient self-management and empowerment, clinical decision support that incorporates evidence-based practice guidelines, a delivery system designed to coordinate the actions of multiple caregivers, clinical information systems designed using a proactive approach to promote patient self-care, and linkages to community resources not otherwise provided by the healthcare organization. The reasoning behind this framework is that the interplay between these six concepts will create productive interactions between informed, active patients and a prepared, proactive healthcare team (Agency for Healthcare Research and Quality, 2015).

Research is ongoing into new ways to reduce healthcare costs and reduce hospital stays associated with chronic disease. Anctil, Kripalani, Theobald, & Vasilevskis (2014) conducted a literature review that examined current interventions to reduce persistently high hospital readmission rates. They found that programs most effective at reducing hospital readmissions incorporated multiple interventions (i.e., medication reconciliation, patient education, timely outpatient appointments, and follow-up telephone contact) into the discharge plan. Post discharge interventions with only a single component were unlikely to reduce readmission rates. Consequently, the role of home based services, information technology, mental healthcare, community partnerships, and transitional care personnel are being increasingly investigated.

In summary, the current demographic trends indicate a shift to an increasingly aged population afflicted with multiple chronic diseases. This shift coupled with expanded health insurance coverage for those who did not previously have access to healthcare threatens to place great strain on the healthcare system. To avoid such a significant burden on available resources, research into effective methods to reduce healthcare costs has become increasingly important. Telehealth has been touted as a promising new area to help reduce healthcare costs via utilizing the latest communications technology. Telemonitoring in particular, has held the promise of helping to reduce costly hospital readmissions and improving overall health while the patient continues to remain at home (Gaikwad & Warren, 2009). Whether home telemonitoring programs can live up to this promise and what factors influence the effectiveness or ineffectiveness of a program remain in question. Home care nurses often play an integral role in the daily operation of telemonitoring systems. Developing, implementing and evaluating telemonitoring systems based on an understanding of home care nurses' experiences with telemonitoring has the potential to enhance the effectiveness of home telemonitoring systems, as well as inform the research on these systems. The purpose of this study is to examine the lived experiences of homecare nurses involved with the day-to-day operation of telemonitoring systems in the homecare setting, and to describe their perceptions of telemonitoring as an addition to home care.

Literature Review

A literature review was conducted using the CINAHL Plus, Medline, PubMed, and Cochrane databases. Key search terms included: telehealth, telemedicine, telemonitoring, nurse, experiences, qualitative, effectiveness, and chronic conditions. Journal articles were limited to full text articles written within the past six years. Multiple articles were identified associated with these parameters. The literature review was limited to articles on the overall effectiveness of telemonitoring programs or influencing factors and to the focus of this study on the lived experiences of nurses involved in the daily operation of a home telemonitoring program.

Telemedicine, Telehealth, and Telemonitoring

Telemedicine is defined as the use of medical information exchanged from one site to another via electronic communications designed to improve a patient's clinical health status (American Telemedicine Association, 2015). This includes video conferencing with patients, transmission of images, e-health, remote monitoring of vital signs, wireless communications, and nursing call centers.

The term telehealth is often used interchangeably with telemedicine. However, some organizations use telehealth to refer to a broader definition of services that do not always involve clinical services (American Telemedicine Association, 2015). Both telehealth and telemonitoring make use of the same communications technology.

Telemonitoring can be considered a subdivision of telemedicine that involves the use of audio, video, or other telecommunication technologies to monitor patient status at a distance (Nangalia, Prytherch & Smith, 2010). While the exact components of telemonitoring systems vary depending on their purpose, most incorporate five components: data acquisition using an appropriate sensor, transmission of that data to a clinician, integration with other data describing the state of the patient, determination of an appropriate action, and data storage. Home telemonitoring utilizes this approach to monitor the condition of a recently discharged or chronically ill patient to detect changes in their health status early while they remain at home.

Target Populations of Home Telemonitoring

Wooten (2012) conducted a literature review focused on the usefulness of telehealth in the management of the common chronic illnesses of asthma, chronic obstructive pulmonary disorder COPD, diabetes, heart failure, and hypertension. Likewise, the majority of research on telemonitoring centers on home telemonitoring for patients with chronic diseases. Using the US National Library of Medicine's PubMed database, Gaikwad and Warren (2009) conducted a systematic literature review of 27 studies published between 2002 and 2007 that examined home based telehealth applications or approaches. Eight of these

studies directly examined home telemonitoring. Of these, the three most common areas for home telemonitoring intervention were for patients with asthma, (COPD), and heart failure.

Uses of Home Telemonitoring

Telemonitoring in home care usually incorporates monitoring devices for physiological data like pulse and blood pressure or for performance of important equipment such as pacemakers. The collected data is then transmitted to a remote monitoring service or healthcare provider via the domestic or mobile telephone service for evaluation (Nangalia, Prytherch, & Smith, 2010). This system is most often used to monitor the conditions of patients living with chronic diseases, such as congestive heart failure or COPD. Alternative uses for this technology have included monitoring fetal heart rates, levels of activity in the elderly, and recording of subjective patient data through responses to pre-set questions related to their condition.

Atkin and Barrett (2012) described how such a system works in practice for patients diagnosed with heart failure. The patient is provided with a body weight scale, a sphygmomanometer and a central telemonitoring device. This device is often a stand-alone box, which reminds patients to complete their recordings, collates data, and asks a series of questions about symptoms. This information is then sent to a central server where it is processed. Patient data are compared against parameters set by healthcare practitioners and, if any readings are abnormal, the system activates an alert. The alerts generated by the system are then reviewed by a healthcare provider and triaged based on the severity of the patient's condition, with follow up care ranging from a phone call to a visit from a provider (Atkin & Barrett, 2012).

Additional care beyond those prompted by alerts is also provided to patients receiving telemonitoring home care. A study conducted by Holman, Ray, Scherubel, and Wakefield (2013) sought to define and analyze patient problems and nursing actions delivered in a home telemonitoring program focused on chronic disease management for patients with comorbid diabetes mellitus and hypertension. The data was drawn from a single-center, randomized,

controlled clinical trial at a Veterans Affairs (VA) outpatient clinic in New York evaluating the use of a messaging device and comparing outcomes of patients receiving usual care with case management, low-intensity telemonitoring, and high-intensity telemonitoring. A total of 2,336 actions taken by nursing staff for the two intervention groups were recorded over the course of the study. The most frequent action taken by the nursing staff was contacting the primary care provider and providing lifestyle information related to diabetes and hypertension. The most frequent mode of contact was mailing of standardized health education (i.e. diet education) letters to participants. Nurses also communicated with patients via the integrated messaging device, telephone calls, and email.

Effects of Telemonitoring Programs

Baker et al. (2013) utilized a retrospective matched cohort study of 1,767 Medicare beneficiaries in the northwest United States receiving treatment for congestive heart failure, chronic obstructive pulmonary disease, or diabetes mellitus receiving home telemonitoring linked to care managers over the telephone. After two years the mortality, inpatient admissions, hospital days, and emergency department visits of these patients were measured. For patients enrolled in the home telemonitoring program the overall all-cause mortality was found to be 15% less and hospital admissions were 18% less than the control group receiving only case management. No correlation was found for Emergency Department (ED) usage or total inpatient hospital days.

Chuang, Chumbler, Huanguang, Wang, & Wu (2009) examined the effect of a home telemonitoring system on the reduction of preventable hospitalizations for patients with diabetes mellitus. In this case, a retrospective matched treatment-controlled study of 387 veterans over a four-year period was used. It was found that the Veterans Administration (VA) Care Coordination Home Telehealth (CCHT) program reduced preventable hospitalization use and decreased direct and indirect healthcare costs.

Orwat and Tompkins (2010) conducted a randomized controlled trial of Medicare patients diagnosed with heart failure. In this study 390 participants were randomly assigned

to standard care or a telemonitoring program for six months. After the experimental period, inpatient hospital days, ED visits, urgent care, and primary care utilization were analyzed for both groups. It was found that patients assigned to the telemonitoring program had fewer hospital days and ED visits, but more frequent urgent and primary care visits (Orwat & Tompkins, 2010).

Abbatecola, Antonicelli, Mazzanti, & Parati (2010) also conducted a randomized controlled trial of the effect of telemonitoring systems on reducing preventable hospitalizations for patients with heart failure. A total of 57 patients participated in this study, 29 of these patients were assigned to the experimental group and received a home telemonitoring system that prompted patients to measure their blood pressure, pulse, oxygen saturation, and daily weights, which were evaluated by a trained nurse within a few hours. Patients in the control group, however, were taught to follow their own weight and symptoms, and received regular home visits. Included in their experimental criteria was telemonitoring's effect on patient adherence to a prescribed treatment regimen. At the end of a twelve-month period, patients utilizing the telemonitoring system had a significant increase in the use of Beta Blockers, statins, and aldosterone receptor antagonists, as well as a significant decrease in the use of nitrates, compared to the control group who received routinely scheduled clinic visits. Inpatient hospitalizations and mortality were also less for patients utilizing the telemonitoring system compared to the control group.

Similarly, Boxer et al. (2013) conducted a randomized controlled study of 99 patients referred to six Ohio based home health care agencies after discharge from a hospital with a diagnosis of heart failure. Outcome criteria for the study were all cause hospitalizations, emergency/urgent care visits, and death. Also measured were responses collected from the home health questionnaire completed at the time of discharge from the home health care agency. Upon completion of the study it was determined there was no significant difference in the time to re-hospitalization or ED visits between the group receiving home telemonitoring and the group receiving regular visiting nurse homecare. Older adults in the

telemonitoring group, however, did report better health status by home health discharge than the control group.

Desai, Spettel, & Wade (2011) performed a randomized clinical trial placing 164 patients with heart failure into a telemonitoring program with case management versus 152 patients with heart failure receiving case management alone. After a six month period the two groups were evaluated for all cause hospitalization, ED visits, and death. Although the telemonitoring system did prompt more phone contact with case managers, the reduction of morbidity and mortality was not statistically significant between the two groups.

A larger scale randomized clinical trial performed by Chaundry et al. (2010) utilized a total of 1653 patients recently hospitalized for heart failure. The subjects were divided into two groups: one group of 826 received telemonitoring while the other group of 827 received usual care consisting of educational materials also provided to the telemonitoring group and a scale. Primary end points for the study were hospital readmission for any reason or death within 180 days of enrollment. Secondary endpoints included hospitalization for heart failure, number of days in hospital, and number of hospitalizations. After analysis it was found that there was no significant difference between the two groups for either the primary or secondary end points.

Results from clinical trials investigating this topic have been mixed at best. The majority of the studies utilizing a more rigorous research design seem to indicate no significant difference in re-hospitalization rates between patients receiving telemonitoring vs. standard post-discharge home care. It should be noted, however, that several of these studies reported some secondary benefits such as independent recognition and management of symptoms and increased satisfaction for patients receiving home telemonitoring.

Health Care Professionals' and Patients' Experiences with Home Telemonitoring

Qualitative research has been conducted to examine the perceptions and experiences of patients and healthcare professionals including nurses involved with the daily operation of telemonitoring programs. Denvir et al. (2012) sought to identify the views of both patients

and healthcare professionals, including a General Practitioner (GP), two Congestive Heart Failure (CHF) nurses, and an information technology professional, involved with home telemonitoring for patients diagnosed with chronic heart failure (HF) on the system's perceived acceptability and usefulness in their day to day care. Semi-structured interviews were conducted with 18 HF patients and 5 professionals. After analyzing the interviews it was found that although telemonitoring was popular with patients because of the reassurance they felt from what they thought was continuous practitioner surveillance; professionals were concerned by the perceived patient dependence on practitioner support rather than independent management. Professionals were also concerned about the increased workload placed upon them by the telemonitoring system, and both patients and health professionals expressed the need for improved technology and changes to service provisions.

Expanding on the concerns raised by professionals that patients may become overly reliant on telemonitoring support, Cowie, Gabe, and Riley (2012) sought to explore the extent to which telemonitoring in patients with HF empowered them to self-care. They conducted interviews with fifteen patients at three and six months of telemonitoring. At the end of this period the researchers found that patients had improved their self-care skills working with the telemonitoring system and learned to link their symptoms to the telemonitoring data, and became more knowledgeable of their condition through conversations with the telehomecare nurse.

Finnie et al. (2012) interviewed 11 physicians and 5 nurses about their attitudes toward home telemonitoring for their patients. From these interviews the researchers were able to identify providers' views that telemonitoring is most appropriate for certain types of patients, specifically older patients with chronic conditions requiring frequent monitoring. In addition, patients were reassured by the frequent contact with a provider, which made the providers feel better in turn. While some providers felt that some data associated with telemonitoring was excessive, others felt that the frequent contact improved their clinical decisions by providing earlier detection of serious problems. Physician style appeared to affect preferences in reviewing data and using information obtained during telemonitoring.

Some physicians who preferred to have a more active role in day-to-day monitoring of their patients' conditions were more willing to use telemonitoring systems if they had the option to closely review the collected data and to take a primary role in management decisions. While other physicians who preferred a more hands-off approach were more receptive to telemonitoring if they were only primarily involved in critical management decisions. This difference in style may have important implications in provider willingness to use telemonitoring for their patients (Finnie et al., 2012).

Brewster, Hawley, Kelley, Mountain, and Wessels (2013) sought to identify factors affecting provider acceptance of telemonitoring systems using a mixed method review of fourteen previous studies. Several main factors affecting health professionals', involved with the direct delivery of telehealth or associated patient care, acceptance of patient care were identified. The healthcare teams involved with direct delivery of telehealth incorporated members from multiple disciplines. Although job titles varied throughout, nurses were significant contributors. Healthcare personnel were less likely to accept telemonitoring's use in practice if they experienced changes to caseload management or had a poor experience with initial implementation, interoperability, user-friendliness, or technical issues. While staff commented that they gained job satisfaction from having the opportunity to have face-to-face contact with patients, they often felt that automated measurements were not relevant or not needed, and they were not confident about the safety and reliability of the equipment. Strong leadership, service co-design, and staff training improved acceptance of new systems.

Similarly, Bardsley et al. (2012) explored barriers to the adoption of telemonitoring. They found certain themes associated with patients' non-participation and withdrawal from the program. These included requirements for technical competence and operation of equipment; threats to identity, independence and self-care; and expectations and experiences of disruption to services.

In summary, qualitative studies of the experiences of both staff and patients involved with home telemonitoring programs indicate that when implemented properly these programs can empower patients' self-care and improve health status. The research also indicates that

the attitudes and style of staff implementing the program have a significant impact on its acceptance and effectiveness. In addition, there are a number of secondary benefits such as self care empowerment and provider reassurance gained by patients receiving home telemonitoring that have not been fully studied. The purpose of this study is to expand upon these qualitative findings to describe the lived experiences of frontline nurses involved with the day-to-day operation of telemonitoring systems and their perceptions of telemonitoring as an addition to home care.

<div align="center">**Theoretical Framework**</div>

The theoretical framework for this study is phenomenology. Phenomenology takes the position that the most basic human truths are accessible only through inner subjectivity, and that the person is integral to the environment (Flood, 2010). There are two main schools of phenomenology, descriptive and interpretive (Cooney, Dowling, Sixsmith, & Tuohy, 2012). The focus of descriptive phenomenology is to bring out the essential components of the lived experiences specific to a group of people. To avoid influencing the experiences of their subjects, researchers must shed all prior personal knowledge of the subject, biases, and preconceptions through a process called 'bracketing.' The process of bracketing involves setting aside natural, every day assumptions in an attempt to get back to a pre-reflective state to describe the phenomenon in its purest form as it occurred before being corrupted by attitudes, prejudices, and other influencing factors. In contrast, the aim of interpretive phenomenology, also called hermeneutics, is to describe, interpret, and understand the experiences of the participants. This approach identifies that an individual's subjective experience is inextricably linked with their social, cultural, and political context. So the focus of interpretive phenomenological research is to examine the meaning of a person's experiences, and how this meaning influences their choices. The primary tool for data collection in phenomenological studies is the interview, which is a reflective process requiring the collaboration of both the researcher and the subject (Flood, 2010). The interview process requires only a general plan for its direction but will pass through three

structured stages; the establishment of the context of the participant's experience, construction of that experience, and reflection on the meaning of that experience.

Once the data has been collected several analytical frameworks can be used to determine its meaning. In the hermeneutic approach, analysis is done to obtain a valid and common understanding of meaning of the recorded text (Flood, 2010). The first step in this process is to read through the material several times in an attempt to grasp its meaning. Then a structural analysis is performed to analyze the text for recurrent themes, which are then condensed into central and sub themes. The final step is to formulate an interpreted whole, where all themes are summarized and reflected on in relation to the research question and context of the study.

Another approach is Giorgi's method, which is used to arrive at meanings and reveal the phenomena under question (Flood, 2010). The first task in this analysis is to read through the collected material to get a sense of the whole while performing bracketing. The collected transcripts from the interviews are then read and re-read to identify areas that exemplify the experiences of participants in relation to the phenomena under investigation. The researcher then integrates these disparate sections and relates them to the research questions to generate final themes. These themes are then enumerated and described in relation to the specific research situation.

Methods

The purpose of this study was to describe the lived experiences of nurses involved with the daily operation of telemonitoring systems in a homecare setting and examine their perceptions of telemonitoring as an addition to homecare from a phenomenological framework. Specific research objectives included:

1. Describe nurses' views of the benefits and disadvantages for patients and providers of a home telemonitoring system.
2. Identify the nurses' view of patient populations who receive the most benefit from home telemonitoring.

3. Identify nurses' perceptions of barriers to usage of home telemonitoring systems.

4. Describe the nurses' perceptions of specific ways that home telemonitoring contributes to patient care.

5. Identify nurses' perceptions of the characteristics of an effective home telemonitoring program.

6. Describe challenges that the nurses have encountered.

Approval for this research project was obtained from the Institutional Review Board (IRB) at Rhode Island College in April 2015. The main ethical consideration identified was confidentiality of participants' identities and responses. Procedures were carried out in accordance in IRB guidelines, and approval from the participating agency was obtained prior to recruiting participants.

Participants were recruited via email and flier from a not-for-profit homecare agency in southern Rhode Island. Information describing the research study and what to expect during the interview process was included in the recruitment materials (Appendix B). Eligible participants were limited to Registered Nurses currently working in homecare. Participation in the study was entirely voluntary, and participants were advised that they could abandon the interview at any time. The consent form and information about the study was provided to each participant before the start of the interview. Participants' interview responses were kept private, with recorded information stored on a password-protected computer. Each participant was assigned a random case number for identification. Participants were asked to respond to 16 questions from an IRB approved interview questionnaire (Appendix A) designed to elicit information about their backgrounds in nursing and homecare and their personal experiences with home telemonitoring. Interviews were audio recorded for later reference.

A total of four participants were interviewed at a time and place of their choosing. Each interview ranged in length from 20-40 minutes. The audio recordings of these interviews were then replayed at a later date and analyzed for content. Brief summaries of each nurse's responses to each individual research question were then recorded and compared against one another for similarities and disparities. Similar responses among all the nurses were

considered primary themes, and individual or atypical responses were considered secondary themes. The audio recordings were then replayed and compared against the identified themes for additional details. From the data the primary and secondary themes were further compared with the findings of studies identified in the literature review to see if the findings were consistent with previous research.

Results

Overview of the Telemonitoring Program

In this program, patients received home telemonitoring in conjunction with regular visits from a homecare nurse. Referrals to this particular program came primarily from nurse case managers preceding discharge from a hospital. Patients performed daily health checks each morning as soon as they woke up. The home telemonitoring system used by this agency incorporated a central unit that provided automated instructions and pre-programmed symptom or general condition questions to patients. The central unit then measured, recorded, and transmitted collected patient data via landline to the agency for analysis. Specific health indicators (e.g., blood pressure, weight or prompts) could be added or removed from the system according to each patient's needs. Any abnormal measurements or responses were flagged by the system and evaluated by a dedicated telehealth nurse. This nurse also acted as a resource to both patients and staff for system questions. Response to an abnormal reading was determined by the telehealth nurse and could range from a phone call from the nurse, visit from a homecare RN, or follow-up visit with the patient's primary care provider, depending on severity.

Educational Background and Experience in Nursing

Three of the four nurses interviewed had received an Associate's degree in nursing as their highest level of education, and the fourth had received a nursing diploma. The four nurses' levels of experience varied significantly, ranging from 6-55 years working in nursing. Their respective levels of experience working in homecare ranged from 3-36 years, and experience working with telemonitoring systems ranged from 3-15 years. One nurse with 55

total years of nursing experience had spent the last 15 years working as a dedicated telehealth nurse for the homecare agency.

Benefits of Home Telemonitoring and the Ways Through Which it Works

For these nurses the benefits of home telemonitoring were the same as the ways through which home telemonitoring works. All four of the nurses identified early detection of changes in a patient's condition as the primary benefit of home telemonitoring. This benefit was repeatedly emphasized as extremely important among CHF patients with whom early detection of CHF exacerbation, such as increasing shortness of breath and rapid weight gain recorded during the daily telemonitoring screenings, was crucial in preventing hospital re-admissions and promoting patient health, overall. In many cases a nurse made a home visit to in order to conduct a more detailed assessment as soon as possible. Arrangements for early and minimally invasive interventions could be made before a serious adverse health event occurred. All of the nurses strongly felt that use of the telemonitoring system among these patients prevented hospitalizations.

Three of the four nurses interviewed also identified a secondary benefit of improved coordination among providers. Two of the nurses stated that they were able to communicate with the provider on behalf of the patient by presenting the collected telemonitoring data, expediting the time it took to meet with the provider and receive treatment. The dedicated telehealth nurse also stated that the frequent telephone contact with telemonitoring patients provided her an opportunity to pick up on easily overlooked functional or educational deficits based on conversations with telemonitoring patients and then coordinate with the appropriate member of the patient's care team to address these deficits. She further emphasized that it was critical for an RN to analyze patient data and to make frequent patient contact, stating;

> "I think it has to be a nurse at the other end calling every day. Everyone assumes all programs are the same. They are not, because putting a telemonitoring system in the home and asking patients to take responsibility is no different than putting a scale and they don't do it (sic)"

All of the nurses believed that use of the telemonitoring system had positively affected the health of their patients and had helped to avoid re-hospitalizations. Two of the nurses also stated that telemonitoring had improved their patients' self-care ability helping patients recognize abnormal signs and symptoms, as well as reinforcing positive behaviors by tracking positive improvements and displaying consequences from negative behaviors. One nurse said of CHF patients, "They can see that when I eat salty food my weight is up the next day and I'm a little more short of breath… and they don't believe that until they see the proof.".

Each of the nurses interviewed agreed that the primary benefit of home telemonitoring was having the daily checks on the patient, rather than once or twice weekly as is most often the case with traditional homecare, and the ability to follow trends in patients' vital signs. Two of the nurses also reported that having the daily contacts with the patient helped to detect subtle changes in the patient's condition and to establish a better rapport with the patient as compared to homecare alone during which the frequency of visits is often weekly. One nurse stated that having the collected telemonitoring data available helped her prioritize patients during her day based on severity of the collected patient data.

Again, all of the nurses interviewed emphasized the importance of daily contact with the patient and early detection of deterioration in the patient's condition. Two of the four also stated that home telemonitoring worked through facilitating communication among healthcare providers. One also stated that telemonitoring in comparison to home care alone, promoted more cost effective care, with more frequent patient contacts, and without the added cost of physically sending a nurse to the home.

Disadvantages

The nurses identified that the main disadvantage to use of the system was patient anxiety from using the system. Three nurses identified that some patients are very uncomfortable with the technology or disruption in their routine and may have altered readings or even have their conditions exacerbated from the stress. Patient safety concerns

while using the body weight scale were expressed by several nurses. One nurse further elaborated that patients with Parkinson's disease were unable to use the telemonitoring system effectively due to psychomotor deficits.

In one nurse's experience, patients who were more interested in managing their own care typically experienced less anxiety using the system than those who relied on others to do so or than those who had a more laissez faire attitude toward management of their condition. Another stated that she looked at the patient's medical history for factors that may contribute to the patient's anxiety using the telemonitoring system, "It might be a patient who lives alone and/or anxiety or depression is a part of their diagnosis." None of the other nurses were able to identify any predictive factors or common characteristics among patients who experienced anxiety.

Patient Populations who Benefit the Most

All four nurses again identified CHF patients as receiving the most benefit from telemonitoring. The nurses identified older adults between the ages of 80-95 as the primary age group, utilizing telemonitoring. Several nurses also identified patients with COPD, diabetes and kidney disease as benefiting from telemonitoring. A single nurse stated that she believed that any population that could benefit by more frequent contact with a healthcare provider should receive telemonitoring.

Patient Barriers to Effective Use of Home Telemonitoring

The main physical barriers interfering with effective home telemonitoring use by patients mentioned by the nurses were problems with visual acuity, endurance, and balance. The presence of these issues led to improper use of the telemonitoring equipment and inaccurate data. Patient mental barriers identified by the nurses included forgetfulness, dementia, and anxiety. Three of the nurses emphasized anxiety while using the system as a persistent problem amongst their elderly clients. Two of the nurses stated that the presence of a caregiver in the home helped reduce the impact of these physical and mental barriers.

Technical Features

The most important feature of an effective system identified by the nurses was reliability of the system to collect and transmit patient data. Additional emphasis was placed on a user-friendly interface that is simple for patients to learn and use on a daily basis.

Challenges

The main technical challenge identified by the nurses was learning how to use and program the system. Challenges were also identified with occasional system glitches causing inaccurate recording or data not being transmitted. Three out of the four nurses voiced dissatisfaction with the use of telephone landlines for transmission of data. One nurse also expressed dissatisfaction with the system's inability to display the collected patient data on nurses' laptops in the field.

Two out of the four nurses stated that occasionally physicians do not want to receive daily updates on their patients' conditions. Overall, however, the nurses reported no other challenges with the system and encouraged its widespread use. One nurse added that 40% of the requests for patients to be placed on home telemonitoring come from nurses with the remainder coming from physicians, patients, or other sources. All of the nurses reported satisfaction with the system.

When asked about future improvements to the telemonitoring systems the nurses' responses focused on improving the technical capabilities of the system. One nurse suggested incorporating video capabilities to perform more complex assessments. Another suggested that future systems should be wireless and easier to program. Three out of the four nurses believed that telemonitoring systems should be utilized on a larger scale and incorporated into more homecare protocols**.**

<div align="center">**Discussion**</div>

All participants interviewed were experienced nurses with at least 5 years of experience as a nurse, and several years of work experience working in homecare with the home telemonitoring systems. The highest level of education obtained by any of the nurses was an Associate's degree or Diploma in nursing. Their extensive experience working with

the telemonitoring system provided them with valuable insights on telemonitoring as an addition to homecare.

Much of the data collected from the interviews was consistent with current research on home telemonitoring. For instance, all of the nurses identified elderly CHF patients as benefiting from use of home telemonitoring, consistent with most ongoing research into the topic (Joanna Briggs Institute, 2011). Also, early identification and intervention in response to symptoms of CHF exacerbation were emphasized during the interviews as the primary functional mechanism of home monitoring (Finnie et al., 2012).

Additional benefits for patients identified by the nurses interviewed included better self-management of their condition, and the ability to see data reflecting the consequences of their actions both positive and negative. Nurses reported that patients also felt reassurance from the frequent contact and daily monitoring of their condition, however, direct patient contacts were not included as a part of this study to verify this belief. These additional benefits of a telemonitoring program are also in agreement with existing research on the topic (Cowie, Gabe, & Riley, 2012). Patient dependence on telemonitoring seen in other studies (Denvir et al., 2012) was not a concern raised by any of the nurses during the interviews.

Several patient barriers were apparent from the nurses' responses, with the most prominent barrier being patient anxiety using the system either from disruption in routine or unfamiliarity with the technology. Some research has already identified anxiety or reluctance as barriers to effective patient utilization of the system (Bower et al. 2012), but neither the existing literature nor the interviewed nurses could clearly identify common predictive factors of patient anxiety with the system. The physical barriers to patient acceptance and implementation of the telemonitoring system associated with vision, balance, and dexterity problems were expected along with other common disorders associated with age such as dementia and forgetfulness. It was noted, however, that several of the nurses stated that in their experience the presence of a caregiver in the home helped improve system acceptance even with these barriers. None of the research included in the literature review had examined this phenomenon.

Technical challenges for the nurses involved difficulty learning to use and program the system. Additional problems listed by the nurses usually involved faulty transmission of data and reliance on a landline. Studies comparing the wireless and non-wireless systems were not examined. Improvements suggested by the nurses included remote viewing of data trends for nurses in the field, increasing the capabilities of the system with video and modular designs, and improving ease of use.

Each of the nurses found that in their experience the use of home telemonitoring was well accepted among healthcare providers. In this agency, nurses did not report any concerns about increases in case load or concerns about the safety or reliability of the system. Although the homecare nurses still relied on face-to-face contact with patients, telemonitoring was valued as a cost effective adjunct to patient homecare. It appears that the design and implementation of telemonitoring within this program was successful at avoiding several barriers to staff acceptance previously identified by Brewster, Hawley, Kelley, Mountain, & Wessels (2013).

Several of the nurses reported that a few providers did not want to receive daily trends in vital signs collected from their patients. This resistance to additional patient data was previously examined and was an expected finding (Finnie et al., 2012). Some of the nurses expressed that the majority of requests for telemonitoring came from nurse case managers and that telemonitoring is a primarily nurse driven intervention.

From the interviews several additional themes beyond the technical telemonitoring system were identified. The studied program utilized a single telehealth nurse to coordinate and follow-up with patients receiving home telemonitoring. This nurse identified that through her daily telephone contact with patients she is able to identify easily missed deficits in patient care and understanding, and provide coaching and continuing education. In addition, all of the nurses identified improved coordination of care with other providers as another important benefit to their program. The incorporation of multiple interventions beyond only monitoring trends in vital signs was also previously identified as a key factor in other telemonitoring programs (Anctil, Kripalani, Theobald, & Vasilevskis, 2014).

Limitations

The main limitation to this study is its scope. Only four nurses from a single home telemonitoring program were interviewed, and their experiences may not be representative of other programs with different methods of homecare delivery. Other limitations include the study method which utilizes qualitative methodology to describe lived experiences, but cannot be used to definitively prove any identified themes. The authors of this study declare no potential conflicts of interest, authorship, or publication.

Conclusions

The lived experiences of the nurses in this study were that home telemonitoring was helpful in early detection of changes in a patient's condition, potentially resulting in reduced re-hospitalizations specifically among elderly CHF patients. The nurses also identified several additional benefits including improved coordination among healthcare providers, identification of easy to miss gaps in education or self-care through frequent telephone contact with a dedicated telehealth nurse, and improvements in patients' abilities to manage their condition. Several patient barriers were also identified including patient anxiety, and physical and cognitive impairments. Nurses identified that home telemonitoring was primarily a nurse driven intervention, but was widely accepted amongst most providers. Technical challenges identified in the interviews involved system design, user friendliness, and problems with data transmission.

Recommendations for Future Research

Areas for future research may include comparing home telemonitoring programs with and without a dedicated home telemonitoring nurse making frequent telephone contact with patients to determine the effects on patient outcomes. Other studies may look to identify commonalities in patients who experience severe anxiety while using the home

telemonitoring system. Also, the role of caregivers in relation supporting the use of telemonitoring with patient populations who experience barriers related to the use of telemonitoring should be explored. The findings of this study identify some of the ways through which home telemonitoring may work, The extent to which early detection of signs and symptoms of disease exacerbation, coordination and prioritization of care, disease self-management, and early detection of educational and self-care deficits are associated with program outcomes such as hospitalizations and emergency room visits should be investigated.

References

Abbatecola, A. M., Antonicelli, R., Mazzanti, I., & Parati, G. (2010). Impact of Home Patient Telemonitoring on Use of Beta-Blockers in Congestive Heart Failure. *Drugs and Ageng*, 801-805.

Agency for Healthcare Research and Quality. (2015, May 4). *An overview of chronic care model*. Retrieved from cahps.ahrq.gov: https://cahps.ahrq.gov/quality-improvement/improvement-guide/browse-interventions/Communication/Planned-Visits/Chronic-Care-Model.html

American Telemedicine Association. (2015, 1 18). *What is Telemedicine?* Retrieved from americantelemed.org: http://www.americantelemed.org/about-telemedicine/what-is-telemedicine#.VLtQV9LF_CA

Anctil, B., Kripalani, S., Theobald, C. N., & Vasilevskis, E. E. (2014). Reducing hospital readmissions: Current strategies and future directions. *Annu Rev Med*, 471-485.

Atkin, P., & Barrett, D. (2012). Benefits of telemonitoring in the care of patients with heart failure. *Nursing Standard*, 44-48.

Baker, L. C., Birnbaum, H. G., Diener, M. D., Johnson, S. J., Macauley, D. S., & Sorg, R. A. (2013). Effects of Care Management and Telehealth: A Longitudinal Analysis Using Medicare Data. *American Geriatrics Society*, 1560-1567.

Bardsley, M., Barlow, J., Bowen, R., Bower, P., Cartwright, M., Chrysanthaki, T., . . . Sanders, C. (2012). Exploring barriers to participation and adoption of telehealth and telecare within the Whole System Demonstrator trial: a qualitative study. *BMC Health Services Research*, 1-12.

Bolton, C. E., Conley, E. C., Elwyn, G., Evans, R., Grey, A., Hardisty, A. R., . . . Yousef, Z. (2011). Detecting deterioration in patients with chronic disease using telemonitoring: navigating the 'trough of disillusionment'. *Journal of Evaluation in Clinical Practice*, 896-103.

Bower, P., Bowen, R., Cartwright, M., Fitzpatrick, R., Hirani, S., Rogers, A., . . . Newman, S. P. (2012). Exploring barriers to participation and adoption of telehealth and telecare within the Whole System Demonstrator trial: a qualitative study. *BMC Health Services Research*, 1-12.

Boxer, R. S., Dicarlo, C. M., Kikano, G., Madigan, E., Pina, I. L., Schmotzer, B. J., & Struk, C. J. (2013). Home health care with telemonitoring improves health status for older adults with heart failure. *Home Health Care Service Quarterly*, 57-74.

Brewster, L., Hawley, M., Kelley, C., Mountain, G., & Wessels, B. (2013). Factors affecting frontline staff acceptance of telehealth technologies: a mixed-method systematic review. *Journal of Advanced Nursing*, 21-32.

Centers for Medicare and Medicaid Services. (2014, April 30). *Readmissions Reduction Program*. Retrieved July 11, 2014, from www.CMS.gov: http://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/AcuteInpatientPPS/Readmissions-Reduction-Program.html

Chamoff, B., & Shea, K. (2012). Telehomecare Communication and Self-Care in. *Worldviews on Evidence-Based Nursing*, 109-116.

Chaudhry, S. I., Cooper, L. S., Curtis, J. P., Hodshon, B. V., Herrin, J., Krumholz, H. M., . . . Phillips, C. O. (2010). Telemonitoring in patients with heart failure. *New England Journal of Medicine*, 2301-2309.

Chuang, H.-C., Chumbler, N. R., Huanguang, J., Wang, X., & Wu , S. S. (2009). Long-term effect of home telehealth services on preventable hospitalization use. *Journal of Rehabilitation Research and Development*, 557-566.

Cooney, A., Dowling, M., Sixsmith, J., & Tuohy, D. (2012). An overview of interpretive phenomenology as a research methodology. *Nurse Researcher*, 17-20.

Cowie, M. R., Gabe, J., & Riley, J. P. (2012). Does telemonitoring in heart failure empower patients for self-care? A qualitative study. *Journal of Clinical Nursing*, 2444-2455.

Denvir, M., Fairbrother, P., Hanley, J., McCloughan, L., Sheikh, A., & Ure, J. (2012). Telemonitoring for chronic heart failure: the views of patients and healthcare professionals - a qualitative study. *Journal of Clinical Nursing*, 132-144.

Desai, A. S., Spettell, C. M., & Wade, M. J. (2011). Telemonitoring With Case Management for Seniors with Heart Failure. *THE AMERICAN JOURNAL OF MANAGED CARE*, 71-79.

Dipnarine, K., Stellefson, M., & Stopka, C. (2013). The chronic care model and diabetes management in US primary care settings: A systematic review. *Preventing Chronic Disease*, 1-21.

Finnie, D. M., Hanson, G. J., Hathaway, J. C., Pecina, J. L., Takahashi, P. Y., & Vickers, K. S. (2012). Health care providers style may impact acceptance of telemonitoring. *Home Health Care Management Practice*, 276-282.

Flood, A. (2010). Understanding phenomenology. *Nurse Researcher*, 7-15.

Gaikwad, R., & Warren, J. (2009). The role of home based information and communications technology interventions in chronic disease management: A systematic literarure review. *Health Informatics Journal*, 122-146.

Holman, J. E., Ray, A. R., Scherubel, M., & Wakefield, B. J. (2013). Nursing Interventions in a Telemonitoring Program. *Telemedicine and e-Health*, 160-165.

Joanna Briggs Institute. (2011). Structured telephone support or telemonitoring programmes. *International Journal of Evidence-Based Healthcare*, 274-275.

Nangalia, V., Prytherch, D. R., & Smith, G. B. (2010). Health technology assessment review: Remote monitoring of vital signs- current strategies and future challenges. *Critical Care*, 14:223.

National Institutes of Health; National Institute on Aging; World Health Organization; U.S. Department of Health and Human Services. (2011). *Global health and aging*. National Institute of Health

Orwat, J., & Tompkins, C. (2010). A Randomized Trial of Telemonitoring Heart Failure Patients. *Journal of Healthcare Management*, 312-322.

US Department of Health and Human Services. (2009). *Telehealth Report to Congress*. phe.gov.

Wootton, R. (2012). Twenty years of telemedicine in chronic disease management - An evidence synthesis. *Journal of Telemedicine and Telecare*, 211-220.

Interview Questionnaire

1. How many years have you worked in nursing?

2. What is your educational background in nursing?

3. How many years have you worked in home healthcare?

4. How long have you worked with telemonitoring?

5. What do you view as the benefits of home telemonitoring for patients? Please describe these benefits

6. What specific populations or types of patients have you found receive the most benefit from home telemonitoring? Please describe these types of patients.

7. What do you view as the benefits of home telemonitoring are for nurses? Please describe these benefits.

8. Do you see any disadvantages with using telemonitoring? Please describe these disadvantages .

9. In your experience, what types of barriers do patients using the system usually encounter?

10. Through what specific ways or mechanisms do you think home telemonitoring works?

11. Describe how you think telemonitoring has affected the health of your patients.

12. What do you think are the key characteristics of an effective telemonitoring system?

13. Describe the technical challenges you have encountered while using the system.

14. While operating the system on a day-to-day basis, are there any other challenges you have encountered with the system, patients, or other healthcare professionals? If so, please describe them

15. Are you satisfied with the system? Describe why or why not.

16. Is there anything you would like to see changed or done differently in the future?

HOMECARE NURSES EXPERIENCES WITH HOME TELEMONITORING SYSTEMS

Research Participants Needed

Seeking RNs involved with the operation of Home Telemonitoring Systems

 Student researcher for the nursing program at Rode Island College is looking for RNs involved with the operation of home telemonitoring systems to participate in a study examining their experiences working with the systems.

As a participant:

- You will be asked to participate in a one-on-one interview with a student researcher conducted at a time and place of your choosing.
- The interview will take around 30-45min and will ask about your experiences with telemonitoring.
- The interview will be audio recorded for later review
- Your personal information and any identifiable responses will be kept completely confidential

If interested please contact Justin Palmer by email at jpalmer_7065@email.ric.edu or by phone at (401) 603-6143

VNS Staff,

Student researcher for the nursing program at Rode Island College is looking for RNs involved with the operation of home telemonitoring systems to participate in a study examining their experiences working with the systems.

As a participant:
·   You will be asked to participate in a one-on-one interview with a student researcher conducted at a time and place of your choosing.
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If interested please contact Justin Palmer by email at jpalmer_7065@email.ric.edu or by phone at (401) 603-6143

Rhode Island College Institutional Review Board

Approval #: _____

Expiration date: _____

Participant's Initials: _____

Document version: _____

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CONSENT DOCUMENT

Rhode Island College

Homecare Nurses' Experiences with Telemonitoring Systems

You are being asked to be in a research study about what it is like for nurses to work with telemonitoring systems. You are being asked because you are a nurse who works with telemonitoring systems as a part of your job. Please read this form and ask any questions that you have before choosing whether to be in the study.

Justin Palmer, a student at Rhode Island College, and Mary Byrd, a professor at Rhode Island College, are doing this study.

Why this Study is Being Done (Purpose)

We are doing this study to learn about what nurses think of using home telemonitoring systems to care for patients. The purpose of this research is to describe the lived experiences of homecare nurses involved with the daily operation of telemonitoring systems and their perceptions of the systems' benefits and weaknesses.

What You Will Have to Do (Procedures)

If you choose to be in the study, we will ask you to:

Respond verbally to interview questions asked verbally by the researcher. The questions ask basic things about yourself like your education, background in nursing, and how long you have worked for your agency. Next, I will ask you questions about what it is like to use a telemonitoring system. I will ask you what you think is good or bad about it. Participation in this study will take approximately 60 minutes. I may take brief notes of your responses. The interview will be audio recorded. You will be interviewed at a time and location of your choice, including the agency, coffee shop, library, or other private location.

Risks or Discomforts

You can skip any questions you don't want to answer, and you can stop the interview at any time.

Rhode Island College Institutional Review Board

Approval #: _____

Expiration date: _____

Participant's Initials: _____

Document version: _____

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Benefits of Being in the Study

Your participation in this study may not benefit you personally, and you will not receive compensation.

Deciding Whether to Be in the Study

Participation in this study is entirely voluntary and not required by VNS Home Health Services. You can choose not to participate in this research and it will have no effect on your employment or benefits. Also, you can change your mind about participating at any time during the interview without negative consequences

How Your Information will be Protected

Because this is a research study, results will be summarized across all participants and shared in reports that we publish and presentations that we give. Your name will not be used in any reports. We will take several steps to protect the information you give us so that you cannot be identified from any of your responses. Instead of using your name, your information will be given a code number. The information will be kept on a password protected computer, and seen only by myself and other researchers who work with me. The only time I would have to share information from the study is if it is subpoenaed by a court, or if you are suspected of harming yourself or others, then I would have to report it to the appropriate authorities. Also, if there are problems with the study, the records may be viewed by the Rhode Island College review board responsible for protecting the rights and safety of people who participate in research. The information will be kept for a minimum of three years after the study is over, after which it will be destroyed.

Who to Contact

You can ask any questions you have now. If you have any questions later, you can contact Justin Palmer at jpalmer_7065@email.ric.edu or Mary Byrd at mbyrd@ric.edu

If you think you were treated badly in this study, have complaints, or would like to talk to someone other than the researcher about your rights or safety as a research participant, please contact Christine Marco at IRB@ric.edu, by phone at 401-456-8598.

You will be given a copy of this form to keep.

Statement of Consent

I have read and understand the information above. I am choosing to be in the study *"Homecare Nurses' Experiences with Telemonitoring Systems"*   I can change my mind and quit at any time, and I don't have to give a reason. I have been given answers to the questions I asked, or I will contact the researcher with any questions that come up later. I am at least 18 years of age.

I   ___agree   ___do not agree   to be audio-recorded for this study.

Print Name of Participant: _____

Signature of Participant: _____Date: _____

Name of Researcher Obtaining Consent:_____