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Abstract

Heart failure (HF) afflicts nearly 6 million Americans and the prevalence continues to rise as the population ages. Hospital use for HF is high and about half of readmissions are believed to be preventable. Promoting self care through telehomecare is an emerging strategy for managing chronic illness. Hospitalized heart failure patients were randomly assigned at discharge to receive usual home care or telehomecare, nurse visits and daily use of monitoring devices such as blood pressure cuffs, scales, glucometers, and pulse oximetry to monitor their symptoms. Nurses at the home care agency monitored the results and interacted with patients as needed to teach self care and treat symptoms. Self care was measured at baseline, 60, 120, and 180 days using the Self Care Heart Failure Index. Despite improving the overall readmission rate, findings suggest telehomecare had no significant effect on self care over usual home care.

Keywords

chronic disease, heart failure, home care services, humans, patient readmission, self care

Disciplines

Cardiology | Cardiovascular Diseases | Circulatory and Respiratory Physiology | Health and Medical Administration | Medical Humanities | Medicine and Health Sciences | Nursing | Preventive Medicine | Telemedicine

The Effect of Telehomecare on Heart Failure Self Care

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Abstract

Heart failure (HF) afflicts nearly 6 million Americans and the prevalence continues to rise as the population ages. Hospital use for HF is high and about half of readmissions are believed to be preventable. Promoting self care through telehomecare is an emerging strategy for managing chronic illness. Hospitalized heart failure patients were randomly assigned at discharge to receive usual home care or telehomecare, nurse visits and daily use of monitoring devices such as blood pressure cuffs, scales, glucometers, and pulse oximetry to monitor their symptoms. Nurses at the home care agency monitored the results and interacted with patients as needed to teach self care and treat symptoms. Self care was measured at baseline, 60, 120, and 180 days using the Self Care Heart Failure Index. Despite improving the overall readmission rate, findings suggest telehomecare had no significant effect on self care over usual home care.

Introduction

Telehomecare, a form of telehealth, is a feasible, widely accessible technology that has the potential to both monitor and promote self-care in an efficient, effective manner for older adults coping with multiple health problems. Most home care patients are age 65 and older and are coping with multiple chronic conditions such as heart failure, hypertension, diabetes, chronic ulcers of the skin, and musculoskeletal conditions.¹

Telehomecare is one possible technological solution to providing cost-effective patient contact for a growing population of chronically ill older adults. A video phone and medical equipment is placed in the patients' homes and connected via the plain old telephone system (POTS) to personal computers in the home care agencies. Nurses in the agencies can monitor patients and use data generated from the system to teach self-care. Placing the technology in the patients' homes may have an impact on patient involvement in self-monitoring, decision-making, and self-care.^{2,3,4} This randomized controlled trial examined the effect of telehomecare on heart failure self care compared to usual home care.

Conceptual Framework

Self-care is defined as a two-phase process of

maintaining health through positive health practices and managing HF through a process of recognizing, evaluating, and treating symptoms, and evaluating the efficacy of the treatments chosen.⁵ The Riegel model of heart failure self-care guided the study.⁶ An assumption underlying the Riegel model of self-care is that if persons with HF are to be successful at self-care, they must embrace healthy behaviors that help them to stay physiologically stable (e.g., eating a low sodium diet). This is the model concept of self-care maintenance. In addition, they must take deliberate action to address new signs and symptoms as soon as they occur (e.g., take extra diuretic if weight increases 4 pounds in one week)—this is the concept of self-care management. The potential for the telehomecare scale, blood pressure cuff, pulse oximeter, and glucometer to increase the measurement of and attention to symptoms was tested in this study. The study hypothesis was that telehomecare will significantly increase self care in patients with heart failure compared to usual home care.

Methods

Sample

Patients hospitalized for heart failure were evaluated for eligibility and approached about study participation during their admission or within two weeks of discharge. Inclusion criteria included being English speaking; mentally competent as determined by the Mini Cog test; ⁷⁻⁸ < 450 pounds (scale maximum); with a telephone in their home and Medicare or managed Medicare insurance; able to see, hear, place a cuff on their arm; and stand on a scale to weigh themselves. Patients were enrolled after providing informed consent and randomized to usual home care or home care with telehealth monitoring. The power analysis for the outcome of self-care using an effect size $f = 0.35$, the requisite power for $\alpha=0.05$ for two groups is 27 per group (total $N=54$).

Two hundred and eighteen patients were enrolled and randomly assigned to the two study arms. The study was approved by the Institutional Review Board of the University of Pennsylvania.

Usual Care

The plan of care in home care typically includes 1-3 skilled nursing visits per week, for up to eight weeks,

determined by patient need. Other disciplines such as social work, physical or occupational therapy were consulted as needed by patient condition. For all HF patients, the care was guided by the agency's HF clinical pathway and included physical assessment, procedures, medications, patient education regarding self care, referrals, nursing activities, and transitional planning. Each of these pathway components is supportive of the stages of the Riegel Model of Self-Care.

Telehomecare Intervention

Home care nurses installed the telehomecare equipment in the homes of consenting patients and taught the patients and caregivers how to operate the equipment. The patient and central clinician stations were linked over ordinary telephone lines via a standard modem. The home unit included a video phone and wireless peripheral devices: blood pressure cuff, pulse oximeter, weight scale, and glucometer if needed. Figure 1. These devices allow a patient to take his or her own measurements, even outside the context of a live telehomecare encounter. The measurements are readable by the patient and transmitted directly to the home health nurse immediately after a measurement is recorded.

Figure 1. Telehealth equipment, nurse station, glucometer, pulse oximeter, blood pressure cuff, and scale (clockwise).



In general, nursing interventions via telehomecare include the routine assessment of physical and emotional status, plus measurement of patient's vital signs, blood oxygen saturation, weight and/or blood sugar levels and review and discussion of objective patient data collected by patient self-use of the wireless devices. Nurses and patients interacted via the video phone intermittently and patients were instructed to use to use the equipment daily by 11am. The protocol aimed for at least four video visits over the home care episode and patient daily use of the

devices. The devices were left in the patients' homes for the duration of the home care episode.

Patient Self Monitoring

Data generated from patient self monitoring were used by the nurses to assess acute change and trends over time. As guided by the clinical pathway, nurses used patient data to teach patients by showing them and discussing the relationship between their data and behaviors such as dietary discretion/indiscretion or medication adherence/non-adherence. For example, traditional home care patients frequently keep a log of their daily weights or blood sugar readings that is reviewed by the nurse at each home visit. In telehomecare, patient self monitoring data is sent to the agency nurse station each time the patient uses the equipment. In both instances the nurse and patient are aware of normal limits for that particular patient and act accordingly (e.g. do further assessment, call the physician, add a visit, or decrease fluids). A potential benefit of telehomecare technology is that the data are immediately visible to the nurse at the agency via the nurse monitoring station. Readings that appear outside of pre-set parameters are highlighted in color to alert the nurse for review. The telehomecare readings were reviewed on a daily basis by a nurse. In the usual care group any data collected by the patient such as daily weights are reviewed at the next home visit or the patient may have called the agency or physician as instructed.

Data Collection

Socio-demographic, clinical information and heart failure self care data were collected by trained nurse research assistants (RAs) blinded to study group. RAs conducted baseline interviews in person at enrollment and follow-up interviews via telephone at 60, 120, and 180 days after enrollment using the Self Care Heart Failure Index (SCHFI).⁹ This instrument takes approximately 5-10 minutes to administer. The SCHFI contains 15 items rated on a 4-point response scale, which form 3 scales: Self Care Maintenance, Management, and Confidence. The coefficient alpha for the Maintenance subscale was .63, the Management subscale was .70 and of the Self-Confidence subscale was .87 for this study. Each scale is standardized to a score of 100; a higher score means better self care.

Data Analysis

Measures of central tendency were used to describe the group characteristics at baseline, t-tests or chi square compared the groups at baseline, and repeated measures ANCOVA was used to assess the fixed effect of intervention group on the dimensions of self

care over time. Variables differing between the groups at baseline were adjusted in the analysis. All analyses were done using an intent to treat model.

Results

Of the 218 patients enrolled, 36 (16.5%) did not receive any dose of telehomecare. Of these, 16 refused the equipment upon arrival, nine withdrew before equipment delivery, eight were discharged before delivery, and one died before delivery. Reasons for non acceptance of the equipment included patients being too sick to bother or some expressed concern over nurses touching their phone systems, and one nurse discouraged the patient from participating since she had to set up the equipment. Patients who accepted the equipment had no problems operating it.

Patients (N=188) who had at least one follow-up data point regardless of exposure to the intervention, were included in the intent to treat (ITT) analysis. Patients not in the analysis (had only baseline data) were not significantly different on any clinical or sociodemographic characteristic than subjects who remained in the study. There was no difference in the results for the ITT, modified ITT (mITT) (some exposure N=182), or per protocol (PP) analyses (n=151). The results presented below are for the ITT analysis with 188 subjects.

Subjects were an average of age 72 (SD=10), 64% female, and 66.5% African American. On average patients had heart failure for 64 months (SD 71.2) and had 6.8 co-morbid conditions (SD=4). Thirty two percent had an education level less than high school, 41% had a high school education.

There were no statistically significant differences in demographic (race, gender, education) or clinical variables (self rated health, time with heart failure, number of co-morbid conditions) between the telehomecare and control groups, with the exception of age, number of medications, and self care maintenance score. The control group was older on average 73.5 versus 70 for telehomecare (p=.01). The mean number of medications was 11.3 for telehomecare compared to 9.8 for the control group (p=.01). Baseline differences of age and number of medications were controlled for in the analysis.

Telehomecare patients received on average 3 video visits, 11 in-home nurse visits, and used the equipment 83% of available home care days. Although the pre-set minimum of four video visits per patient was not reached, the rate of usage of the monitoring equipment was very good at 83% and telehealth patients received three more in-person

home visits on average. The investigators believe the additional in-person visits in the telehealth group off-set any loss of contact from the video visit and therefore less video contact probably did not affect self care outcomes. Usual home care patients received 8 nurse visits on average. The telehomecare patients had more visits and more days in home care partly because they were hospitalized less than usual care patients (at 60 days the readmission rate was a mean of 3.4 hospital days for usual care and 1.7 hospital days for telehealth, p=.50) and readmission was delayed among those readmitted by 13 days in the telehomecare group. The readmission rate was calculated as the readmission rate per patient year. It was derived from the total readmissions/total non-hospital days x 365 days per subject.

Over the three data collection periods (60, 120, and 180 days) there were no statistically significant differences in self care between the groups. Table 1. Both groups improved their mean scores significantly from baseline to 180 days in all three self care categories and self care maintenance reached the level of adequate self care (at least 70).¹⁰

Table 1. Self care outcomes baseline and 180 day comparison

Concept	Baseline Mean, (SD)	180 days mean(SD), p value
Self care maintenance	57 (24)	72 (19) p<.0001
Self care Management	48 (26)	64(24), p<.0001
Self care Confidence	54 (23)	67(24) p<.0001

Conclusion

The results suggest telehomecare has no added effect on self care maintenance, management, or confidence over usual home care. The investigators hypothesized that using the equipment to self monitor would translate into an effect on self care of heart failure, but the hypothesis was not supported. The heart failure patients' ability to perform self care significantly improved over time whether using telehealth or receiving usual home care, indicating, in general, a benefit of receiving home care. Patients are considered adequate at self care with SCHFI scores of 70 or greater.¹⁰ The patients in our study reached a mean of at least 70 only for self care maintenance which involves symptom monitoring and treatment adherence. The levels did not decline over time, indicating that the effect of home care and telehealth did not wear off, but perhaps the care episode ended

prior to the patient being at the desired level of self care.

Discussion

Several systematic reviews and meta-analyses show that using the technology reduces the rate of readmission compared to home care visits alone.^{3,4,11-12} Preliminary analysis of readmissions in the current study indicates telehomecare produced a trend toward decreasing readmissions and keeping patients out of the hospital longer, but it does not appear that improved self care explains these findings. Other explanations may be early identification of and intervention for clinical changes in weight and heart failure symptoms that prevent severe exacerbations. Further study is needed to examine the relationship between self care and numbers of home visits, skill of nurses, types of equipment and quality of collaboration with physicians. The mixed findings in the literature indicate that just placing the equipment in the home is not enough; there must be a comprehensive program of heart failure disease management in which the technology is one tool.

Dansky, Vasey, and Bowles¹³ used the SCHFI in a randomized telehealth field study with heart failure home care patients, and confidence was a significant predictor of self management in the telehealth group. This included self management activities such as reducing fluid or salt intake or taking an extra diuretic. Further, patients who used video-based systems had the greatest gains in confidence. One difference between the Dansky study and the current study is that it was conducted at agencies that were experienced in telehealth. The agency where the reported study was conducted had no established telehealth experience. Both studies suffered from attrition, a common problem in longitudinal studies.

This study has some limitations. It occurred at one home care agency where nurses had no experience with telehealth or computer systems. The learning curve was steep and may have affected how nurses taught the patients using the technology. The model of telehealth at the agency required collaboration between the telehealth nurse and the home care nurse making it difficult at times to communicate and coordinate care. Attrition over time decreased the power to show a difference. By the 180 day analysis, there remained only 44 telehealth and 47 control subjects in the study.

Although most have small sample sizes, the majority of telehealth studies consistently show a positive effect on reducing readmissions for chronic illness.^{3,4,11,12} Although this study did not show a

direct relationship between self care and telehealth use, others show that chronically ill persons who participate in their care experience fewer disease-related complications and use fewer resources than those who remain passive.¹⁴ Dansky and colleagues also found greater improvement in symptoms in telehomecare patients than usual care patients with heart failure.¹⁵ Self care management also improved significantly in diabetic patients using telehomecare over usual home care.¹⁶ A body of evidence is beginning to accumulate about the value of telehealth for promoting self care and influencing outcomes in chronic illness. However, the mixed findings published to date indicate the need for further study to understand the mechanism behind improved clinical outcomes when using telehealth.

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