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Applying Research Evidence to Optimize Telehomecare

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Abstract

Telemedicine is the use of technology to provide healthcare over a distance. Telehomecare, a form of telemedicine based in the patient's home, is a communication and clinical information system that enables the interaction of voice, video, and health-related data using ordinary telephone lines. Most home care agencies are adopting telehomecare to assist with the care of the growing population of chronically ill adults. This article presents a summary and critique of the published empirical evidence about the effects of telehomecare on older adult patients with chronic illness. The knowledge gained will be applied in a discussion regarding telehomecare optimization and areas for future research. The referenced literature in PubMed, MEDLINE, CDSR, ACP Journal Club, DARE, CCTR, and CINAHL databases was searched for the years 1995–2005 using the keywords “telehomecare” and “telemedicine,” and limited to primary research and studies in English. Approximately 40 articles were reviewed. Articles were selected if telehealth technology with peripheral medical devices was used to deliver home care for adult patients with chronic illness. Studies where the intervention consisted of only telephone calls or did not involve video or in-person nurse contact in the home were excluded. Nineteen studies described the effects of telehomecare on adult patients, chronic illness outcomes, providers, and costs of care. Patients and providers were accepting of the technology and it appears to have positive effects on chronic illness outcomes such as self-management, rehospitalizations, and length of stay. Overall, due to savings from healthcare utilization and travel, telehomecare appears to reduce healthcare costs. Generally, studies have small sample sizes with diverse types and doses of telehomecare intervention for a select few chronic illnesses; most commonly heart failure. Very few published studies have explored the cost or quality implications since the change in home care reimbursement to prospective payment. Further research is needed to clarify how telehomecare can be used to maximize its benefits among diverse adult chronic illness populations.

Keywords

home care; telecommunications; telemedicine

Telemedicine is defined as the use of technology to provide healthcare over a distance.¹ Telehomecare, a form of telemedicine based in the patient's home, is a communication and clinical information system that enables the interaction of voice, video, and health-related data using ordinary telephone lines.² As noted in other articles in this issue, typical equipment can include a telephone line; simplified, regular computer, or wireless devices; videocamera; and physiologic monitoring equipment such as a blood glucose monitor, stethoscope, blood

pressure cuff, scale, or thermometer. Many terms are used, sometimes interchangeably, to describe telehomecare services. These include telemanagement, telemonitoring, telenursing, telehealth, telecare, and telehome health. For the purposes of this article, telehomecare is defined as the use of a telecommunication device with medical peripherals to provide home visits with a nurse.

The purpose of this article is to summarize and critique the published empirical evidence about the effects of telehomecare on adult patients with chronic illness. The knowledge gained is discussed in terms of how to optimize telehomecare and identify areas for future research.

Background

Telehomecare has been tested and reported to be beneficial for providing wound and cardiopulmonary assessments, managing symptoms, and teaching for patients with diabetes mellitus (DM),² heart failure (HF),³⁻⁶ hypertension,⁷ spinal cord injury,⁸ and chronic wounds.⁹⁻¹⁰ One small study reported using telehomecare for managing HF, wounds, and chronic obstructive pulmonary disease (COPD), and expanded its use to cancer and stroke patients.¹¹ The earliest studies examined the feasibility of telehomecare with mixed results. Whitten et al¹² studied 31 patients' perceptions of telehomecare technology that included an interactive video system. More than half of the patients (51%) felt that there was no purpose to telehomecare and only 13% thought that it could address a medical condition. Despite this, no patient found using the technology uncomfortable. Finkelstein et al¹³ completed a pilot study with 24 patients with HF, COPD, and chronic wounds. Telehomecare was successful with 13 patients, demonstrating that, although it was a small sample, the technology worked, and patients and caregivers could use the technology without difficulty. However, 11 patients could not use it due to severe illness, physical conditions of the home, lack of interest, or concerns about the equipment, suggesting the importance of prescreening to determine eligible patients.

Encouragingly, Jenkins and McSweeney³ reported that the majority of their 28 HF participants found the telehomecare experience comfortable and useful. They felt they could trust the monitor nurse, and the physical examination was adequate. Seventy-five percent felt that the monitor nurse would understand their needs, and 67% could see the nurse. Both patients and nurses expressed that quicker and more frequent nursing visits could be done via telehealth.

As positive reports of patient and provider acceptance of telehomecare began to surface, so did the adoption of the prospective payment system, changing reimbursement from fee for service to prospective payment for an episode of care. Because of this change, home care agencies are financially at risk and therefore are seeking new ways of providing cost-effective quality care. Simultaneously, the home health industry is coping with challenges, including a nursing shortage, increased concern over quality of care, decreasing reimbursements, and an aging population with complex chronic illnesses. These challenges require new and creative ways to deliver efficient, high-quality care. Telehomecare is believed to be an effective and innovative way to deliver services under these demanding conditions, and the home care industry is increasingly integrating this technology.¹⁴ A retrospective chart review revealed that as many as 45% of home care visits may be suitable for telehomecare of some form.¹⁵ Given these facts, it is important to analyze and report the effects of telehomecare so that it can be optimized.

Methods

PubMed, MEDLINE, CDSR, ACP Journal Club, DARE, CCTR, and CINAHL databases were searched for the years 1995–2005 using the keywords “telehomecare” and “telemedicine,” and limited to primary research in English. Telehomecare is a new technology so a 10-year search was determined to be adequate. The subject of home healthcare was searched and combined

with subject searches for Telemedicine, Telenursing, and Telehealth. The reference lists of articles were also examined for frequently cited studies. Dissertations and theses were not searched. Articles were selected if telehealth technology with peripheral medical devices was used to deliver home care for adult patients with chronic illness. Studies where the intervention consisted of only telephone calls or did not involve video or in-person nurse contact were excluded. Articles were entered into a table of evidence, summarized, and critiqued based on purpose, sample size, study design, and outcomes.

Findings

The 19 studies included in this analysis (Table 1) were organized into 4 themes: (1) effects on adult patients, (2) chronic illness outcomes, (3) providers, and (4) costs.

Effects on Older Adult Patients

Many assume that older adults will be unwilling to use technology or will lack the dexterity, or visual and auditory acuity to operate the equipment. Seven studies, reported in 10 articles, challenge these assumptions.^{3,10,11,19–21} Jenkins and McSweeney³ and Johnson-Mekota et al¹⁰ reported that more of their patients were satisfied with the telehealth consultation than with the in-person consultation. However, patients felt they better understood their condition when they saw the nurse in person. Diabetic telehomecare patients felt that the technology empowered them²¹ and that the equipment's presence reminded them to prepare for nursing visits.²⁰

Dimmick et al¹¹ reported an increased sense of security, ease of use, reduced pain and anxiety for 14 patients with a variety of chronic illnesses. A larger study with 90 HF patients reported that patients felt significantly more confident managing their HF when using a telehealth device with or without nurse visits compared with receiving telephone calls alone.²⁶ More recently, Chumbler et al¹⁷ reported that of 111 older adult telehealth users, 98% said it was easy to use, 85% felt more secure, and 92% felt it was helpful in managing their chronic illness (diabetes, hypertension, heart disease, and respiratory disease).

In conclusion, most studies report that patients were receptive to and satisfied with telehomecare, dispelling the myth that elderly patients are not willing to try computers.^{19,24} Study participants were comfortable with the use of the technology,¹⁹ and some even reported greater empowerment²¹ or increased confidence in managing chronic illness.²⁶

Effects on Chronic Illness

Many studies have evaluated the effects of telehomecare on chronic illness outcomes. Research has shown decreased rehospitalization rates in patients with HF,^{4,6,7,28} diabetes,^{2,21} and spinal cord injury⁸; better diabetic management¹⁶; and the ability to assess chronic wound progression using telecommunications technology.⁹ However, variations in sample characteristics, such as age, equipment type used, intervention length, and study design, make generalizations difficult. For example, Chumbler et al¹⁸ reported interesting results when comparing weekly intense telehealth intervention to daily less intense monitoring for 297 diabetic veterans. In this non-randomized sample, the daily monitored group had 52% less all-cause hospitalizations, 53% less diabetes-related hospitalizations, and 8 fewer bed days of care over 12 months than the weekly monitored group. These findings stress the need for rigorous evaluation of the types and intensities of telehomecare monitoring to determine the optimal fit for particular types of patients.

Two studies found significantly reduced hospitalization rates when using either telehealth or telephone follow-up compared with usual care, but they failed to show significant value of

telehealth over the less expensive telephone follow-up.^{5,8} The results suggest that positive results may be achieved without the expensive equipment used in telehomecare and that for some chronic illnesses and age groups, the telephone may be sufficient technology. However, more research is needed because these studies had younger patients in their sample, small sample sizes (n = 37 and 47) with 3-group designs.

Gardner et al⁹ demonstrated the value of telehomecare for remote management of wounds by comparing the accuracy of chronic wound assessments on 11 patients using interactive video technology and in person. Agreement was noted over 75% of the time for 8 of the 9 wound characteristics used. The authors believe that this level of agreement indicates that chronic wound assessment was not diminished by the use of the communications technology, despite small sample size and only 1 nurse was used. Additionally, the nurse at the distant site was not trained in wound assessment and felt that she learned a great deal, indicating this technology's potential to transfer nursing knowledge.

Several other studies demonstrated positive chronic illness outcomes beyond preventing rehospitalization. A randomized telehomecare study with patients with diabetes significantly increased self-management,¹⁶ improved general health,²¹ significantly increased the number of people discharged to home (n = 174) than those receiving usual home care. The LaFramboise team²⁶ achieved improvement over time in quality of life, functional status, and depression with no between-group differences. Chumbler et al¹⁷ used a 3-group case control design with 12-month follow-up to achieve improved function with instrumental activities of daily living, activities of daily living, and cognition in the telehomecare group compared with matched controls. However, this study had several limitations such as a nonrandom sample and large amounts of missing data.

In summary, most published studies show that telehomecare can positively affect outcomes, including rehospitalization rates, self-management, adherence, general health, and length of hospital stay for patients with chronic illnesses such as HF, diabetes, hypertension, or wounds. Two small studies^{5,8} that included younger patients raise questions regarding whether the use of extensive telemonitoring equipment provides better outcomes than simple telephone use. Few studies have examined the effect of telehomecare on function or quality of life. Most studies used relatively small sample sizes (n = 11–90),^{4,5,7–9,26,28} with the exception of 4 studies that used samples of 174, 216, 226, and 297.^{2,6,17,18} Findings from these larger studies suggest that telehomecare used with elders with chronic illnesses such as HF and DM, will lead to improved clinical outcomes. However, only 2 of these larger trials were randomized with a control group.^{2,6}

Effects on Providers

Researchers also have studied the effects of telehomecare on nurses. Nurses reported that using telehomecare technology added dimensions to caring by creating new types of bonds with patients, and that patients who received telehomecare were more focused and more comfortable managing their diseases.²⁰ Nurses also reported it was useful for monitoring vital signs, saved time and money, increased productivity,¹¹ and gave them the ability to provide better care to patients.¹⁰ However, nurses noted that the complexity of technology can be frustrating and anxiety provoking.²⁰

The above 3 studies agree that nurses feel that they can provide quality care using telehomecare. Dansky et al²⁰ implied that nurses would find the technology even more useful if it was streamlined and simplified. As is the case with most research regarding telehomecare, small groups of providers used in these studies (n = 9–12) and the variety of equipment make it difficult to generalize results to all nurses and providers. Also, all studies are limited to

exploring the impact on nurses with none addressing impact on physicians or other members of the healthcare team.

Effects on Costs

Finally, logic suggests that telehomecare could save money by limiting nurse travel and time and overall healthcare utilization. To examine this assumption, several studies have included costs and healthcare utilization as outcome measures.

In a quasi-experimental study, Johnston et al²⁵ studied the use of remote video technology with 212 chronically ill patients. They found no differences in the quality indicators of medication compliance, knowledge of disease, or self-care ability; patient satisfaction; or service use. Although the average direct cost for home health services, including equipment and communication expenses, was higher in the intervention group than in the control group, the total mean costs of care, excluding equipment costs, were lower in the intervention group. The cost savings were attributed to fewer hospitalizations while the quality of care remained stable. Benatar et al⁶ and Dansky et al² both significantly decreased hospitalization charges for their randomized telehomecare patients versus controls.

Using these data, Dansky et al²² estimated the financial costs and savings associated with providing telehomecare services. They suggest that, although the initial cost of the equipment and training imposes additional expenses, over time telehomecare contributes substantial savings through reductions in rehospitalizations and travel costs without compromising quality, and the financial benefit increases exponentially as the duration and number of patient care episode increases. Pringle-Sprecht et al²⁷ agree, stating that increased equipment use will offset the initial cost and depreciation, and make telehealth more effective in terms of saved time and reduced transportation costs for the nurse and the patient.

All 4 studies reviewed indicate that telehomecare has the potential to be cost effective. Three larger studies^{2,6,25} showed that although initially care delivery costs were increased due to the cost of equipment, overall costs of care were decreased due to decreased hospital charges and travel costs. In most studies, small sample sizes and lack of robust economic analyses preclude generalization of financial results. Further, most of the studies that evaluated costs were conducted before the change to a prospective payment system. Patients in these studies received telehomecare in addition to in-person visits. This additional care may have influenced the achievement of positive outcomes and is important to note. The extra care also equates to extra cost. New evaluations of the cost and quality effectiveness of this technology are needed under the new reimbursement structure.

Applying the Evidence to Optimize Care

This small body of telehomecare evidence reveals potential benefits for patients, providers, and the healthcare system. The research suggests that home care using communication and monitoring technology is feasible and acceptable to patients, caregivers, and providers. The addition of telehomecare technology seems to improve outcomes among patients with chronic illness, most often HF, diabetes, and chronic wounds. Finally, over the long term, cost for management of chronic illness seems to decrease with the use of telehomecare.

We can apply this knowledge to increase patient involvement and self-determination, which are especially important in the context of the recent Institute of Medicine's promotion of patient-centered, patient-directed care.²⁹ Positive results have been achieved with diabetic patients who improved in their self-management when using telehomecare as opposed to traditional home care support.^{2,16} The evidence indicates that patients are accepting of the technology and are willing to use it to self-monitor. Increased convenience and privacy are selling points.

¹¹ However, patients do not want to lose in-person contact completely,^{3,10} so a combination of telehomecare and in-person visits seems best.

Few evidence exists to guide providers regarding what is the best combination of telehomecare and in-person contacts. We do know that telehomecare helps us to be more efficient while achieving equal or better clinical and cost outcomes. For example, the average in-person home health visit in one study was 45 minutes compared with 18 minutes for a telehomecare visit.²⁵ The authors noted that with traditional home care, the nurse can see 5 or 6 patients in 1 day; telehomecare may allow 15 to 20 video visits per day. Dansky et al²² suggested a cost-effective pattern of telehomecare use, but no studies have tested various patterns of telehomecare versus in-person visits to find the most effective one. Based on the projection of Dansky's team²² and information from Wooten et al,¹⁵ a starting point to increase efficiency might be to use telehomecare to achieve a 45% reduction in-person visits.

The evidence strongly suggests that telemonitoring reduces rehospitalization for patients with HF and diabetes. This guides us to target those most at risk for rehospitalization. Telehomecare also works best for conditions that require close monitoring and quick intervention such as HF. This principle may also apply for patients with asthma, COPD, pain management, or unstable conditions such as cancer, but few studies have explored using telehomecare for these conditions. Also, very little is known about how patients of various age groups react to telehomecare. Two small studies suggested that telephone follow-up may be enough in younger cohorts, again indicating the need to experiment with various levels of technology and patterns of care with varying subjects other than older adults.

Outcomes of completed telehomecare research tell us that the reduction of rehospitalization and increased patient involvement in self-monitoring are the most common outcomes. However, little impact in improvements in quality of life and function has been made and we need to design telehomecare interventions to improve these outcomes. Involvement of other disciplines may be one strategy. In general, nurses react favorably to the use of telehomecare, but there are no reports of how it affects medical, social work, or physical therapy practice. Nurses need to educate our colleagues from other disciplines as to the benefits of telehomecare and help them to use it as a tool for patient care.

Areas for Future Research

Although most of the studies achieved positive outcomes and the technology appears safe and well accepted, there is much more to learn. This review included 19 completed studies. The researchers used different designs and equipment among mainly small samples of patients and providers. Five studies used randomized samples and only 2 studies were randomized clinical trials with sample sizes of 174 and 216. Most were pilot studies with samples sizes from 11 to 90 patients and used pretest-posttest design or matched controls. Therefore, more rigorous studies of telehomecare technology among larger, diverse populations are needed. Investigators should carefully describe the features of the technology and the patterns of care so that accurate comparisons can be made.

Telehomecare is a new intervention so the body of evidence is sparse. There is much more to learn to optimize the use of telehomecare. Table 2 contains suggestions for future research. For example, although positive outcomes have been achieved, little is known about the mechanism behind those outcomes. It is not known how changes in therapy are made based on data provided by telehomecare technology. More studies are needed that use methods described by Dansky et al.²³ They videotaped telehomecare interactions to analyze nursing activities. Such studies can inform us about how information and knowledge are transferred during a telehomecare visit.

This review suggests that the age of the patient and type of disease may be significant factors. This analysis was limited to studies with older adults, but telehealth has been used in children and younger adults with similar results. However, there have been no studies that compare patients of different age groups or diseases to determine the best technology or patterns of care for particular cohorts. Further, no studies have examined the value of telehealth technology for patients who do not qualify for home care but need close monitoring. Also, the length of the intervention across all of the studies was short term with a follow-up of less than 6 months. Studies are needed that examine the longer term benefits of telehealth. Finally, in most of the published studies, telehomecare was provided in addition to usual care. Therefore, studies are needed that truly examine the cost effectiveness of telehomecare when used in conjunction with in-person versus traditional visits alone. By expanding the research on telehomecare, we can apply more evidence toward optimizing the use of this promising technology.

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TABLE 1

Research Studies on Telehomecare

Author	Purpose	Design	Sample	Outcomes	Results
Benatar et al ⁶	To compare outcomes of usual home healthcare to telemanagement (NTM).	Prospective, randomized	216 HF patients; mean age of 63	HF readmissions and LOS Hospitalization charges QOL	Patients in the NTM group had fewer HF readmissions, shorter LOS, and lower charges. QOL improved in both groups with a trend toward more improvement in the NTM group.
Bondmass et al ⁴	To determine the effect of physiologic home monitoring and telemanagement on chronic HF outcomes.	Pretest, posttest	Sixty patients with mean age of 61	Hospital readmissions LOS Charges QOL	Readmissions, LOS, and charges were all significantly decreased, and QOL significantly improved.
Bowles and Dansky ¹⁶	To compare the effects of telehomecare on quality of care and costs associated with home health services to usual care.	Prospective, randomized field study	174 diabetic home care patients Intervention group, n = 84 Control group, n = 90 mean age = 74.5	Health status QOL Healthcare costs Patient satisfaction Self-management of DM	Significantly increased self-management of DM with telehomecare group compared with usual care.
Chumbler et al ¹⁷	To compare health-related outcomes of frail elders monitored via home telehealth to those that received no intervention.	3-group case control	N = 226 male veterans with hypertension, diabetes, respiratory disease, or heart disease	Functional outcome measures Cognitive outcome measures	Home health technologies, when coupled with care coordination, achieved improved function with instrumental activities of daily living, activities of daily living, and cognition compared with matched controls.
Chumbler et al ¹⁸	To assess the utilization of healthcare services and clinical outcomes in veterans with diabetes.	Observational study	N = 297 veterans (n = 197) weekly monitored patients, with more intense evaluations and (n = 100) daily monitored patients with less intense evaluations	Clinical variables Service utilization	52% less all-cause hospitalizations, 53% less diabetes-related hospitalizations, 8 less bed days over 12 months in the daily monitored group versus the weekly monitored group.
Dansky and Bowles ¹⁹	To compare the effects of telehomecare on quality of care and costs associated with home health services to usual care.	Prospective, randomized field study	174 diabetic home care patients Intervention group, n = 84 Control group, n = 90 Mean age = 74.5	Health status QOL Healthcare costs Patient satisfaction Self-management of DM	Telehomecare patients were more likely to be discharged to home, and control patients were more likely to be hospitalized. There were no group differences in satisfaction.

Author	Purpose	Design	Sample	Outcomes	Results
Dansky et al ²⁰	Describe home health nurses' responses to a telehomecare project.	Descriptive Qualitative analysis Action research approach	9 nurses chosen for experience with DM. Mean age = 41.6 years All female	Reactions Feelings Challenges Successes Problems	Added dimensions to caring, creates a new bond and increases rapport. Nurses feel that patients feel more comfortable managing their disease. Frustrations with management and with complexity of technology. Patients were not reluctant to try the technology. Assessment of the home environment must be considered. Fosters patient empowerment. The presence of the equipment reminded patients to prepare for RN visits. Increased general health in video group. Negative feedback included issues related to the home and the quality of the video picture.
Dansky et al ²¹	Describe effect of telemedicine on patients and costs associated with home health services.	Descriptive	Diabetic patients in the intervention group received video visits in addition to skilled nursing visits.	Home assessment Patient satisfaction Health status	Telehomecare patients showed greater improvements in self-management and 63% needed no further care at 60 days versus 40% of the control group. Telehomecare patients were less likely to be hospitalized and to use the emergency department.
Dansky et al ²²	To compare the effects of telehomecare on costs associated with home health services to usual care.	Prospective, randomized field study	174 diabetic patients Intervention group, n = 84 Control group, n = 90 Mean age = 74.5	Health service utilization Self-management of DM	Telehomecare patients showed greater improvements in self-management and 63% needed no further care at 60 days versus 40% of the control group. Telehomecare patients were less likely to be hospitalized and to use the emergency department.
Dansky et al ²²	To estimate the financial costs associated with providing telehomecare services.	Randomized	174 diabetic patients Intervention group, n = 84 Control group, n = 90 Mean age = 74.5	Financial costs	Provided a cost analysis projection for patterns of use to make telehomecare cost effective.
Dansky et al ²³	To use functional job analysis to analyze telehomecare nursing interventions.	Observational study	Video recording of 5 registered nurses conducting telehomecare visits for 4 weeks, of which (n = 10) visits were selected for observation, recording, and analysis	Nursing tasks related to: <ul style="list-style-type: none"> • Data • People • Things 	47% of all nursing tasks were in the people category, suggesting that telehomecare intervention is patient/family focused. Telehomecare nurses need to have advanced assessment, computer and electronic charting skills.
Demiris et al ²⁴	To measure patients' perceptions of a telehomecare system before and after they participated in it.	Randomized, pretest, posttest	11 control patients, 17 intervention patients	Patient perception	The control group showed no change in perception, the experimental group showed an improved perception. Elderly patients saw the experience as positive and felt more comfortable with the technology.
Dimmick et al ¹¹	Determine advantages and disadvantages of telehome healthcare from patients' and providers' views,	Intervention group only	14 patients, 12 with a mix of Home Touch and traditional home health, and 2 with just Home Touch.	Patient satisfaction Caregiver satisfaction Provider satisfaction	Patients felt increased sense of security, that system was easy to use, reduced pain and anxiety, saved time and money, and that they received a good quality of care. Caregivers felt that it saved time, reduced anxiety, and increased privacy. Providers felt that the patients were more focused, the

Author	Purpose	Design	Sample	Outcomes	Results
Finkelstein et al ¹³	assess drive time and mileage savings. To test actual and virtual HC and the feasibility of combining the 2 to deliver quality care at acceptable costs.	Randomized pilot study	24 patients with HF, COPD, and chronic wound healing who receive skilled nursing care at home.	Feasibility of recruiting and training patients nurses installing equipment in homes, and running virtual visits	system was useful for monitoring vital signs, saved time and money, and increased productivity. Telehomecare was successful with 13 patients, and not acceptable in 11 patients due to severe illness, physical condition of home, lack of interest, and concerns about equipment use.
Gardner et al ⁹	To examine the accuracy of chronic wound assessments using interactive video technology.	Pilot study	11 patients with mean age of 72 with 1 or more chronic wounds.	Nine wound characteristics	Agreement was greater than 75% for 8 of the 9 wound characteristics.
Jenkins and McSweeney ³	Using TH to monitor physical condition, reinforce patient teaching and compliance, and support patient and family. To establish differences between real-time and monitor-time assessments. Determine nurses and elderly HF patients' perceptions of telehealth.	Longitudinal, prospective crossover design	28 elderly HF patients (86% women, mean age = 83) 12 home health nurses (mean age = 41, mean of 3.5 years of education, 11.8 years of experience in acute care, and an average of 2.5 years in home health nursing)	Assessment parameters Patient satisfaction	There were no significant differences except for inspiratory wheeze, which was detected more frequently by the real-time nurse. The majority of patients found the experience comfortable, felt they could trust the monitor nurse, did not feel nervous, and felt that the physical exam was adequate. 75% felt that the monitor nurse would understand their needs, and 67% could see the nurse.
Jerant et al ⁵	To compare home telecare delivered via a 2-way video with an integrated stethoscope, to nurse telephone calls, and usual outpatient care.	Randomized trial	37 subjects 40 years and older with a primary hospital admission diagnosis of HF.	HF-related readmission during a 6-month period	Mean HF-related readmissions were lower in telecare group and telephone group, but the between-group difference was not significant.
Johnston et al ²⁵	To evaluate the use of remote video technology in the home healthcare setting.	Quasi-experimental randomized	Patients with HF, COPD, CVA, cancer, DM, anxiety, or wound care. Intervention (n = 102) or control (n = 110)	Quality of care Access to care Patient satisfaction Costs	No differences in the quality indicators, patient satisfaction, or use were seen. Although the average direct cost for home health services was \$1,830 in the intervention group and \$1,167 in the control group, the total mean costs of care, excluding home health care costs, were \$1,948 in the intervention group and \$2,674 in the control group.

Author	Purpose	Design	Sample	Outcomes	Results
LaFramboise et al ²⁶	To determine feasibility of providing a HF management program through an in-home telehealth communication device.	Pilot study	n = 90 HF patients. Mean age was 70.3 years	Self-efficacy Functional status Depression Health-related QOL	Improvement over time in QOL, functional status, and depression with no between-group differences.
Mass et al ¹⁰	To determine patient and provider satisfaction associated with a telehomecare intervention.	Pilot study	11 patients with chronic wounds	Patient satisfaction Provider satisfaction	55% of patients were very satisfied with the intervention, whereas 40% were very satisfied with the in-person visit. 77% said that it made receiving care easier. 33% would have preferred in home care secondary to seeing and hearing the nurse. All of the nurses were very satisfied.
Phillips et al ⁸	To determine if telehealth intervention can reduce secondary conditions among people with spinal cord injury.	Randomized trial	47 patients finished the 1-year enrollment	Days of hospitalization Depressive symptoms Health-related QOL	Mean hospital stays were lower for the intervention groups. QOL was higher at 1 year for the intervention groups.
Schneider ²⁸	To outline how telehealth can provide quality care and improved outcomes while decreasing home nursing visits and rehospitalization rates.	60-day observational study	Number of HF patients not stated	30-day rehospitalization rate Number of skilled nursing visits Patient outcomes and satisfaction	Rehospitalization rate dropped from 38% to 6%. Number of total visits/60 days decreased from 20 visits to 9.
Sprecht et al ²⁷	To evaluate costs associated with a telehealth intervention.	Pilot study	11 patients	Cost	The average cost of a telehealth wound evaluation was \$136.16 compared with \$246.28 for the in-person visit with the patient being transported.
Stricklin ⁷	To measure quality of care outcomes and the costs and benefits of using telehealth in the home setting.	Randomized trial	37 hypertension or chronic HF patients Knowledge of disease Compliance with lifestyle changes Nurse contact time/productivity and acceptance	Patient satisfaction	Both groups equally compliant with medications, exercise, and stress reduction. TH patients more likely to follow recommended diet. Significantly greater number of home visits to control group.
Whitten et al ¹²	To determine patients' views of telehomecare.	Pilot study	31 elderly patients	Patient feelings, views, and perceptions	No patients felt uncomfortable with the technology, however, patients did not see the benefit of telehomecare.
Wooten et al ¹⁵	To explore the potential for telehomecare in	Retrospective chart review	1,700 episodes of care reviewed	Home visit suitable for telehomecare	Proportion of visits in the United States suitable for telehome care was 45%. Percent was less than 15% in the UK.

Author	Purpose	Design	Sample	Outcomes	Results
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the provision of home care.

HF indicates heart failure; LOS, length of stay; QOL, quality of life; DM, diabetes mellitus; RN, registered nurse; COPD, chronic obstructive pulmonary disease; CVA, cerebrovascular accident.

TABLE 2
Areas for Future Research

- Examine the content of the telehomecare visit compared with in-person care
- Determine how telehomecare data influence changes in the plan of care
- Match the level of patient risk with intensity of the technology
- Test various patterns of telehomecare use in conjunction with in-person visits
- Perform rigorous cost-effectiveness analyses
- Incorporate and test input from consumers and providers in designing telehomecare interventions
- Expand the use of telehomecare to other illnesses, settings, and age groups
- Compare in-person home care with technology to technology alone on patient satisfaction, and clinical and cost outcomes
- Study the effect of telehomecare on physicians, social workers, and physical therapists
- Examine the longer term effects of telehomecare on cost and clinical outcomes
- Identify types of patients who can benefit from telemonitoring but do not qualify for home care
