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State of the Science
Posthospitalization Nursing Interventions in Congestive Heart Failure

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Nursing's role as key healthcare providers who give emotional support and teach self-care to patients with congestive heart failure has evolved substantially in recent years. The purpose of this article is to provide a systematic evaluation of the impact of posthospital nursing interventions in the management of heart failure. Four models of nursing interventions emerged: home-based nursing interventions, multidisciplinary interventions, heart failure clinics, and telephone- or technology-based nursing interventions. On the basis of currently available data, posthospital nursing interventions in congestive heart failure can improve clinical outcomes and decrease healthcare costs and resource use. **Key words:** *congestive heart failure*, *nursing interventions*

CONGESTIVE heart failure (CHF) is costly in human and economic terms, with 5 million in the United States affected annually and 260,000 deaths related to the disorder in 2002. In 2004, the estimated direct and indirect costs of CHF were $28.6 million. Hospital discharges for CHF rose from 377,000 in 1979 to 995,000 in 2001, an increase of 164%.[1] Research describing the impact of various management strategies on outcomes in CHF patients has multiplied within the past 5 years. There is general recognition that optimal heart failure management, in addition to pharmacologic therapy, involves a coordinated plan of care that includes individualized management, support, and promotion of self-care activities.[2] Therefore, the role of nurses in the management of CHF has evolved substantially in recent years.

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METHODS

The purpose of this article is to provide a systematic evaluation of the impact of posthospital nursing interventions in the management of heart failure. An extensive review of the literature from 1999 through March of 2004 was completed. Studies were identified by a computerized search of the MEDLINE database and the Cumulative Index of Nursing and Allied Health Literature (CINAHL). The term congestive heart failure was combined with a total of 33 subject headings related to management of CHF. Studies that reported the impact of interventions in which nurses play a major role on outcomes in patients with CHF and that have special components implemented posthospitalization were examined in this review. Four models of nursing interventions were identified through the review of research: nursing interventions that are home-based, nurses in pivotal roles in multidisciplinary interventions that extend to the home, heart failure clinics including nursing as a significant component, and telephone- or technology-based nursing interventions. Excluded were studies that focused almost exclusively on care given by physicians[3] and/or

pharmacologic interventions.[4] Also excluded were studies of interventions that included patients with diagnoses other than CHF,[5] case studies,[6] and descriptive reports of quality improvement programs.[7]

The literature search revealed 4 studies[8–11] that were systematic reviews of CHF management programs. Three of these[8–10] were published in 1999. All 4 reviews were substantially different from this review because the focus was not specifically on the impact of nursing interventions. Also, the outcomes examined in these 4 studies were primarily related to the economic impact of management programs, with little attention paid to other outcomes such as quality of life, self-care knowledge, exercise capacity, and functional status. Twenty-nine studies met the criteria for inclusion in this review of the impact of nursing interventions implemented posthospitalization on patients with CHF.

HOME-BASED NURSING INTERVENTIONS

Table 1 summarizes findings from 5 studies[12–16] of various home-based nursing interventions. This model of care included interventions that took place in the patient's home and the nurse was the major healthcare provider. Jaarsma and colleagues[12] studied a single home visit that focused on education and support, guided by a standard nursing care plan. The Heart Failure Self-care Behavior Scale, an instrument developed for this study, measured self-care behavior. Patients from the intervention group reported complying with more behaviors at 1, 3, and 9 months. Assessment of admissions and use of healthcare resources was done through follow-up interviews with patients and review of data banks maintained by the hospital and outpatient clinics.

The visit and follow-up telephone calls over 1 year in the study by Krumholz et al[15] was done by an experienced cardiac nurse educator. An accounting equation that included hospital readmission costs and the costs of the intervention measured costs.

Blue et al[13] and Pugh et al[14] studied home visits focused on early detection of complications and coordination with other healthcare team members. The nurses were trained in the intervention procedure and used protocols to manage medications. Pugh[14] measured functional status with the 6-minute walk test, quality of life with the Short Form (SF)-36[17] Scale, and costs of care by tracking healthcare resource use.

The role of the nurse in the final study,[16] which examined effects of a home walking exercise program, was to provide a weekly walking prescription, patient assessment, and review pedometer data. Walking distances were measured by the 6-minute walk test. A dyspnea fatigue index score rated symptoms.

Summary of home-based nursing interventions

Controlled randomized research comprised studies in this category. A total of 569 patients, 68% male, were included. With one exception,[16] all studies employed some form of telephone follow-up. The impact of home-based nursing interventions on clinical outcomes and healthcare costs and resource use is unclear. Some studies noted improved self-care behavior,[12] decreased symptoms, and longer walking distances.[16] However, no significant improvement in functional status or quality of life was noted in others.[14,16] Some studies suggested that readmissions and resource use is not effected[12,14] by home-based nursing interventions, while others found a reduction in costs and readmission.[13,15]

The variation in the results of these studies may have several explanations. A difference in what constitutes the usual care received by control groups and the different approaches used to measure costs[12,14,15] could have influenced outcomes. Sample size could have been a primary factor in the lack of significant findings.[14,16] Telephone contact following a single home visit may enhance outcomes, and

Table 1. Home-based nursing interventions

Reference	Study design and subjects	Intervention	Outcome
Jaarsma et al[12] (1999)	Prospective randomized study of 179 patients: 95 in the intervention group and 84 in the usual care group. Eight months' follow-up.	Education by a study nurse, a telephone call within 1 week after discharge, and a home visit. Completed 10 days after discharge from the hospital.	Self-care behavior was increased in the treatment group. No difference was found in readmissions or healthcare resources use.
Blue et al[13] (2001)	Prospective, randomized controlled trial of 165 patients; 81 received usual care, 84 received the nurse intervention. Twelve months' follow-up.	Planned home visits of decreasing frequency, supplemented by telephone contact. Focused on education, teaching, home monitoring, psychological support, and referral.	All cause readmission, heart failure readmission, deaths, and days in the hospital for congestive heart failure were decreased in the intervention group.
Pugh et al[14] (2001)	Prospective, randomized study of 58 patients: 27 in the intervention group, 37 in the usual care group. Six months' follow-up.	Enhanced discharge planning, postdischarge instruction, and intensive posthospital collaboration with providers. Telephone contacts and follow-up visits by nurse case manager.	No differences were found in functional status, costs, and quality of life.
Krumholz et al[15] (2002)	Prospective, randomized study of 88 patients, 44 each in the intervention and usual care groups. Twelve months' follow-up.	Baseline home visit within 2 wk of discharge. Contacted by phone weekly for 4 wk, biweekly for 8 wk, and monthly for a total intervention period of 1 y. Focused on education and support, but did not modify regimes.	Readmission, costs, and deaths were lower in the intervention group.
Corvera-Tindel et al[16] (2004)	Randomized study of 79 patients, 37 in the usual activity group and 42 in a progressive home walking group. Three months' follow-up.	Home walking exercise training. Home visits were conducted weekly for the first 6 wk and biweekly for the last 6 wk.	The intervention group had longer walking distance and decreased symptoms. Peak oxygen consumption and the heart failure functional status inventory were unchanged

this combination should be further explored as an intervention technique. What is meant by usual care and its impact on outcomes in the control group needs to be delineated in future research of home-based nursing interventions.

MULTIDISCIPLINARY INTERVENTIONS EXTENDING TO THE HOME WITH NURSES IN PIVOTAL ROLES

Table 2 summarizes 8 studies[18–25] of multidisciplinary interventions with nurses in a major role and a home component. Nurses provided intensive patient and family education and follow-up for a minimum of 90 days in a study by Raugh and colleagues.[18] The average total net nonreimbursed hospital revenue for CHF treatment before and after program implementation measured costs.

Four studies by Stewart and various colleagues[19,20,23,24] examined the impact of a structured home visit on various outcomes and cohorts of patients. The nurse was responsible for the home intervention, which included assessment, education, referral, and telephone follow-up in the first of these reports.[19] More intervention group patients remained event-free, defined as deaths or unplanned readmission at 6 months. Costs, representing all inpatient, outpatient, and emergency service activity were measured by monitoring of hospital records. The Minnesota Living with Heart Failure Questionnaire (MLHFQ)[26] measured quality of life. Stewart and colleagues[20] studied the impact of this intervention over an 18-month period. Referral to their primary care physician on the basis of early clinical deterioration and/or adverse medication effects occurred in one third of the patients in the intervention group.

In 2002, Stewart and Horowitz[23,24] described the impact of the structured home visit in 2 studies. One study[23] reported the impact during a median of 4.2 years follow-up. In the second 2002 report,[24] the impact of the intervention on patients prone to early clinical deterioration, defined as clinical instability detected at the home visit, was assessed. Comparison of intervention patients to selected usual care patients was done as part of the randomized study.

A study by Riegel and colleagues[21] matched 240 CHF patients on preadmission functional status, comorbidity, and age. Members of the in-hospital multidisciplinary team shared patient information with the home health nurse. The program was allocated no additional clinical resources. The use of acute care resources was measured by a cost-accounting database.

Harrison and colleagues[22] tested a transitional care intervention that included 3 major aspects of hospital-to-home transition: (1) supportive care for self-management; (2) linkages between hospital and home nurses and patients; and (3) the balance of care between the patient and the family and professional providers. The MLHFQ[26] measured quality of life.

Vavouranakis and colleagues[25] compared outcomes in 33 CHF patients during consecutive years before and after implementation of a multidisciplinary intervention. Factors modified through this multidisciplinary intervention were compliance with medications associated with poor mental status, social isolation, and early clinical deterioration. Hospitalization rates for cardiovascular reasons were measured by patient report with confirmation through examination of hospital files. MLHFQ[26] measured quality of life.

Summary of multidisciplinary interventions extending to the home with nurses in pivotal roles

This model of care category consisted of 5 randomized, controlled trials,[19,20,22–24] one retrospective comparison,[18] one pretest/posttest,[25] and one quasi-experimental design.[21] A total of 1879 patients participated in these studies, 52% male. Like the home-based nursing intervention studies, there is little description of the usual care given to the intervention groups in the randomized trials, with only one study describing usual care in any detail.[22]

Table 2. Multidisciplinary interventions that extend to the home*

Reference	Study design and subjects	Intervention	Outcome
Raugh et al[18] (1999)	Retrospective, comparative study of patients before ($N = 407$) and after ($N = 347$) the implementation of a management program. Twelve months follow-up.	Protocol implemented by a multidisciplinary team composed of a cardiologist, clinical nurse specialist, 2 registered nurses, a social worker, and a dietician consult. Focused on patient and family education and follow-up.	Decreases in length of stay, admissions, and readmission rates and costs to patients and providers.
Stewart et al[19] (1999)	Prospective, randomized trial of patients discharged home. Randomly assigned to usual care ($n = 100$) or intervention ($n = 100$). Six months follow-up.	Structured home visit by a qualified cardiac nurse 7–14 days after discharge. Focus was assessment and teaching to improve adherence and response. Telephone assessment at 3 and 6 months. Home visits were repeated as indicated.	Fewer unplanned admissions, days in the hospital, and events, less costs, and improved QOL at 3 months, but not at 6 months.
Stewart et al[20] (1999)	Ninety-seven CHF patients from a larger study prospectively selected for comprehensive 18-month follow-up, randomized to a home-based intervention (HBI) group (49) or to usual care (48).	Structured home visit by a qualified cardiac nurse and pharmacist 7–14 days after discharge to optimize medication management, identify early clinical deterioration, and intensify medical follow-up and caregiver vigilance where appropriate.	Fewer unplanned readmissions, out-of-hospital deaths, fewer days of hospitalization, emergency department visits, fewer readmissions, less hospital-based costs.
Riegel et al[21] (2000)	Two hundred forty CHF patients were matched at preadmission, with half assigned to usual care and half to a multidisciplinary intervention. Six months follow-up. Quasi-experimental design.	A multidisciplinary program using education materials, in-hospital counseling by pharmacists and dieticians, discharge assessment by home health nurse visits. Case management by telephone.	No significant differences were noted in resource utilization, in overall hospitalization rate, days in the hospital, or total costs at 3 or 6 months.
Harrison et al[22] (2002)	Randomized controlled trial of 192 patients: 100 were in the usual care group, 92 were in the transitional care group. Three months follow-up.	Nurse-led transitional care program including an evidenced-based protocol for counseling and education plus planned linkages to support individuals.	Improved quality of life, decreased readmission rate, and decreased emergency department visits.
Stewart and Horowitz[23] (2002)	Prospective, randomized intervention trial of patients allocated to either a home-based intervention (HBI) group ($n = 149$) or usual care ($n = 148$). 4.2 years follow-up.	A structured home visit by a cardiac nurse 7–14 days after discharge. Focused on assessment, including physical examination, adherence, knowledge, social support, and referral. A report with recommendations was sent to physicians.	Fewer unplanned readmissions or deaths, prolonged survival, and less readmission costs.
Stewart and Horowitz[24] (2002)	Sixty-six patients, who experienced early clinical deterioration. Six months follow-up. Prospectively planned analysis of original data from a larger study.	Same as 1999 study by Stewart, Marley, and Horowitz.	Fewer days in the hospital, improved 6 months survival compared with case controls.
Vavouranakis et al[25] (2003)	Pretest/posttest observational community-based study of 33 class III and IV patients. Comparisons of cardiac admissions and QOL were made between the year before the intervention and the year after the intervention.	Patients were visited every 30 days by nurse for education and assessment. Telephone contact was made every 10 days. Physicians were notified of problems.	The mean readmission rate decreased, QOL increased in the year following the initiation of the intervention.

*QOL indicates quality of life; CHF, congestive heart failure.

Overall, these studies suggest that a multidisciplinary intervention with nurses in pivotal roles extending to the home may be associated with important benefits. Decreased length of stay, admission and readmission rates, decreased costs, decreased mortality/longer event-free survival, and improved quality of life were noted. Benefits were noted in short-term (3–6 months) follow-up,[19,22,24] year-long analysis,[18,25] and in longer-term (18 months–4 years) studies.[20,23] Although lower costs was an outcome in several of the studies,[18–20] when Stewart et al[19] factored in the costs of community-based care, a decrease in costs was lost.

The only study in this category that did not demonstrate positive outcomes tested an intervention that provided in-hospital counseling by members of multiple disciplines and sharing of the in-hospital assessment with the home health nurse.[21] The study states that "no additional clinical resources were allotted to the program."[21(p291)] The results of this approach were that not all patients in the intervention group received all components of the intervention. In contrast, other studies[22,25] provided comprehensive resources and support for the nurses and other team members involved in the intervention. The 4 studies by teams led by Stewart[19,20,23,24] tested an intervention that included a structured home visit soon after discharge by a nurse with other healthcare team members. However, interventions in these studies included more than a single visit. Referral, communication with physicians, telephone follow-up, and further home visits were done in some cases.

There are several conclusions that can be drawn from the review of these studies. Multidisciplinary interventions that extend to the home should: (1) involve an experienced cardiovascular nurse with access to a cardiologist for consultation; (2) include intensive follow-up and be implemented over time; (3) include comprehensive patient and family education; (4) involve members of multiple disciplines, and (5) include adequate support and resources for the team members implementing the intervention. Finally, the interventions in all of these studies are multifaceted, with little attempt to explain what components of the intervention may have had the most impact or what client behavior is altered through the interventions. Further research into multidisciplinary interventions is needed to clarify these issues.

HEART FAILURE CLINICS WITH NURSING AS A SIGNIFICANT COMPONENT

Table 3 summarizes 10 studies of heart failure clinics[27–36] in which the intervention primarily takes place in a clinic setting with nurses in a major role. Oddone and colleagues[27] studied an intervention designed to enhance patient access to primary care physicians. Subjects were from 9 Veterans Administration sites. The SF-36 health survey[17] measured quality of life, the reporting of ejection fraction in the medical record measured diagnostic evaluation, and a review of records on filled prescriptions from the VA pharmacy files measured pharmacologic management. The proportion of patients receiving target doses of angiotensin-converting enzyme (ACE)-inhibitor therapy and appropriate use of other CHF medications such as digoxin, β-blockers, and other afterload-reducing agents was compared.

In Paul's pilot study,[28] a cardiologist and pharmacist evaluated the patient on the first visit. The nurse practitioner was responsible for follow-up, using delineated clinical protocols. Hospital admissions and hospital days decreased, while length of stay and hospital charges did not.

Hershberger et al[29] compared clinical and cost outcomes after referral of patients to an outpatient heart failure management program. Comprehensive medical evaluation and planning was done during the first visit. Nurses were then responsible for implementation, coordination, and monitoring of the plan. Preemptive hospitalization was used for decompensating patients. Hospitalization and emergency department visits were measured

Table 3. Heart failure clinics with nursing as a significant component*

Reference	Study design and subjects	Intervention	Outcome
Oddone et al[27] (1999)	Multisite, randomized, controlled trial of 443 VA patients; 222 patients were in intervention group and 221 patients received usual care. Six months follow-up.	A phone call from the nurse within 2 days of discharge, an appointment with the physician and nurse within 1 wk. Other clinic visits and calls were left to the discretion of the physician, patient, and nurse. The control group received usual care.	No differences were noted in QOL or diagnostic evaluation. The intervention group had more readmissions and clinic visits. Pharmacologic management was improved in digoxin dosing only.
Paul[28] (2000)	A convenience sample of 15 clinic patients admitted to a university hospital. Data were retrieved via a chart review for 6 months before and 6 months after the date the patient was seen at the clinic. Pretest/posttest design.	A multidisciplinary nurse-managed outpatient clinic. The nurse practitioner reinforces education, reassesses the patient, adjusts medications, and provides follow-up clinic and telephone contact.	Total hospital readmissions and hospital days were reduced after beginning treatment at the clinic. There was no change in length of hospital stay, hospital charges, or visits to the emergency department.
Hershberger et al[29] (2001)	A total of 100 patients. Outcomes were compared for the 6 months before and 6 months after referral. Pretest/posttest design.	Cardiologists, specially trained nurses, and a social worker team used current heart failure practice guidelines, telemanagement of patients, preemptive hospitalization, provided continuity of care. Follow-up clinic visits and calls.	Patient's self-care knowledge and QOL improved, proportion of patients with NYHA class decreasing from IV to III increased, hospitalization, and emergency department visits decreased.
Holst et al[30] (2001)	Forty-two CHF patients were assigned to management program. Each patient was his or her own control and a comparison was made at entry to the study and after 6 months.	Consultation for 1 h with a cardiologist and a 30-min session with the nurse manager. Exercise program at a cardiac rehabilitation center. The nurse answered questions by telephone throughout follow-up.	Decrease in hospital readmission days and emergency department visits, increase in β-blocker and ACE-inhibitor dose and use, and in QOL.
Whellan et al[31] (2001)	Ninety patients enrolled in a CHF disease management program. Pretest/posttest design. Median follow-up was 4.9 months.	Protocols for the management of medications, comorbidities, and exacerbations determined the schedule of clinic visits and telephone calls.	Decrease in hospitalization and inpatient costs, increase in outpatient costs and clinic cardiologists visits.
Akosah et al[32] (2002)	Retrospective chart review on 101 CHF patients discharged from an integrated healthcare center. Thirty-eight patients received the interventions, 63 received usual care. Data were tracked for 12 months.	A multidisciplinary heart failure clinic with 3 cardiologists, 2 nurse practitioners, and a nurse educator. Management of meds and comorbidities, patient education and empowerment.	In the intervention group, 90-day and 1-year readmission rates were lower, event-free survival was higher, outpatient visits and patient initiated contacts were higher. There was no difference in mortality rate.

(*continues*)

Table 3. Heart failure clinics with nursing as a significant component* (*continued*)

Reference	Study design and subjects	Intervention	Outcome
Capomalla et al[33] (2002)	234 patients randomized to usual care (122) or a day hospital program (112). Follow-up in 1 year.	Multidisciplinary staff. Tailored plan of care, including healthcare education, counseling, tailored therapy, identification, and correction of risk factors.	The day hospital patients were readmitted to the hospital less frequently, showed improvements in the NYHA functional class, and had fewer cardiac events.
Doughty et al[34] (2002)	Cluster, randomized controlled trial of 97 patients: 56 patients received intervention, 95 usual care. Follow-up was for 1 year.	Outpatient clinical review within 2 weeks of discharge. One-on-one education with the study nurse was given at the first clinic visit, followed by group education sessions. Follow-up plan for 6 weekly visits alternating between a general practitioner and the heart failure clinic was implemented.	No differences between groups for the combined endpoint of death and hospital readmission. The physical dimensions of QOL showed significant improvement in the intervention group. There was no difference in all-cause first readmissions, but the intervention group showed fewer subsequent readmissions.
Kasper et al[35] (2002)	A prospective, randomized study of 200 patients: 102 in the intervention group and 98 in the usual care group. Six months' follow-up.	Team consisted of telephone nurse coordinator, the CHF nurse, the CHF cardiologist, and the patient's primary physician. Telephone calls were made within 72 hours of discharge then weekly for 1 month, biweekly for 2 months, and monthly thereafter. Telephone calls followed a set script and pursued problems as indicated. CHF nurses saw patients monthly at a clinic.	No differences in the primary end-points of the combination of deaths and CHF readmissions or costs. QOL score and percentage of patients on target vasodilator therapy with diet recommendations and at goal weight were higher in the intervention group.
Stromberg et al[36] (2003)	A prospective, randomized study of 106 patients: 52 received the intervention, 54 usual care. Twelve months' follow-up.	Nurse-led heart failure clinic staffed by a cardiac nurse, who was delegated the responsibility for making protocol-led changes in medications. The patients were first seen 2–3 weeks after discharge.	Fewer deaths or admissions in the intervention group after 12 months. The intervention group had fewer admissions and days during the first 3 months and had higher hospital self-care scores at 3 and 12 months.

*VA indicates Veterans Affairs; QOL, quality of life; NYHA, New York Heart Association; CHF, congestive heart failure; and ACE, angiotensin-converting enzymes.

by patient's self-report and verified by checking medical records. The MLHFQ[26] measured quality of life. The number of patients who weighed themselves daily and understood the significance of salt restriction measured self-care knowledge. The number of patients receiving ACE inhibitors increased at 6 months.

The intervention in the study by Holst and colleagues[30] included education sessions led by a multidisciplinary team. The primary intervention was participation in a 3-day a week clinic-based exercise program. During the program, patients attended the clinic an average of 3.4 times over the 6-month period. Unscheduled visits to the patient's general practitioner due to worsening CHF declined, while scheduled visits to the general practitioner for assessment and review purposes increased. Functional status improved from a mean NYHA class of 3.1 to 1.8. Exercise capacity and ejection fraction improved as well.

The fifth study in this category[31] examined a disease management program that included clinic visits and phone calls. The nurses in this study were nurse practitioners or clinical nursing specialists. There was a significant overall increase in the percentage of patients receiving target dose of ACE inhibitors. The total costs of care decreased.

Akosah and colleagues[32] compared outcomes in patients discharged to a multidisciplinary heart failure clinic (group 1) with those discharged to primary care providers for follow-up care (group 2). A plan of care was developed at enrollment, which included education related to self-care management, aggressive titration of medicines, and management of comorbidities. *Event-free survival* was defined as no hospitalization or deaths. Survival without hospitalization was higher in group 1 at 90 days and 1 year. Maintenance on adequate doses of standardized medications (ACE inhibitors and angiotension receptor blockers) was higher at 1 year in group 1.

Capomolla and colleagues[33] compared CHF patients discharged into a management program delivered by day hospital to patients receiving usual care. Open access to the day hospital was a critical component of the intervention. The dosages of both long- and short-acting ACE inhibitors, nitrates, and β-blockers were higher in the day hospital group, whereas the dosage for diuretics and digitalis were lower. Death due to cardiac causes was less in the day hospital group, and actual survival at 1 year was 96% in the day hospital patients and 78% in the control group. At 1 year, the weighted mean utility measured by the time trade-off method was greater in the day hospital group than in the community group, meaning that the intervention group was willing to trade 10 years of their present health for 7.2 years of excellent health, whereas control group patients were willing to trade 6.3 years. A cost comparison revealed a cost savings of $10,768 for day hospital patients.

Doughty and colleagues[34] studied the impact of an integrated heart failure management program. Randomization in this clinical trial was accomplished by randomly assigning the general practitioner to either the intervention group or control group. The MLHFQ[26] measured quality of life. The main effect of the intervention was the prevention of multiple readmissions, with all-cause readmissions and heart failure readmissions being fewer in the intervention group. Kasper[35] and colleagues sought to determine whether a multidisciplinary outpatient program decreased hospital admissions and mortality. The cardiologists, along with the primary care physicians, provided guidance; nurses provided the care. The treatment plan for usual care patients was documented in the patient's chart without further intervention. All patients in the intervention group were provided a pill sorter, a list of their medications, a list of dietary and physical activity recommendations, a 24-hour contact number, a patient education booklet and other resources such as a scale or medications, if needed.

The final study in this category examined a nurse-led heart failure clinic conducted at 3 centers by Sromberg and colleagues.[36] The clinic was led by specially educated and experienced cardiac nurses who were empowered

to make protocol-guided changes in medications. Clinic visits were scheduled until the patient was stable, well informed, and pharmacologic treatment was optimized. At that time, patients were referred back to their general practitioner. Data were collected at baseline, 3, and 12 months. The nurse collecting the data did not know what group the patient was in and was not involved in patient care. The primary outcome was all-cause mortality or hospital readmission after 12 months. The Heart Failure Self-Care Behavior Scale[12] measured self-care at 3 and 12 months.

Summary of heart failure clinics with nursing as a significant component

These 10 studies of the impact of heart failure clinics included 1522 patients, 77% male, due to the fact that one study[27] was a multisite study of 9 Veterans Affairs Medical Centers. Five of the studies[27,33–36] were randomized trials, 4 used pretest/posttests designs,[28–31] and one was a retrospective chart review.[32] Two of the pretest/posttest studies[28,30] could be classified as pilot studies because of their small sample size. Like the previous studies, there is little description of usual care, with one study[27] stating that discharge care was neither prescribed nor prohibited and one study[33] defining usual care as follow-up by a primary care physician with the support of a cardiologist. Kasper and colleagues[35] noted that the primary care physicians of the usual care group received a written plan of care from the cardiologists involved in the study at the time of discharge. Only one study[36] addressed the issues of statistical power.

Although the pretest/posttest studies could be criticized because of the lack of randomization and potential for overestimation of the findings,[30] the randomized trials in this category bring support and balance. Taken together, these studies offer convincing evidence that heart failure clinics that include nursing are effective in reducing hospital admissions and emergency department visits, decreasing mortality, improving self-care and quality of life, and reducing costs. Only one study did not demonstrate a majority of positive outcomes.[27] A noticeable difference in this study was the method of determining the frequency of clinic visits and telephone calls, which was described as occurring when deemed necessary by the patient, nurse, or physician, rather than in a more prescribed manner as seen in other studies.

The issue of access to the clinic or frequent visits and contacts, although addressed differently in the studies, emerges as 1 of 3 key components of the interventions. An increase in scheduled visits for assessment,[31] an increase in follow-up visits and patient-initiated contacts to healthcare providers,[32] and open access to day hospital care[33] improved outcomes. Nurses with physician backup were on call 24 hours a day in 2 studies.[29,35] A second key component of interventions in all of the studies was patient education and support. The nurse took a leading role in providing education about all aspects of CHF and establishing supportive relationships. The third key component of the interventions emerging in many of the studies was the pharmacologic management of CHF. It was apparent that the ability of the nurse or other healthcare provider to adjust medications improved outcomes. For example, in several studies[28,31,35,36] the nurse adjusted medications on the basis of a protocol. Patients in the day hospital[33] and the clinic-based exercise program[30] received higher doses of ACE-inhibitors, nitrates, and β-blockers than the usual care patients. In the chart review,[32] it was found that adequate doses of ACE-inhibitors and angiotension receptor blockers were associated with positive outcomes.

Individual aspects of these studies warrant comment. For example, one study [29] suggested that the concept of preemptive hospitalization should be further explored. Another study[34] suggested that integrated management, or alternating visits between a heart failure clinic and a general practitioner, needs further examination. A clinic-based exercise prescription studied by Holst et al[30] supports positive outcomes seen in the home-based exercise study in category one,[16]

suggesting that the impact of exercise on CHF needs further exploration. There were 2 unique strengths in the study reported by Capomolla et al,[33] namely the formalization of the process of care and the use of evidenced-based medicine (EBM) methodology. To define the care process, 8 phases of healthcare interventions were identified and developed. Applying the process of care results in interventions tailored to the unique needs of each patient. Although a number of studies[32,34,36] referred to evidenced-based practice specifically related to clinical guidelines for pharmacologic management, this study[33] utilized EBM more extensively in assessing risk, developing treatment, and follow-up.

In conclusion, 3 major factors of a successful heart failure clinic were apparent from these studies: (1) optimized pharmacologic management; (2) increased and easy access to the clinic, nurses, and other healthcare providers; and (3) facilitated self-care through education and support from nurses. Furthermore, several concepts that need further study emerged, including preemptive hospitalization, integrated management, a process of care approach, and EBM methodology.

TELEPHONE- OR TECHNOLOGY-BASED NURSING INTERVENTIONS

The nursing interventions in the final category were interventions delivered by telephone or other technologies such as Internet-based tools or video. Table 4 summarizes findings from these 6 studies.[37–42] Cordisco[37] and colleagues studied the Day Link monitor, a telemonitoring system. This system combines an electronic scale with a display and communications device. It weighs the patient and asks 5 simple "yes/no" questions about symptoms. The information is transmitted over the patient's phone line to a central monitor. A nurse reviews the data daily. The control group consisted of CHF patients, ambulatory while awaiting cardiac transplant.

Two reports by Jerant and colleagues[38,39] described the impact of 3 models of care, home telecare delivered via a 2-way videoconference device with an integrated electronic stethoscope, traditional telephone follow-up, and usual care. Patients randomized to the telecare group received an Aviva SL 1010 Personal Telecare Unit (American Telecare, Eden Praire, Minn). The units operate over telephone lines and allow real-time videoconferencing with the study nurse. The study nurse used a protocol for drug regimens and the Visiting Nurse Association CHF Care Steps[43] to guide telecare and telephone visits. Both intervention groups had access to the study nurse during business hours. The Medical Outcomes Study Questionnaire[17] measured health status, the MLHFQ[26] measured quality of life, the Client Satisfaction Questionnaire[44] measured patient satisfaction, and compliance to self-care was measured by self-report.

Riegal and colleagues[40] studied a telephonic case management intervention utilizing a software support system developed by Pfizer.[45] This program emphasized education related to adherence to medications and diet knowledge as well as the signs and symptoms of worsening illness. Study nurses received a total of 95 hours of training. The intervention group members were phoned within 5 days of discharge and thereafter at a frequency guided by the software. Patients received an average of 17 phone calls, and an average of 16 hours of the case manager's time overall. Because of the possibility that the physicians would modify care in the control group to mimic aspects of the intervention, physicians were randomized in this study. A review of automated records measured heart failure hospitalization rates and acute care resource use.

Artinian et al[41] examined a Web-based monitoring system, the Med-e Monitor (InforMedix, Inc., Rockville, Md) in a pilot study. Via a standard browser interface, clinicians are able to monitor patients and update treatment. Usual care included visits to the cardiologists in the heart failure clinic. The intervention group received usual care plus the MedeMonitor. The Revised Heart Failure Self-Care Behavior Scale,[46] medication compliance, and 6-minute walk test measured

Table 4. Telephone- or technology-based home interventions*

Reference	Study design and subjects	Intervention	Outcome
Cordisco et al[37] (1999)	Prospective, randomized study of 81 patients: 30 in the treatment group, 51 in the usual care group. Follow-up was 1 year.	The Day Link monitor weighs the patient and communicates the information over a phone line to the nurse.	Emergency department (ED) visits and hospitalizations were decreased in the intervention group.
Jerant et al[38] (2001) and Jerant et al[39] (2003)	Prospective, randomized study of the impact of 3 hospital discharge care models on 37 patients: 13 in the home telecare group, 12 each in the telephone care and usual care groups. Six months' follow-up.	Telephone care group received scheduled phone calls from the study nurse. Video-based telecare group received scheduled telecare visits. During all contacts, the study nurse used established protocols.	2001—no difference in costs in the 3 groups. Intervention groups had fewer ED visits. 2003—no differences in therapeutic regimen, medication adherence, self-care, quality of life, or satisfaction.
Riegel et al[40] (2002)	Randomized controlled trial of 358 patients: 130 received the intervention, 228 usual care. Six months' follow-up.	Telephonic case management by a registered nurse using decision-making support software specifically designed for CHF.	CHF hospitalization rates, readmission rates, hospital days, and inpatient costs were lower, patient satisfaction higher.
Artinian et al[41] (2003)	Prospective, randomized study of 18 CHF VA patients followed for 3 months. Nine patients each were in the intervention and usual care groups.	A self-care and medication compliance device (Mede-Monitor) linked to a Web-based monitoring system prompted patients about self-care.	Improved quality of life. No difference in compliance to medications, B/P, or weight monitoring (or functional status).
Laramee et al[42] (2003)	Randomized, controlled trail of 287 patients: 141 patients received the intervention, 146 usual care. Twelve weeks' follow-up.	Early discharge planning, patient, and family education. Twelve weeks of telephone follow-up.	No differences in the 90-day readmission rates or medication adherence. Adherence to self-care and diet improved.

*CHF indicates congestive heart failure.

self-care behavior. Functional class was measured by the NYHA classification system. The MLHFQ[26] measured quality of life.

A master's-prepared cardiology nurse implemented the intervention in the study by Laramee and colleagues.[42] The intervention was accomplished by telephone calls only, no home or clinic visits were made. During the telephone calls, the nurse surveyed CHF symptoms, lab values, medications, and adherence. Patients were instructed to contact their physician when indicated. At 6 weeks, if the patient was not taking target doses of an ACE inhibitor or angiotension receptor blocker and a β-blocker, a recommendation letter was sent to the primary care physician. Usual care was standard care typical of a tertiary care hospital. Adherence to daily weight monitoring, edema checks, and diet recommendations was better in the intervention group.

Summary of telephone- or technology-based home intervention

The studies in this model of care were randomized prospective trials. Seven hundred patients were studied, 52% male. Of the 4 studies that tested innovative technologies,[37–40] 2 found that emergency department visits decreased[37,38] and 1 revealed an improved patient satisfaction.[40] For the most part, there were no other positive outcomes. Possible explanations could include difficulties with the technologies, for example, 76% of the technology-based visits were limited by technical problems in 2 reports.[38,39] Small sample size may explain the lack of significant findings.[37,38,41] Two studies[41,42] tested strictly telephone interventions, with positive outcomes noted. Both of these studies used case managers with special training. Complex technologies may not be superior to traditional telephone follow-up for CHF patients.

DISCUSSION

Taken together, these studies suggest that posthospitalization nursing interventions in CHF have a positive impact on patient-oriented outcomes such as functional status, quality of life, and self-care behaviors, as well as resource utilization issues such as costs and readmissions. The synthesis of the reviewed studies reveals strengths, weaknesses, and implications for practice and research.

Strengths

The number of posthospital nursing intervention studies has increased in the past 5 years. The overwhelming majority of these studies were prospective randomized trials[12–16,19,20,22–24,27,33–42] in which an intervention group of patients was compared with a usual care group. Although sample sizes varied, a number of studies included 200 to 500 subjects [19,21,23,33,35,42] and 3 studies[18,27,40] had more than 500 participants. Sixty-two percent of the subjects studied were men. When the study of Veterans Administration patients is omitted,[27] 54% were men, indicating an increase in the number of women with CHF being studied when compared with the findings in a previous research review.[7] Randomized trials, larger sample sizes, and increased female participants all contribute to improve generalizabilty of these studies compared with previous research.[7]

The impact of posthospitalization nursing interventions on a variety of outcomes was studied, rather than a primary focus on resource and cost issues, as was the case in the past.[11] While the economic burden of CHF is important, consideration of other factors such as quality of life and functional status are critical to caring for this vulnerable group of patients.

Weaknesses

These studies lacked theoretically driven interventions and the identification of factors modified by the interventions that could have produced the positive outcomes. Only one study described a theoretical framework.[22] Another study identified factors modified by the intervention.[25]

Replication of the studies is lacking and would not be easy. Several factors contribute to difficulty in replicating the studies. First,

what is meant by usual care is unclear in the majority of studies. It is likely that usual care varies from study to study, perhaps even within studies, making its impact on outcomes impossible to replicate. Second, different measures are utilized to assess the same outcome. For example, one study defines costs as an accounting equation,[15] another study defines costs as the average total net nonreimbursed hospital revenue for CHF treatement,[18] yet another measures costs with all inpatient, outpatient, and emergency service activity.[19] This variation complicates the comparison of results. Third, virtually all of the studies test complex, multifaceted interventions. The interventions are generally well described, but unique to the practices and resources of various institutions and regions, making replication difficult.

Reference to the patients' race or ethnicity was found in 10 of the studies.[15,16,27–29,31,34,35,38,39] Most investigators enrolled predominately Caucasians. This lack of attention to race or ethnicity limits generalizability.

Implications for nursing practice

The nurses responsible for the interventions in all of the studies were all specially educated for their roles. This education varied from staff education specifically tailored for the study to utilizing master's-prepared nurse practitioners or clinical nursing specialists. Therefore, nurses caring for CHF patients posthospitalization should have education above and beyond standard practice.

Heart failure clinics with nursing as a significant component and multidisciplinary interventions extending to the home with nurses in major roles were the 2 models of interventions that had primarily positive outcomes. Approaches shared by these models of care should be implemented in practice. Specifically, interventions for CHF patients posthospitalization should include comprehensive patient and family education and support, involvement of multiple disciplines, easy and increased access to healthcare, and adequate resources for team members.

Implications for research

Home-based nursing interventions and telephone- or technology-based nursing interventions were 2 models of care that had a conflicting or unclear impact on outcomes. The majority of these studies had small sample sizes. These categories of interventions merit further study.

Studies with well-developed conceptual frameworks need to be designed and implemented. Theoretically sound research can assist investigators in identifying which component of multifaceted interventions and mediating variables explain outcomes. Replication of studies would also help clarify which intervention or a combination of interventions would be the best to institute.

Nurses working with the CHF population vary in their educational backgrounds and experiences. The impact of education and special training for nurses on patient outcomes needs to be examined. Finally, future research should include different races and ethnicities as participates.

CONCLUSION

This article reviews what is known about the impact of posthospitalization nursing interventions on outcomes in CHF. Despite weaknesses that should be addressed in future studies, the similarity of results among these studies lends credence to their validity. This group of studies suggests that posthospitalization nursing interventions improve patient outcomes and reduce resource utilization.

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