Applied Research

The effects of an advanced practice nurse-directed heart failure program

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This study sought to determine if an inpatient heart failure program directed by an advanced practice nurse could affect length of hospital stay, mortality, readmission rates, and adherence to the recommended clinical regimen. [DIMENS CRIT CARE NURS 2001:20(5):20-28]

Heart failure afflicts more than 4.6 million people in the United States,[1] with average mortality rates of 10% in the first year of diagnosis and 50% in 5 years.[2] In the Framingham Heart Study, the 6-year mortality rate was 85% for men and 67% for women, which corresponded to a death rate fourfold greater than that for the general population of the same age.[3] The incidence of heart failure is increasing at an alarming rate of 400,000 new cases each year.[4]

Heart failure's increased incidence contributes to the growing cost of treating this condition. Patients with heart failure are prone to repeat exacerbations of their cardiac disease, thereby requiring recurrent and frequent hospitalizations. In the United States, these health care costs are more than $38 billion annually, and more than $23 billion of this is spent on inpatient hospital care.[5] In 1992, Medicare paid $2.4 billion for 654,000 hospital admissions for heart failure alone.[6] In 1994, there were 840,000 hospital admissions, with an average hospital stay of nearly 7 days for each admission.[7] The average cost per discharge was $5,104, while the average Medicare reimbursement was $4,610. Five cents of every health care dollar is spent on this chronic condition. Heart failure is the primary Medicare expenditure for patients over age 65.[8]

Recent studies have shown that a disease management, multidisciplinary model may be effective in improving the heart failure patient's quality of life in addition to decreasing costs.[9-11] Many such programs are coordinated by advanced practice nurses (APNs), who are ideally suited for this role. Patients with heart failure are heavy users of the health care system and require close clinical management and encouragement to manage their symptoms. The APN has the ability to focus not only on the clinical needs of the patient, but the educational and supportive needs as well. Additionally, APNs are skilled in identifying and rectifying system issues that are barriers to quality care.

LITERATURE REVIEW

The most common causes of heart failure include coronary artery disease and hypertension. These conditions account for more than 80% of all clinical events.[12] Because of func-

tional abnormalities, the heart remodels itself by changing its shape. In left ventricular systolic dysfunction, the myocardium of the left ventricle becomes thin and enlarged, whereas in left ventricular diastolic dysfunction, the myocardium of the left ventricle becomes stiff and noncompliant. Both types of heart failure lead to symptoms of dyspnea and fatigue.

Heart failure is graded on the extent of dyspnea and fatigue experienced by the patient using the New York Heart Association classification system.[13] Patients who are rated as class I experience no symptoms with ordinary physical activity, whereas those in class II have symptoms with ordinary activity along with a slight activity limitation. Patients in class III have symptoms with less than ordinary activity and marked limitation with daily tasks. Patients in class IV are considered severely decompensated when symptoms are experienced with any type of physical activity or even at rest. About 50% of persons with heart failure are symptomatic.[14] Patients with heart failure may also be classified into four categories of all patient refined (APR)-diagnosis-related groups (DRGs) as established by the Health Care Financing Administration.[6] This classification is performed on discharge for billing purposes; it classifies patients according to the severity of their symptoms.

The growing incidence and grim prognosis of heart failure have prompted many to investigate how to better manage patient care. A multitude of compensation mechanisms are invoked in heart failure, which cause vasoconstriction and fluid retention. Heart failure management includes symptom relief, quality of life improvement, and prevention of further heart failure progression. Long-term strategies include prevention of myocardial structure changes and improvement of long-term survival. Heart failure treatment primarily involves pharmacologic therapy, risk factor reduction, dietary adjustments, exercise, and patient and family education. Drugs used to treat heart failure may include digitalis, diuretics, angiotensin-converting enzyme (ACE) inhibitors, angiotensin II receptor blockers, and anticoagulation drugs. ACE inhibitors and vasodilators or combinations of these have been studied extensively to establish their role in improving heart failure.[15-19] Triple therapy consisting of digitalis, ACE inhibitors, and diuretics is the standard of care for most patients.

TABLE 1
Program aspects received by hospitalized heart failure patients

Program aspect	Number of patients (n=381)	Percentage
APN coordination	248	65
Dietitian consultation	208	54
Heart failure orders	133	35
Heart failure pathway	224	59

Adding certain beta-blockers to this regimen is already showing great promise. According to the 1999 CONSENSUS Recommendations for the Management of Chronic Heart Failure, stable patients with class II or III heart failure due to left ventricular systolic dysfunction should receive a beta-blocker unless they are unable to tolerate the drugs or have a contraindication to their use.[20]

Patients are generally restricted to a 2-gram sodium diet per day, and fluids are limited to 2 liters per day. Patients are advised to weigh themselves daily and report to their health care provider a weight gain of 3 to 5 pounds or signs of congestion. Risk factor reduction includes treatment of all risk factors associated with coronary heart disease: hypertension, obesity, hyperlipidemia, diabetes, and tobacco use. Patients may be placed on an exercise program using the guidelines established by the American Association of Cardiovascular and Pulmonary Rehabilitation.

Many researchers have continued drug trials; others have attempted to understand the reasons for decompensation and early readmission rates for heart failure patients. One researcher found that many factors contribute to subsequent hospital admissions.[21,22] In this study, the most common factors included noncompliance with low-sodium diet (22%) and drugs (6%) and a combination of the two (37%). Failure to adhere to the clinical regimen caused a total of 65% of heart failure decompensation. Other studies examined the reasons for readmissions and determined that recurrent heart failure was cited as the most common cause, occurring in 38% of patients.[23] To prevent readmissions, contributing factors such as diet compliance, comprehensive discharge planning, follow-up, adequate social systems, and attention to signs and symptoms need to be included in the patient's plan of care.

In 1994, the Agency for Health Care Policy and Research (AHCPR, now the Agency for Healthcare Research and Quality) published clinical practice guidelines for the evaluation and care of heart failure patients.[2] These guidelines outlined the range

RESEARCH METHODS

The purpose of the study was to determine if an APN-directed heart failure program improved clinical management and educational and support needs of the patient, leading to positive patient outcomes. A quantitative, quasi-experimental design was used to determine if an APN-directed heart failure program affected patient outcomes.

Sample and setting

The target population consisted of 1,192 patients who were admitted to the hospital for heart failure and discharged with DRG 127 either before the existence of an APN-directed heart failure program (n=583) or after program initiation (n=609). A convenience sample was used. The accessible population for this study consisted of patients who were hospitalized at a 572-bed hospital in a large metropolitan area in the Midwest for heart failure from 1995 to 1997. Patients who were hospitalized for heart failure in 1995 to the middle of 1996 and coded as DRG 127 at the time of discharge (n=583) before implementation of the heart failure program were labeled as the preprogram group. Patients who were hospitalized from the middle of 1996 to 1997 for heart failure and coded as DRG 127 at the time of discharge when the heart failure program was in place (n=609) were labeled as the program group.

Only patients who were admitted for heart failure were included in the study. For example, if patients had procedures such as a hip replacement and had heart failure as a comorbidity, they were not included in either group. If patients had a principle diagnosis with DRG 127 by the medical records department, they were included in the study. Those patients with diastolic dysfunction and right-sided heart failure were also included; however, because of management differences of these disorders and a lack of standard treatment guidelines, the APN did not intervene with these patients.

Documentation of the patient's New York Heart Association classification of heart failure was not routinely performed or tracked for this study. The classification system denotes the patient's usual lifestyle and does not take into consideration acute episodes of care. APR-DRGs were monitored between the two study groups. The breakdown for each class was minor class (2%), moderate class (38%), major class (50%), and severe class (10%).

Before program implementation, 86% of patients were admitted by their primary care physician and 14% were admitted by a cardiologist. In the preprogram group, 30% of patients were managed by both the primary care physician and a cardiologist. Of the 609 patients in the program group, 97% were admitted by the primary care physician and 3% were admitted by a cardiologist. Some 60% of the program group were managed by both the primary care physician and a cardiologist consultation. About 65 different physicians admitted patients to this hospital. There were no exclusions in this study.

The features of the program group included institution of routine heart failure physician and nursing orders and a clinical pathway. An automatic referral system was put in place when the routine heart failure orders were used employing the services of an APN, social worker, and dietitian. The APN, social worker, and dietitian were available to all heart failure patients in the program group regardless of their age, physician, or insurance carrier. Controls were not placed on the study regarding the number of visits by the APN, social worker, and dietitian.

The APN served as the care coordinator and coordinated the services of the social worker and dietitian depending on the patient's compliance, knowledge level, and needs. APN was defined as a master's-prepared, certified nurse specialist—either a nurse practitioner or clinical nurse specialist. The study was conducted using two second-year graduate nursing students who were employed by the institution and directed by a certified adult nurse practitioner. One student was enrolled in an adult nurse practitioner program, and the other student was enrolled in a clinical nurse specialist program. The student nurse practitioner and clinical nurse specialist were responsible for the ongoing operation of the heart failure program. They followed all automatic referrals and also rounded on the telemetry and medical units to identify other patients admitted to the hospital with heart failure, possible heart failure, or a history of heart failure. Their APN roles were to address the clinical guidelines for heart failure with the primary care physician and use the standard heart failure orders and clinical pathway. The APN completed assessments of patients with heart failure that entailed clinical status, knowledge of heart failure and management, and discharge planning and support needs. The APN then ordered other health care professionals, as needed, in the care of the patient. The APN was also responsible for education and postdischarge patient needs.

Education sessions taught by the APN were directed toward patients with heart failure and their family members. Topics discussed included the definition and causes of heart

RESEARCH METHODS (continued)

failure, drug use and compliance, daily weights with parameters, 2-gram sodium diet restriction, activity guidelines, and symptoms to report. Other topics that were routinely discussed, if time permitted or if the patient was identified as being at risk, included fluid restriction, alcohol and smoking avoidance, fat and cholesterol monitoring, and avoidance of nonsteroidal anti-inflammatory drugs. Initial education sessions were about 45 minutes and follow-up sessions were about 15 minutes. The number of sessions each patient received depended on the patient's needs; the number of sessions was documented but not tracked for this study. Some patients received only the initial education session because their knowledge level or treatment compliance history was good. Many patients were not able to receive more than the initial education session because of a shorter length of stay. These patients were asked to visit an outpatient heart failure support group for further education. The APN made follow-up phone calls after discharge to high-risk patients: those who did not demonstrate knowledge of the education material, lacked social support, or were not likely to comply with the treatment regimen. The goals of the follow-up phone calls were to reinforce education and provide support and motivation.

Another role of the APN was to investigate the clinical management of patients with heart failure and make suggestions according to the guidelines established by the multidisciplinary team, when appropriate. This approach was used when reviewing all patient charts, especially when the routine physician heart failure orders were not utilized. The APN primarily examined how the heart failure diagnosis was established, ACE inhibitor use for patients with poor left ventricular function, beta-blocker use, and the institution of a 2-gram sodium diet. A cardiologist who specialized in heart failure was readily available to the APN for consultation. Suggestions were made directly to the physician caring for the patient or were noted on a checklist that was clipped to the front of the chart and not kept as a permanent part of the patient's record. The employment of the suggestions was strongly advised but voluntary.

Lastly, the APN was responsible for facilitating multidisciplinary group meetings for reviewing data from a heart failure registry established at this setting. The group included physicians, nurses, dietitians, social workers, respiratory therapists, and pharmacists. Periodic meetings were held to review, revise, and improve standards of care. These meetings served to educate the staff nurses involved in caring for heart failure patients and primary care and emergency department physicians who admitted patients with heart failure to the hospital. Those involved in the meetings developed patient-education materials for the program patients. A home health care plan also was developed and incorporated in the discharge plan when appropriate. Weekly meetings were held between the APN and the cardiologist who oversaw the program guidelines.

Data collection and analysis

The patient outcome data were obtained through the hospital medical records department and the heart failure registry. This research was approved by the Institutional Review Board at the College of St. Catherine and United Hospital, Allina Hospitals and Clinics. For data analysis, comparisons were made between the preprogram and program groups. Data analysis through the medical records department consisted of comparing differences in length of stay and mortality and readmission rates between the preprogram and program groups.

T-tests were used as the statistical tool to evaluate the difference in length of stay between the preprogram and program groups. Chi-square analysis was used to analyze 15-day, 30-day, and 90-day readmission rates.

Three types of readmission rates were considered: total readmissions including heart failure, cardiac causes, and all other types encompassing all DRGs; all cardiac-related readmissions including heart failure involving DRG codes 103-145, 478, and 479; and heart failure alone or DRG 127 readmissions. Data analysis through the heart failure registry consisted of ACE inhibitor use, beta-blocker use, the institution of a low-sodium diet, pathway use, heart failure clinical and nursing order use, mortality rates, and readmission rates. The heart failure registry for the program group consisted of 584 patients, whereas data obtained through the medical records department for the program group consisted of 609 patients. This sample size difference is a result of abstracting data by admission date (heart failure registry) versus discharge date (medical records department).

Investigator

For more information or to replicate this study, contact Sue Penque RN, CNP, MS, at sue.penque@allina.com.

of diagnostic and management strategies appropriate for patients with left ventricular systolic dysfunction. When the AHCPR heart failure expert panel organized, it found many variations in heart failure management despite the existence of strong evidence from clinical trials. The three variations identified were missed diagnosis of heart failure, inaccurate and incomplete evaluation and testing of heart failure, and improper management of heart failure.

To improve the care of heart failure patients and decrease the growing costs, hospitals developed and instituted a variety of disease management models. Expert nurses were chosen to coordinate these heart failure programs based on their experience in case management, collaboration, process improvement, clinical skills, cost-containment efforts, and evaluation. One researcher examined the effects of a comprehensive discharge planning protocol implemented by APNs for patients with heart failure or angina/myocardial infarction compared with the hospital's general discharge planning.[10] The results showed that there were fewer readmissions (15% versus 16%), fewer total days rehospitalized (22% versus 70%), lower readmission charges ($52,384 versus $189,892) and lower charges for health care services after discharge ($2,453 versus $6,746) for those patients who received the comprehensive discharge planning protocol.

TABLE 2
Readmission rate comparisons

Category	Percentage of patients readmitted					
	15 days		30 days		90 days	
	Preprogram	Program	Preprogram	Program	Preprogram	Program
Heart failure	3.77	3.45	7.89	4.76	14.58	8.37
Cardiac	5.83	5.75	11.49	9.20	21.78	15.93
Total	9.90	8.37	18.87	14.12	37.56	30.38

Another researcher analyzed the effectiveness of a nurse-directed multidisciplinary plan of care for patients with heart failure who were at high risk for readmission.[9] The plan of care included intensive education about heart failure, a detailed drug analysis, early discharge planning, and enhanced follow-up through home health care and telephone contacts for the study group. Positive outcomes for the patients who received this plan of care resulted in lower 90-day readmission rates (33.3% versus 45.7%) and fewer hospitalized days for the study group (4.3% versus 5.7%). Additional benefits included improved quality of life scores and lower overall cost of care for the study group. Similar outcomes were evaluated in another study using a program with an APN and cardiologist in addition to the establishment of a special heart failure center for use after discharge for continued assessment, drug management, and education.[11] Results from this study showed an 85% reduction in hospital readmissions, improved functional status, and an estimated hospital readmission cost savings of $9,800 per patient.

Heart failure incidence continues to grow and take its toll on the health of society. Some 75% of the $10 billion spent annually on heart failure treatment is attributed to inpatient care.[24] Although this chronic condition can be severely debilitating, many new treatment options and patient pathways are available. Among the most promising of these is the benefit of the APN-directed, multidisciplinary heart failure program for patients. The structure of the health care delivery system for this patient group is paramount in the attainment of positive patient outcomes.

FIGURE 1
Length of stay

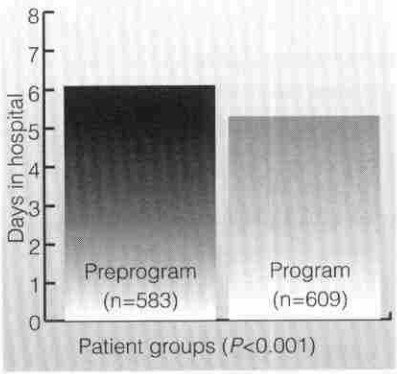
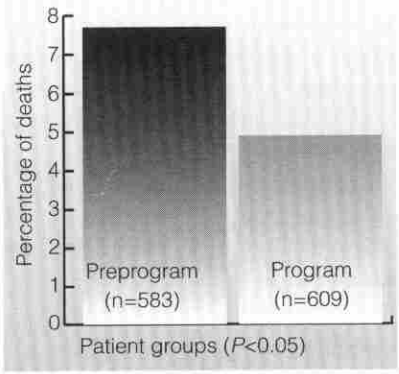


FIGURE 2
Mortality rate comparison



PURPOSE

This study sought to determine if an inpatient heart failure program managed by an APN affects patient outcomes. The goal of the APN-directed program in this study was to improve the care of patients hospitalized with heart failure while decreasing the high use of resources caused by frequent and complicated admissions.

The program also aimed to improve clinical management and the patient's educational and support needs. These improvements would result in a decreased length of stay, mortality, and readmission rates. For more details on the study, see *Research Methods.*

RESULTS

Of the patients in the program group, 381 (63%) received one or more of the program aspects. Some 228 patients (37%) in the program did not receive any of the four program aspects. Of the patients who did not receive any of the program components, 200 had diastolic dysfunction and 15 had right-sided heart failure. The patients who were not seen were probably missed because of the APN's schedule or the placement of patients in noncardiac care units. Table 1 details the frequency distribution of the four program aspects received by these patients. The average age of the program group was 75 and 96% were Caucasian. The average age of the preprogram group was 72 and 95% were Caucasian.

Length of stay

A t-test for independent samples was used to evaluate the difference in length of stay between the preprogram and program groups. The length of stay was 6.1 days (SD=4.38) for the preprogram group compared with 5.3 days (SD=3.92) for the program group (see Figure 1). A significant difference existed in length of stay for those patients in the program group with a 14% reduction and corresponding P value of <0.001.

Mortality

In the preprogram group, 45 patients (7.7%) died during their hospital stay versus 30 patients in the program group (4.9%) (see Figure 2). This was a 36% reduction in deaths for the program group compared with the preprogram group, which was statistically significant (P<0.05). Of those patients in the program group who died while in the hospital, 12 received one or more of the program components.

Readmission rates

The chi-square statistic was used to analyze 15-, 30-, and 90-day readmission rate data. To further examine this, three categories of readmission types were considered: heart failure alone; cardiac etiology including heart failure; and total readmissions including heart failure, cardiac causes, and all other types.

Readmission rates within 15, 30, and 90 days of discharge from the hospital for the different categories of readmission types were compared (see Table 2). Patients in the program group were rehospitalized less for each readmission reason, but this difference was not statistically signifi-

TABLE 3
Influence of program aspects on program patients

Outcome variable (number of patients)	No program aspects (number of patients) (n = 203)	One or more program aspects (number of patients) (n = 381)	*P* value
90-day readmission rate			
• heart failure (35)	8.4% (17)	4.7% (18)	0.077
• cardiac (73)	14.3% (29)	11.5% (44)	0.340
• total (136)	28.1% (57)	20.7% (79)	0.046*
Angiotensin-converting enzyme inhibitor use (346)	51.2% (104)	63.5% (242)	0.004*
2-gram sodium diet (188)	16.4% (23)	59.8% (165)	0.000*
Mortality rate (28)	7.9% (16)	3.1% (12)	0.011
Left ventricular function measured (489)	77.8% (158)	87.3% (331)	0.003
Length of stay	5.0 days	5.6 days	0.293

* Program aspects included APN, social worker, or dietitian consultation and heart failure orders or heart failure pathway.

cant for the 15-day readmission category. However, it was statistically significant in the 30-day readmission category for heart failure, in the total readmission categories, and in all categories for 90-day readmissions.

Table 3 provides a comparison of outcomes based on receiving none of the four program aspects as opposed to receiving one or more. These results showed positive trends for the patients who received some part of the program compared with those who did not receive any program aspect. This was significant for the total 90-day readmission rates, ACE inhibitor use, mortality rates, and the institution of a low-sodium diet.

Table 4 illustrates the effects of the program aspects on the individual outcomes compared with those patients who did not receive these program components. These findings provide a further breakdown of how the different program components affected the patient outcome variables. Length of stay was significantly longer for patients who received APN coordination and dietitian consultation. This is most likely due to the increased chance of receiving these services if the inpatient stay is longer. APN coordination significantly improved mortality, ACE inhibitor use, the institution of a 2-gram sodium diet, and the measurement of left ventricular function.

Multiple regression analysis was performed to establish which program aspect had the greatest effect on each of the patient outcome variables. Linear multiple regression for length of stay revealed dietitian consultation had a significant negative impact ($P>0.001$) on length of stay. Length of stay was longer for those patients who received one or more program aspect. This may be because a longer length of stay increases the likelihood of educational intervention. Using logistic multiple regression, it was found that APN coordination most positively affected mortality ($P<0.05$), ACE inhibitor use ($P<0.001$), and left ventricular function measurement ($P<0.001$). The use of the heart failure pathway decreased total 90-day readmission rates ($P<0.05$). Cardiac and heart failure readmissions were not significantly affected. The use of heart failure or-

TABLE 4
The effects of program aspects on patient outcomes

Outcome variable	APN coordination (teachable patients n=536)		Dietitian consultation (teachable patients n=536)		Heart failure orders (all patients n=584)		Heart failure pathway (all patients n=584)	
Received	yes	no	yes	no	yes	no	yes	no
Length of stay (days)	5.7	4.9*	6.1	4.8**	5.3	3.0	5.2	5.3
Mortality (%)	1.2*	6.2	3.4	4.2	5.1	5.3	3.1	5.8
Total 90-day readmission rate (%)	27.5	31.5	29.1	30.0	24.1	30.6	21.9*	33.6
Cardiac 90-day readmission rate (%)	15.2	17.1	13.8	17.7	14.3	16.5	12.5	18.3
Heart failure 90-day readmission rate (%)	7.8	8.9	9.6	6.4	6.0	8.9	5.4*	10.0
Angiotensin-converting enzyme inhibitor use (%)	69.3†	53.4	63.1	59.2	65.5	57.7	64.3	56.1
2-gram sodium diet instituted (%)	68.9†	25.9	65.2	30.8	84.6†	29.8	71.3†	26.9
Left ventricular function measured (%)	92.1**	78.8	87.7	83.3	88.0	82.9	89.7*	80.5

*P value of ≤ 0.05 **P value of ≤ 0.001

ders ($P<0.001$) significantly affected the institution of a 2-gram sodium diet. Other program components also had an effect on the outcomes; however, they were not measurable and not included in the analysis.

DISCUSSION

Significant improvements were found in all patient outcomes in the program group compared with the preprogram group. Length of stay, in-hospital mortality rates, and readmission rates for the program group patients were significantly reduced. The readmission rate findings were consistent with the results of several other heart failure program studies.[9-11] Thus, a multidisciplinary APN-directed heart failure program may decrease the need for rehospitalization of heart failure patients. Although sufficient data were not available from other studies regarding the effects of length of stay and mortality rates, this study found that a significant positive trend existed in these variables to further validate this theory.

The program group included patients who received formal consultation with the APN, social worker, or dietitian. Patients who received one or more program aspects had better outcomes than those in the program group who had none. This may be attributed to the education of the staff who cared for the program patients. Additionally, familiarity with the AHCPR guidelines and awareness of the clinical pathway by the nursing staff and primary care physicians could have contributed to the change in outcomes for this group of patients, regardless of receiving formal program components.

A variable that was not considered in the research was the issue of cost. Cost savings were found in other studies.[9-11] Thus, it is reasonable to assume that cost savings—for the patient and health care system—existed in this study because length of stay was decreased, and the need for readmissions was decreased while the heart failure program was in place. The financial implications of such a program would be important for the health maintenance organizations to consider as their prevalence increases.

LIMITATIONS

The limitations of the study were the use of a retrospective design expanding from 1995 to 1997 and a nonrandom sample. It was difficult to attribute positive patient outcomes solely to the effects of the APN-directed program because of the many changes in health care delivery during this time period, such as managed care and an intense effort by providers to reduce costs.

A second study limitation was the affected readmission rate data obtained from the hospital. All readmissions for heart failure for both groups of patients were made to the study hospital. However, three smaller hospitals exist within the area where patients could have been admitted for reasons other than heart failure. A method was not available for tracking readmission rates for noncardiac events at other health care facilities for this patient sample.

Further, no attempt was made to compare the attributes or psychological profiles of either group. Patients were not categorized into their heart failure classification and an analysis of outcomes compared accordingly. Outpatient mortality was not measured.

FUTURE STUDY RECOMMENDATIONS

Recommendations for future studies include examining the quality of life and functional status of patients with heart failure before and after heart failure program involvement. Studies that examined the specific educational components that most affected patients would be beneficial to hospital-designed programs and outpatient clinics. A qualitative study to learn more about patients' situational and personal attributes that contribute to treatment compliance and their ability to cope with heart failure is also needed. Further research is needed to examine other outcome measures such as frequency of follow-up clinic visits, outpatient mortality, and benefits of outpatient cardiac rehabilitation programs for heart failure patients.

Many health care providers found patients were not being managed successfully until an APN took a more comprehensive management approach.

PRACTICE IMPLICATIONS

The research findings confirm those of other studies in establishing the APN's role as an effective care coordinator. Despite substantial clinical research confirming the effectiveness of proper diagnosis and drug regimens for heart failure treatment, many health care providers found patients were not being managed successfully until an APN facilitated a more comprehensive management approach.[1,9-11,23,24] This management, meeting the patient's educational needs and ensuring a proper support structure, led to positive results for

patients with heart failure.

The research illustrates that an APN-directed multidisciplinary heart failure program can have a positive effect on patient outcomes and can curb the elevating costs of care. Advanced practice nurses provide a unique position for health maintenance organizations, because they can improve the quality of care given to heart failure patients while decreasing the cost to the institution, the patient, and the health care system. The study's findings also could support exploring the APN's role in managing the care coordination of other chronic illnesses.

CONCLUSION

Heart failure is a major public health problem in the United States. Heart failure hospital admissions are often unplanned readmissions that have a high mortality rate. Underuse of the AHCPR guidelines continues. A program of intensive inpatient case management directed by an APN using a multidisciplinary approach is one method for achieving more favorable patient outcomes. Through this mechanism, a coordinated disease management approach may be implemented that includes early assessment in the hospital, comprehensive education, and behavior modification. ■

REFERENCES

1. Simons WR, et al. Effects of improved disease management strategies on hospital length of stay in the treatment of chronic heart failure. *Clinical Therapeutics* 1996;18(4):726-46.
2. Agency for Health Care Policy and Research. Heart failure: Evaluation and care of patients with left-ventricular systolic dysfunction. Washington, D.C.: United States Department of Health and Human Services. Clinical practice guideline No. 11. AHCPR Publication No. 94-0612, 1994.
3. Kannel WB, Belanger AJ. Epidemiology of heart failure. *American Heart Journal* 1991;21:951-7.
4. American Heart Association. *Heart and Stroke Facts: 1996 Statistical Supplement.* Dallas, Texas: American Heart Association.
5. O'Connel JB, Bristow MR. Economic impact of heart failure in the United States: Time for a different approach. *Journal of Heart and Lung Transplantation* 1994;13:107-12.
6. Health Care Financing Administration. MedPAR Database. Baltimore, Md.: HCFA Bureau of Data Management and Strategy, Office of Statistics and Data Management, 1995.
7. Health Care Financing Administration. MedPAR Database. Baltimore, Md.: HCFA Bureau of Data Management and Strategy, Office of Statistics and Data Management, 1996.
8. Lemrow N, et al. Fifty most frequent diagnosis related groups (DRGs), diagnoses, and procedures: Statistics by hospital size and location. Rockville, Md.: Agency for Health Care Policy and Research, 1990;117.
9. Rich MW, et al. A multidisciplinary intervention to prevent the readmission of elderly patients with chronic heart failure. *The New England Journal of Medicine* 1995;333(18): 1190-5.
10. Naylor MD, et al. Comprehensive discharge planning for the hospitalized elderly: A randomized clinical trial. *Annals of Internal Medicine* 1994;120(12):999-1006.
11. Fonarow GC, et al. Impact of a comprehensive heart failure management program on hospital readmission and functional status of patients with advanced heart failure. *Journal of the American College of Cardiology* 1997; 30(3):725-32.
12. Ho KKL, et al. The epidemiology of heart failure: The Framingham study. *Journal of the American College of Cardiology* 1993; 22:6A-13A.
13. The Criteria Committee of the New York Heart Association. *Diseases of the Heart and Blood Vessels: Nomenclature and Criteria for Diagnosis,* 6th edition. New York, N.Y.: Little Brown and Co., 1994.
14. Giles T. The cost-effective way forward for the management of the patient with heart failure. *Cardiology* 1996;87(1):33-9.
15. CONSENSUS Trial Study Group. Effects of enalapril on mortality in severe chronic heart failure: Results of the Cooperative North Scandinavian Enalapril Survey Study. *The New England Journal of Medicine* 1987; 316:1429-35.
16. SOLVD Investigators: Effects of enalapril on survival in patients with reduced left ventricular ejection fractions and chronic heart failure. *The New England Journal of Medicine* 1991;325:293-302.
17. SOLVD Investigators: Effect of enalapril on mortality and the development of heart failure in asymptomatic patients with reduced left ventricular ejection fractions. *The New England Journal of Medicine* 1992;327: 685-91.
18. Swedberg K, et al. The Trial Study Group. Effects of early administration of enalapril on mortality in patients with acute myocardial infarction: Results of the Cooperative New Scandinavian Enalapril Survival Study II (CONSENSUS II). *The New England Journal of Medicine* 1992;327:678-84.
19. Pfeffer MA, et al. Effect of captopril on mortality and morbidity in patients with left ventricular dysfunction after myocardial infarction: Results of the Survival and Ventricular Enlargement (SAVE) Trial. *The New England Journal of Medicine* 1992;327:669-77.
20. Packer M, Cohn JN. Consensus recommendations for the management of chronic heart failure. *American Journal of Cardiology* 1999;83(2A).
21. Ghali JK, et al. Precipitating factors leading to decompensation of heart failure: Traits among urban blacks. *Archives of Internal Medicine* 1988;148:2013-16.
22. Ghali JK, et al. Trends hospitalization rates for heart failure in the United States, 1973-1986: Evidence for increasing population prevalence. *Archives of Internal Medicine* 1989;150:769-73.
23. Vinson JM, et al. Early readmission of elderly patients with chronic heart failure. *Journal of the American Geriatric Society* 1990;38: 1290-5.
24. Philibin E, DiSalvo T. Managed care for chronic heart failure: Influence of payer status on process of care, resource utilization, and short term outcomes. *American Heart Journal* 1998;136(3):553-61.

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