

A Literature Review of Home Care Monitoring of Heart Failure Patients

**An outcomes based literature review of the application
and effectiveness of home care monitoring in the
management of heart failure patients.**

FINAL Paper

Richard B. Greene, R.Ph.

Email: rgreenerx@comcast.net

**University of Florida
College of Pharmacy
Working Professional Doctor of Pharmacy**

ABSTRACT

BACKGROUND: Chronic heart failure (CHF) is the most common reason for hospital admissions in the Medicare age group. Studies have shown that 30% of patients with a discharge diagnosis of heart failure are readmitted at least once within 90 days with readmission rates ranging from 25 to 54% within 3 – 6 months. There is some evidence that a multidisciplinary management program and home-based intervention can reduce readmission rates and length of hospital stay in heart failure patients. **OBJECTIVE:** To evaluate the medical literature and assess the effectiveness of home care monitoring for heart failure patients as a means of reducing hospital readmissions and length of stay.

METHODS: A literature search was conducted on studies involving home care monitoring of heart failure patients between 1999 and 2004 using PubMed, Cochrane Library and Google.

RESULTS: Five articles were reviewed and analyzed. One study suggests the quality of life was significantly improved for two groups when comparing post-intervention and pre-intervention scores.⁽¹⁾ While in another study, a home care management organization reported a 35% decrease in hospitalizations for patients with heart failure from 22.6 to 14.6 per 1,000 members.⁽²⁾ Three additional studies reviewed readmission rates of home monitored patients with the rates with non-home monitored patients. One study showed telemanagement patient compliance rates averaging 89.5 % after 18 months. This demonstrates CHF hospitalization rates that were 0.6/patient/year compared with the national benchmark of 1.7/patient/year.⁽³⁾ In a different study from the previous year patients had an average of 1.8 hospitalizations each, while in the follow-up period (mean length = 307 days) there were 0.2 hospitalizations per patient (P=50.0001).⁽⁴⁾ Another study revealed a decrease in readmissions, length of stay, and hospital charges, that were all significant (p < 0.001) compared to pre-study values. Quality of life was also significantly (p 0.002) improved from baseline.

CONCLUSION: Home care monitoring may have an important role as a strategy to provide effective and cost efficient health care for heart failure patients. The use of new improved technology to monitor patients along with the support of a health care provider significantly improves heart failure management while reducing the cost of health care. Additional multicenter, randomized controlled studies are required to further evaluate the potential benefits such as quality of life and cost effectiveness of these technologies and interventions.

Background

In the United States, the prevalence of chronic heart failure (CHF) is approximately 5 million, and 400,000 new cases are diagnosed yearly⁽¹⁾. Chronic heart failure (CHF) is the most common reason for hospital admissions in the Medicare age group and is nearly double the rate of pneumonia, the next highest volume diagnosis. Heart failure claims the lives of more than 200,000 Americans annually, with 50% of the patients dying within 5 years of onset. The incidence of heart failure increases with age, approaching 10 per 1,000 after age 65. Between 1997 and 2000, hospital discharges for heart failure increased 165% (American Heart Association [AHA], 2003). Studies have shown that 30% of patients with a discharge diagnosis of heart failure are readmitted at least once within 90 days and readmission rates range from 25 to 54% within 3– 6 months⁽⁶⁾.

The cost of caring for patients with CHF exceeds \$8 billion/yr and continues to increase. To manage costs, medical centers have adopted various strategies. The economic burden of CHF demands a mechanism to improve quality of care while preventing unnecessary hospitalizations.

There is some evidence that a multidisciplinary management program and home-based intervention can reduce readmission rates and length of hospital stay in heart failure patients. A 1993 survey of U.S. hospitals performed by the Cardiology Advisory Board Co. (Washington, DC) identified several strategies: heart failure clinics, home health cardiac specialists, community-based service coordinators, patient telemanagement, hospital-sponsored cardiac rehabilitation, emergency department observation units, and CHF sub acute care. In the hospital setting, the most common strategy is the clinical pathway. However, none of these clinical pathways has been studied rigorously for efficacy.

The telephone may be a simple, useful tool for enhancing compliance. Telemonitoring permits home monitoring of patients using special telemonitoring (telecare) devices in conjunction with a telecommunication system. Telemonitoring allows the evaluation of patients by providing diagnostic information, which can be used to assist in management decisions. To support chronically ill patients at home health care providers are increasingly using Telecare.

According to the American Society of Health-System Pharmacists Guidelines on the Pharmacist's Role in Home Care: The pharmacist is responsible for ongoing clinical monitoring of the patient's drug therapy according to the care plan and for appropriately documenting and communicating the results of all pertinent monitoring activities to other health care providers involved in the patient's care. The pharmacist is also responsible for ensuring that relevant information is obtained from the patient, the caregiver, and other health care providers and for documenting this information in the patient's home care record.

The purpose of this literature review is to evaluate the evidence supporting the effectiveness of home care monitoring for heart failure patients as a means of reducing hospital readmissions. The use of effective home care monitoring of heart failure patients will decrease the incidence of readmissions, increase patients the quality of life and lower the costs of health care.

Methods for Literature Search

A literature search was conducted on studies involving home care monitoring of heart failure patients between 1999 and 2004 using PubMed, Cochrane Library and Google. The keywords used were: heart failure, chronic heart failure, outcomes, and telemonitoring. The search was limited to complete articles, which could be obtained electronically. A variety of peer reviewed outcomes based articles were reviewed evaluating homecare management and telemangement of heart failure patients. The search excluded non-outcomes based articles and any literature prior to 1999. Although several other articles were found, the five chosen to be reviewed and analyzed appeared to provide a representation of the current status of the application and effectiveness of home care monitoring of heart failure patients as a means of reducing re-hospitalizations.

Discussion of Studies

In an article authored by Knox et al, the outpatient clinic was designed to optimize medications and risk-stratify patients to allow noncompliant and end-stage patients frequent visits.⁽³⁾ A compliance tracking mechanism, called CHF Tel-Assurance™, was implemented. Patients were monitored using technology and reviewed each week by a multidisciplinary team. The team consisted of the CHF physician; pharmacist; dietitian; exercise physiologist; nurses; and members from the telemetry unit, home care, research, and cardiac rehabilitation. The goals of the team were to provide improved patient outcomes, decrease hospitalizations and reduce readmissions. Patient education was the core approach to allow patients to become “co-managers” of their disease. Interventions by members of the healthcare team included: education, determining the reasons for non-compliance, developing strategies for effective management, encouragement of good health practices, and telemanagement of vital signs.

In an article written by Scalvini et al, patients received a portable ECG monitor which could transmit a single-lead ECG trace, and used as a basis for patient evaluations and medication dosage adjustments.⁽⁴⁾ Seventy-four CHF patients were enrolled in the program of single-lead electrocardiography (ECG) monitoring and telephone follow-up. The patients then transmitted their ECG data by fixed telephone to a receiving station where a health care professional was available for an interactive teleconsultation. Patients were evaluated based upon the stratification of illness severity according to the New York Heart Association (NYHA) functional classification, daily living activities, medication compliance, vital signs and general signs and symptoms.

In the Disease Management Program for Heart Failure article by Gorski et al, patients were referred to a Heart Failure Disease Management home care program⁽²⁾. In a unique collaboration that transcends the traditional relationship between payer and provider, a home care agency developed a successful disease management approach for managing patients with heart failure integrated with a care management organization.⁽²⁾ A comparison was made of heart failure outcomes between one of two home health care delivery methods for three months after discharge. Heart failure patients were monitored by a disease management team.⁽²⁾

The Effect of Physiologic Home Monitoring and Telemanagement on Chronic Heart Failure Outcomes study by Bondmas et al attempted to determine the feasibility and effectiveness of telemomitoring on outcomes related to the management of chronic heart failure. This was accomplished by evaluating heart failure related readmissions, length of stay, and hospital charges for any heart failure readmissions. The patients were evaluated by telemonitoring for blood pressure, heart rate, arterial oxygen saturation, and weight. This study also evaluated humanistic outcomes such as quality of life, patient safety, and patient satisfaction.⁽⁵⁾

The Outcomes of Chronic Heart Failure study by Benatar et al set out to compare outcomes for patients whose home health was provided by telemanagement with outcomes based upon home visits. The outcomes evaluated included heart failure readmissions, length of stay, heart failure hospitalization charges, and preintervention and post intervention quality of life measurements. Patients used telephonic home monitoring devices to measure their weight, blood pressure, heart rate, and oxygen saturation level. These data were transmitted to a secure Internet site for review by a health care provider.⁽¹⁾

In the Scalvini et al study, patients were followed up for a mean (SD) of 307 (108) days; 1467 calls were analyzed (213 ad hoc consultations and 1254 scheduled consultations). A total of 124 cardiovascular events were recorded. Modifications to therapy were suggested in response to 119 calls; hospital admissions were suggested for 13 patients, further investigations for 7 and a consultation with the patient's general practitioner for 13. No action was taken after 1330 calls. Twenty-two ECG abnormalities were recorded. In 63 patients receiving the beta-blocker carvedilol, the mean dosage increased from 36 to 42 mg. In the previous year there were 1.8 hospitalizations per patient, while in the follow-up period there were 0.2 hospitalizations per patient.⁽⁴⁾ This study supported the notion that home-based telecardiology can benefit patients and can also be an effective tool in medication dosage adjustments.

The Benatar et al study provided a detailed summary showing the cost effectiveness savings and an improvement of quality of life when compared to patients not receiving the intervention.⁽¹⁾ After 3 months, patients in the nurse telemanagement (NTM) model group (n=108; mean±SD age, 62.9±13.2 years; 83% African American; 64% female) had fewer heart failure readmissions (13 vs. 24) with shorter lengths of stay (49.5 vs. 105.0 days) compared with the home nursing visit (HNV) group (n=108; mean±SD age, 63.2±12.6 years; 89% African American; 62% female). Hospitalization charges at 3 months were less in the NTM group compared with the HNV group (\$65023 vs. \$177365). At 6 and 12 months, cumulative readmission charges in the NTM group were also less (\$223638 vs. \$500343 and \$541378 vs. \$677710, respectively) compared with the (HNV) group. Quality of life was significantly improved for both groups when compared post-intervention and pre-intervention scores.⁽¹⁾ This study demonstrated the combination of telemanagement and heart failure management is cost effective and leads to improved outcomes and care.

After 18 months of intervention in the disease management program by Knox et al, telemanagement patient compliance rates averaged 89.5 %. CHF hospitalization rates were 0.6/patient/year compared with the national benchmark of 1.7/patient/year. In the previous year, the patients had had an average of 1.8 hospitalizations each, while in the follow-up period (of mean length 307 days) there were 0.2 hospitalizations.⁽³⁾ This study validates a multidisciplinary approach encompassing inpatient education, outpatient

home care, and compliance monitoring is advantageous to patients in all health care settings. The study further demonstrates the effectiveness and use of telemanagement.

The results of the Bondmas et al study are detailed in Table 1. This study showed a reduction in readmissions, length of stay, and hospital charges, which were all significantly ($p < 0.001$) decreased compared to pre-study values. In addition, quality of life which was significantly ($p = 0.002$) improved from baseline.⁽⁵⁾

This review showed how the quality of life in heart failure patients was significantly improved in groups when comparing pre-intervention and post-intervention scores. Home care monitoring from these studies often led to an increase in utilization of oral diuretics prescribed, even though in some cases diuretics were administered by the health care professional. Telephone follow-up calls were increased to monitor patient response to the intervention. These studies provide support to show that telemanagement home monitoring can provide a major advantage to either as a 'stand-alone' program or as an adjunctive strategy to existing programs for the monitoring of heart failure patients.

In the Gorski study, a collaboration between a home care agency and a care management organization yielded an average cost saving from rehospitalizations of program patients to be projected at \$165,000.⁽²⁾ Even though this was a limited study, the findings are significant.

Critique

The Benatar study was in an urban academic medical center with a sample composition not representative of the ratio of white to African American persons in the general population. The Knox et al study was shown to be a self-care management program in performing daily weight measurement, which was tracked as an outcome only for the patients who completed the program. The same health care provider in this study also verified this outcome as they continued telephone follow-up after the home care program. This may have led to a biased or limited report of results.⁽³⁾ This study was extremely interesting and informative but provided little objective supportive data.⁽³⁾ (Table 1)

The Scalvini study did note of existing differences in the management of CHF in practice between cardiologists, internists and general practitioners. The study acknowledged these differences and attempted to minimize them by the use of principal guidelines. This study also provided an insight into the need of follow-up care for chronic heart failure patients.⁽⁴⁾

In the disease management study by Gorski there was a limitation of only a small group in addition to not normally providing patients with baseline educational support. The study design was not specified; therefore, the reader must assume the conclusions provided are valid and correct.

The study design was which causes also not noted which.⁽²⁾ This same limitation was also found in another study, which also did utilize a randomized two-group design.⁽⁵⁾ (Table 1)

Summary of Findings

All five studies provided an insight of the high level of support, which can be provided to the homebound heart failure patient. It is evident that the key factor in any therapeutic disease management system is patient education. Empowering the patient requires daily compliance monitoring through telemanagement and reinforcement of education across all settings. The best approach appears to be a combination a multidisciplinary team approach along with a refined telemanagement support system.

The adaptation of state-of-the-art computerized technology to closely monitor patients with Heart Failure by health care providers significantly improves heart failure management while reducing the cost of care and improving the quality of life. When a program used home visits and telephone follow-up, telehealth and telemonitoring systems became an increasingly important part of disease management. In many patients, low-tech and low cost strategies aimed at patient self-care management work well, while reserving certain high-risk patients for a home telemonitoring system.

Recommendations

Chronic heart failure is increasing and continues to be associated with a high mortality rate. The economic burden of this debilitating disease requires an armamentarium of resources to decrease costs and hospitalizations. A multidisciplinary approach encompassing care across the continuum: inpatient, education, outpatient, home care, and compliance monitoring is advantageous to patients and the health care system.

Telephone follow-up by a health care provider could be targeted to a time of need (e.g., increased weight) versus a routine call. Integration of home telemonitoring should be a focus for future programs. Telemonitoring may have an important role as part of a strategy for the delivery of effective health care for patients with heart failure but more evidence of efficacy is required before its widespread adoption can be recommended. Furthermore, analysis of existing studies and new large multicentre, randomized controlled trials are necessary to evaluate the potential benefits and cost-effectiveness of this evolving intervention.

Conclusions

This literature review has evaluated five outcomes based evidence articles on the effectiveness of home care monitoring for heart failure patients as a means of reducing hospital readmissions. In summary, the results of these studies demonstrate significant improvements in outcomes by reducing hospital readmissions, improving the quality of care for patients with severe Heart Failure when combining aggressive remote telemonitoring supported by a health care provider. The data provides evidence that the introduction of current state-of-the-art computerized technologies allows rapid and accurate monitoring of patients with severe Heart Failure. The combination of these technologies and Heart Failure management by a health care provider is cost-effective and leads to improve outcomes and care.

Articles:

1. Benatar D, Bondmass M, Ghitelman J, Avitall B., Outcomes of chronic heart failure. *Arch Intern Med.* 2003 Feb 10;163(3):347-52.
2. Gorski LA, Johnson K, A disease management program for heart failure: collaboration between a home care agency and a care management organization, *Lippincotts Case Manag.* 2003 Nov-Dec;8(6):265-73.
3. Knox D, Mischke L., Implementing a congestive heart failure disease management program to decrease length of stay and cost. *J Cardiovasc Nurs.* 1999 Oct;14(1):v-vii.
4. Scalvini S, et al, A pilot study of nurse-led, home-based telecardiology for patients with chronic heart failure. *Journal Telemedicine and Telecare.* 2004;10(2):113-7.
5. Mary Bondmass, Nadine Bolger, Gerard Castro, Boaz Avitall: The Effect of Physiologic Home Monitoring and Telemanagement on Chronic Heart Failure Outcomes. *The Internet Journal of Advanced Nursing Practice* 2000; Volume 3, Number 2: <http://www.ispub.com/journals/IJANP/Vol3N2/chf.htm> ; Published March 27, 2000.
6. Cleland JGF, Gemmell I, Khand A, Boddy A. Is the prognosis of heart failure improving? *Eur J Heart Fail* 1999; 1:229-41
7. American Society of Health-System Pharmacists: Guidelines on the Pharmacist's Role in Home Care, Practice Settings Guidelines: *Am J Health-Syst Pharm.* 2000;57:1252-7

Table 1 (Outcome summary table)⁽⁵⁾

<u>Primary Outcomes</u>	<u>Endpoint</u> <u>Month (surviving n)</u>	<u>Pre-Intervention</u> <u>(retrospective data)</u>	<u>Post-Intervention (prospective data)</u>	<u>Percent Change*</u>	<u>Significance (p value)</u>
Number of HF re-admissions	3 (58)	62	12	81	<0.001
	6 (56)	70	16	77	<0.001
	12 (48)	74	22	70	<0.001
Length of stay of HF re-admissions	3 (58)	326	35	90	≤0.001
	6 (56)	395	56	86	≤0.001
	12 (48)	388	105	67	≤0.001
HF re-admissions charges	3 (58)	\$699,880.00	\$65,613.00	91	≤0.001
	6 (56)	\$890,159.00	\$110,797.00	88	<0.001
	12 (48)	\$880,695.00	\$214,603.00	69	≤0.001

Table 2 A Literature Review of Home Care Monitoring of Heart Failure Patients

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Author(s) - Date - ref#	Study Design	#	Inclusion Criteria	Exclusion Criteria	Results	Limitations
Benatar D, Bondmass M, Ghitelman J, Avital B., Outcomes of chronic heart failure. Arch Intern Med. 2003 Feb 10;163(3):347-52.	A prospective, randomized design was used to compare HF outcomes from 216 patients randomized to 1 of 2 home health care delivery methods for 3 months after discharge.	216	Confirmed HFAt least 1 of the following: (1) documented diagnosis of HF as determined by means of radiographic evidence of pulmonary congestion; (2) documented New York Heart Association functional classification III or IV; (3) conventional clinical HF symptoms of dyspnea and edema that responded to diuresis; and (4) echocardiographic evidence suggestive of HF.	at least 1 of the following: (1) documented diagnosis of HF as determined by means of radiographic evidence of pulmonary congestion; (2) documented New York Heart Association functional classification III or IV; (3) conventional clinical HF symptoms of dyspnea and edema that responded to diuresis; and (4) echocardiographic evidence suggestive of HF. Heart failure was defined as an ejection fraction of 40% or less for systolic dysfunction, or impairment in 1 or more indices of ventricular filling with a corresponding clinical picture for diastolic dysfunction, in accordance with the American College of Cardiology/American Heart Association guidelines for chronic HF.	Quality of life was significantly improved for both groups when we compared post-intervention and pre-intervention scores.	It was an urban academic medical center with a sample composition not representative of the ratio of white to African American persons in the general population.
Gorski LA, Johnson K, A disease management program for heart failure: collaboration between a home care agency and a care management organization, Lippincotts Case Manag. 2003 Nov-Dec;8(6):265-73.	Not specified	74	patients were referred for the HF Disease Management home care program from October 2000 through December 2001	Transferred to long-term care or hospice Dropped Medicare/HMO Patient Request/not willing to participate after admission to program Death (hospitalized within 30 days) Patient moved and lost follow-up Transferred to large case management org.	There were 33 interventions in 22 patients. Our assumption was that an untreated increase in fluid volume excess would lead to a hospitalization. The average cost of hospitalization was estimated at \$5,000 which is likely a low estimation. Based on these assumptions, cost savings from rehospitalization of program patients were projected at \$165,000.	Limited patients Aggressive education not normal
Knox D, Mischke L., Implementing a congestive heart failure disease management program to decrease length of stay and cost. J Cardiovasc Nurs. 1999 Oct;14(1):v-vii.	Patient satisfaction Survey	?	Fluid Overload requiring IV diuretics CXR with Volume overload Increased ankle edema Jugular vein distension Financial and clinical outcomes were measured.	Unknown?	After 18 months, telemanagement participants' compliance rate averages 89.5 %. CHF hospitalization rates are 0.6/patient/year compared with the national benchmark of 1.7/patient/year.	No data was provided
Scalvini S, et al, A pilot study of nurse-led, home-based telecardiology for patients with chronic heart failure. Journal Telemedicine and Telecare. 2004;10(2):113-7.	telephone follow-up and single-lead electrocardiography (ECG) monitoring	74	Patients had to be in a stable clinical condition January to April 2000 with a confirmed diagnosis of CHF and at least one hospitalization for CHF in the previous year were considered for inclusion in the study.	1) ejection fraction 440%; (2) inability to perform an exercise test to determine oxygen consumption (VO2); (3) peak VO2416 ml/kg/min; (4) unstable angina; (5) planned coronary revascularization procedures; (6) status I (emergency status)11 on a waiting list for heart transplantation; (7) dementia or severe psychiatric illness; (8) anticipated survival of less than one year.	In the previous year the patients had had an average of 1.8 hospitalizations each, while in the follow-up period (of mean length 307 days) there were 0.2 hospitalizations per patient (P50.0001).	Differences in practice management has existed between cardiologists, internists and GPs.
Mary Bondmass, Nadine Bolger, Gerard Castro, Boaz Avital: The Effect of Physiologic Home Monitoring and Telemanagement on Chronic Heart Failure Outcomes. The Internet Journal of Advanced Nursing Practice 2000; Volume 3, Number 2: http://www.ispub.com/journals/IJANP/Vol3N2/chf.htm ; Published March 27, 2000.	Daily measurement of weight, blood pressure, heart rate, and oxygen saturation daily. Data transmitted via modem and patients telemanaged.	60	At least one of the following: 1) documented diagnosis of HF as determined by radiographic evidence of pulmonary congestion; 2) documented New York Heart Association (NYHA) functional classification III or IV; 3) conventional clinical HF symptoms of dyspnea and edema that responded to diuresis; 4) echocardiographic evidence of heart failure (either systolic or diastolic dysfunction).	1) unstable angina; 2) renal failure; 3) severe dementia or other debilitating psychiatric disorder; 4) end-stage heart failure requiring regular inotropic infusions; 5) anticipated survival of less than six months; 6) planned discharge to a long-term care facility; 7) current illicit drug use; 8) participation in another HF research protocol within the last six months; 9) scheduled HF-specific home health nursing; and/or 10) lack of an operating home telephone line.	Readmissions, length of stay, and hospital charges, were all significantly (p < 0.001) decreased compared to pre-study values and quality of life was significantly (p 0.002) improved from baseline.	A randomized two-group design was not used in this initial study