Suma Peter, MD; Nallu Reddy, MD; Nazneen Hashmi, MD; Cheryl Schraeder, RN, PhD, FAAN; Christine Kucera, BFAID; Paul Shelton, EdD

Characteristics of Congestive Heart Failure Patients Hospitalized at Carle Foundation Hospital Enrolled in the Carle Medicare Coordinated Care Demonstration

Introduction

Congestive heart failure (CHF), a disease primarily affecting the elderly, is increasing rapidly as the US population ages, and presents an enormous burden on our healthcare system. The incidence of CHF increases with age; approximately 5% in individuals aged 60–69, increasing to 10% in individuals 70 years and older. The primary reasons for this increase are improved treatment and life expectancy of patients with coronary artery disease (CAD) and/or hypertension, and improved pharmacological treatment.[1,2]

In persons over the age of 65, CHF is the leading cause of hospital admissions. Once diagnosed, one year mortality rates have been reported to be as high as 20–30%, and five year rates are over 50%. Hospital readmission rates are also high; 2% within two days of discharge, 20% within 30 days, and 50% within six months. The economic impact of CHF is immense. The American Heart Association (AHA) estimates that in 2007, direct and indirect costs of CHF will exceed $33 billion. While only 14% of Medicare beneficiaries have the diagnosis, they account for 43% of total annual expenditures. [2-7]

Congestive heart failure is a complex clinical syndrome characterized by dyspnea and fatigue that limits movement and exercise and promotes fluid retention, which leads to pulmonary and peripheral edema. The disease is largely managed in the primary care setting and patients experience significant variations in processes and outcomes of care. Uncertainty regarding diagnosis, lack of awareness of research results and guidelines, worries about adverse medication effects or noncompliance, and poor communication between primary and specialty care providers are leading factors that contribute to this variability.[8-10]

Because CHF has such a substantial effect on morbidity, mortality, and healthcare expenditures, the American College of Cardiology (ACC) and the AHA have developed evidence-based guidelines and therapies that have demonstrated improved patient outcomes in randomized controlled trials, especially survival rates. Despite these promising results, research consistently identifies gaps in applying and utilizing this evidence in clinical practice. Both ACE (angiotensin-converting enzyme) Inhibitor or ARB (angiotensin receptor blocker) and Beta Blocker (beta-adrenergic blockade) therapy have been shown to reduce morbidity and mortality but remain underused in a large percentage of patients.[11-16]

Multidisciplinary interventions following hospital discharge have demonstrated positive results in improved quality of life, reduced hospitalizations and cost, and longer survival time. However, these types of interventions are not typically provided to patients with CHF in our healthcare system due to cost constraints and lack of funding, especially with Medicare beneficiaries. Researchers have suggested that it is important to monitor and document these therapeutic interventions to determine their relevance and influence on clinical outcomes, especially examining how following, or adhering to, the ACC/AHA guidelines impact post hospital discharge outcomes.[12,17-20]

Methods

Study Setting: The Medicare Coordinated Care Demonstration

Chronic illness is a principle source of disability and a major factor of healthcare expenditures. Multimorbidity, the coexistence of two or more chronic conditions, is a significant problem among older patients. It is estimated that over 75% of high-cost Medicare beneficiaries have one or more chronic conditions, including heart disease, chronic renal failure, diabetes, cancer, pulmonary disease, or senility.[21]

It is well documented that our present healthcare system suffers from deficiencies in providing appropriate chronic disease care, and the Institute

of Medicine called for vast improvements in chronic care delivery and coordination. The Centers for Medicare & Medicaid Services (CMS), through the fee-for-service (FFS) Medicare program, have initiated programs that are testing different delivery models which emphasize the use of evidence-based practice for selected chronic diseases based on the principles of case and disease management that the FFS Medicare program does not provide. One such program is the Medicare Coordinated Care Demonstration (MCCD). The CMS selected 15 sites to test whether this type of care coordination approach, using a prospective, randomized clinical trial design, could improve patient outcomes without increasing costs for beneficiaries with complex medical problems. Carle Foundation Hospital, Urbana, Illinois, was selected as an MCCD site and began enrolling patients in April, 2002. The MCCD study protocol was approved by the Carle IRB (01-25). [22,23]

The Carle MCCD targets patients with diagnoses typically associated with high healthcare costs. Eligible applicants are Medicare recipients who live in a 13-county service area (11 Illinois and two Indiana counties) and have one or more of the following chronic conditions: atrial fibrillation (Afib), CHF, CAD, chronic obstructive pulmonary disease/ asthma (COPD), or diabetes mellitus (DM). The purpose of Carle's MCCD is to evaluate whether a multidisciplinary, coordinated primary care approach can improve medical treatment plans, reduce avoidable hospital admissions, and promote self-care behaviors and clinical health status outcomes without increasing program costs. The intervention, based on the core components of the Chronic Care Model, provides care and disease management services to patients from primary care teams comprised of primary care physicians (PCP), registered nurses, and patients.[24-26]

A primary focus of the intervention is to develop the patient's ability to self manage their chronic condition(s) with support from a nurse case manager (NCM) via assessment, planning, education, coordination, and psychosocial support. Patient, NMC and PCP decision supports include having access to appropriate blood tests, trended reports of laboratory test results and other health measures, and disease specific, evidence-based medical and nursing guidelines maintained by a board of MCCD Medical Directors. Electronic clinical information systems allow for timely access to individual patient and panel information, and the tracking of patient contacts and interventions. On average, each NCM has a caseload of 150–200 patients.

Research Questions:

This study addressed the following research questions:

1. What are the characteristics (demographic, health and clinical status, service utilization) of MCCD patients in the intervention group with CHF who were hospitalized at Carle Foundation Hospital at least once during the study period?
2. What characteristics (demographic, health and clinical status, service utilization) are predictive of hospital readmissions for MCCD patients in the intervention group with CHF?
3. What characteristics (demographic, health and clinical status, service utilization) are predictive of all-cause mortality for MCCD patients in the intervention group with CHF?

Study Design

A retrospective analysis (medical record review) of a randomized clinical trial.

Study Sample

The study sample consisted of all patients who voluntarily enrolled in the Carle MCCD between April 19, 2002, and April 30, 2003, and met the following criteria: (1) were randomized into the intervention group; (2) had a verified diagnosis of CHF, indicated in their medical record or by their PCP; and (3) were hospitalized one or more times at Carle Foundation Hospital between April 19, 2002 through the end of December, 2005. A total of 191 intervention patients were hospitalized at least once during the study period, and 125 were hospitalized at Carle Foundation Hospital. The study group consisted of 120 (96%) of these identified patients; two patients had incomplete utilization information, and three could not be located in Carle's electronic medical record (EMR) system.

Data Collection and Measurement

The data analyzed in this study included Medicare claims and utilization files for hospital admissions, emergency department (ED) visits, nursing home admissions, and physician visits; the Medicare common working file for mortality; patient self-reported conditions and background information collected at enrollment (age, gender, name of PCP, marital status, race, educational attainment, living arrangement, self-rated health, limitations in activities of daily living, other health conditions, preventive health behaviors, and number of daily prescription medications); medical record review for the verified health conditions necessary for enrollment; and detailed patient hospital information (dates of admission and discharge, type of admission, and disposition status at discharge).

The three physician co-investigators (SP, NR, NH) abstracted specific information from the Carle EMR system for each patient's first three hospitalizations if they were hospitalized at Carle Foundation Hospital, including: documentation of the patient's weight at admission and discharge, documentation of the patient's ejection fraction (LVEF), documentation that the patient was taking an ACE Inhibitor and Beta Blocker at hospital discharge, and documentation that a physician follow-up appointment was made. They also recorded the date of the physician follow-up visit and whether or not their physician changed or adjusted their medications at the visit.

All study data were entered into a secure, password protected database for storage, retrieval, and analysis. Information from Carle's EMR system was abstracted between April and June, 2007.

Statistical Analysis

Logistic regression modeling was used to identify characteristics that predicted hospital readmissions and Cox proportional hazard modeling to identify characteristics predictive of all-cause mortality. Characteristics used to model hospital readmissions included COPD, age (>80 years at time of first admission), gender, documentation of taking an ACE inhibitor and a Beta Blocker at the first hospital discharge, first hospital discharge was on a weekend (Friday/Saturday/Sunday), any nursing home admission during the study period, whether or not the patient had a physician visit after discharge, and total number of months enrolled in the MCCD. Characteristics used to model all-cause mortality included the variables listed above except the nursing home criteria was an admission following the first hospitalization.

All analyses were conducted using SPSS software (V. 14.0) and a *P* value of .05 (2-sided) was considered statistically significant.

Results

***Research Question 1:** What are the characteristics (demographic, health and clinical status, service utilization) of MCCD patients in the intervention group with CHF who were hospitalized at Carle Foundation Hospital at least once during the study period?*

The baseline characteristics of the 120 intervention patients with CHF who were hospitalized at least once at Carle Foundation Hospital are displayed in Table 1. The average age at first hospitalization was 77 years, 35% were at least 80 years old, and 52% were female. The average number of verified health conditions (+ standard deviation) was 2.8 + 1.0 per patient; 68% CAD, 39% DM, 29% COPD, and 43% were hypertensive. Only 24% reported they weighed themselves on a daily basis, 55% rated their health as fair or poor, 61% followed a healthy diet, and 44% exercised on a regular basis. They averaged taking 7.7 + 2.4 prescription medications a day; 63% were taking an ACE Inhibitor, 47% were taking a Beta Blocker, and 21% were not taking either medication.

Table 1. Characteristics of MCCD Intervention Patients with CHF Who Were Hospitalized One or More Times at Carle Foundation Hospital During the Study Period

Characteristics	Values
N Patients	120
Age, mean ± SD	76.6 ± 9.0
Age ≥80, N (%)	42 (35.0)
Male, N (%)	58 (48.3)
Lives Alone, N (%)	39 (32.5)
< HS Education, N (%)	22 (18.3)
Verified Health Conditions, N (%):	
Afib	53 (44.2)
CAD	81 (67.5)
COPD	35 (29.2)
DM	47 (39.2)
Afib & CAD	35 (29.2)
Total, mean ± SD	2.8 ± 1.0
Other Health Conditions, N (%):	
Any Cancer	22 (18.3)
Depression	28 (23.3)
Stomach/Bowel Problems	37 (30.8)
Stroke	22 (18.3)
Hypertension	55 (42.5)
Health Status, N (%):	
Obesity (BMI>30)	39 (32.5)
Frailty (BMI<22)	11 (9.2)
Fair/Poor Health	66 (55.0)
ADLs, mean ± SD	1.3 ± 1.5
Current Smoker	8 (6.7)
Preventive Health Behaviors, N (%):	
Eat Healthy Diet	73 (60.8)
Regular Exercise	53 (44.2)
Weigh Daily	29 (24.2)
Advance Directives	84 (70.0)
Medications, N (%):	
Total, mean ± SD	7.7 ± 2.4
Documented Taking Ace Inhibitor at First Hospital Discharge	75 (62.5)
Documented Taking Beta Blocker at First Hospital Discharge	56 (46.7)
Prior Health Service Utilization	
(12 Months Before MCCD Enrollment), N (%):	
Any Hospitalization	55 (48.7)
≥2 Hospitalizations	32 (28.3)
Hospitalizations/person, mean ± SD	1.0 ± 1.3
Hospital Days/person, mean ± SD	4.3 ± 7.9
Any ED Visits	58 (51.3)
ED Visits/person, mean ± SD	0.7 ± 1.2
Any Nursing Home Admissions	14 (12.4)
Nursing Home Days/person, mean ± SD	2.8 ± 9.1
Any Home Health Visits	31 (25.8)
Home Health Visits/person, mean ± SD	2.6 ± 6.0
Physician Visits/person mean ± SD	2.3 ± 3.5
No Physician Visits	34 (30.1)
>10 Physician Visits	8 (7.1)

Notes: N = number; % = percentage; SD = standard deviation

These patients had high utilization patterns in the previous year before enrolling in the MCCD; 49% had been hospitalized at least once, 28% had experienced multiple hospitalizations, 51% had at least one ED visit, and 12% had at least one admission to a nursing home. Surprisingly, 30% had not seen a physician in the past 12 months.

Table 2 displays the overall health service utilization patterns of the 120 patients during the study period. Patients were enrolled an average of 30 months. During this time period 66% (N=79) experienced two or more hospitalizations with 53% (N=63) hospitalized at Carle Foundation Hospital. They averaged three hospitalizations per person for a total of 11 hospital days. Other utilization measures were also high: 68% had at least one ED visit for an average of 2.1 visits per person, and 34% had at least one nursing home admission. Each patient averaged eight physician visits during the study period.

Table 2. Health Service Utilization Characteristics of MCCD Intervention Patients with CHF Who Were Hospitalized One or More Times at Carle Foundation Hospital During the Study Period

Characteristics	Values
Months Enrolled in the Study Period, mean ± SD	29.7 ± 13.1
Health Service Utilization, N (%):	
≥2 Hospitalizations	79 (65.8)
≥2 Hospitalizations at CFH	63 (52.5)
Hospitalizations/person, mean ± SD	2.7 ± 2.1
Hospital Days/person, mean ± SD	11.4 ± 11.2
Any ED Visits	81 (67.5)
ED Visits/person, mean ± SD	2.1 ± 2.9
Any Nursing Home Admissions	41 (34.2)
Nursing Home Days/person, mean ± SD	11.7 ± 23.6
Any Home Health Visits	48 (40.0)
Home Health Visits/person, mean ± SD	5.7 ± 11.9
Physician Visits/person, mean ± SD	7.9 ± 10.0

Notes: N = number; % = percentage; SD = standard deviation

Table 3 displays the results of the EMR reviews conducted by the physician co-investigators. Over 50% of admissions came through the ED. The patient's weight at either admission or discharge was almost never documented for any hospitalization, and rarely was the patient's ejection fraction documented (about 10% of the time). Documentation was also missing (over 80% of the time) noting a scheduled physician follow-up appointment after discharge. However, over 70% of patients had a follow-up visit about 10 days after hospital discharge. For those individuals who had a second hospitalization, their average time to admission was approximately six months, but 22% were re-hospitalized within 30 days. For those individuals who had a third hospitalization, their average time from second hospital discharge to admission was seven months, but 41% were re-hospitalized within 30 days. At the follow-up visit after hospital discharge the patient's physician seldom adjusted or changed their medication regime.

Table 3. Electronic Medical Record Abstraction Results of MCCD Intervention Patients with CHF Who Were Hospitalized One or More Times at Carle Foundation Hospital During the Study Period

Characteristics	First Hospitalization	Second Hospitalization	Third Hospitalization
N Patients	120	63	29
Age at Hospitalization, mean ± SD	77.6 ± 9.0	77.6 ± 9.2	75.2 ± 8.7
Age ≥80, N (%)	47 (39.2)	26 (41.3)	9 (31.0)
Urgent Admission, N (%)	95 (79.2)	51 (81.0)	23 (79.3)
ED Admission, N (%)	67 (55.8)	36 (57.1)	18 (62.1)
Hospital Days/person, mean ± SD	3.9 ± 3.1	4.8 ± 4.0	4.9 ± 4.5
Discharge Status, N (%):			
Home	78 (65.0)	40 (63.5)	18 (62.1)
Inpatient Mortality	3 (2.5)	4 (6.3)	2 (6.9)
Nursing Home	27 (22.5)	13 (20.6)	8 (27.5)
Unknown	10 (8.3)	6 (9.5)	1 (3.4)
Patient Weight, N (%):			
Documented at Admission	2 (1.7)	0 (0)	0 (0)
Documented at Discharge	0 (0)	0 (0)	1 (3.4)
Documentation of Ejection Fraction, N (%):	16 (13.3)	7 (11.1)	3 (10.3)
Medications, N (%):			
Documented Taking ACE Inhibitor at Discharge	75 (62.5)	34 (54.0)	16 (55.2)
Documented Taking Beta Blocker at Discharge	56 (46.7)	29 (46.0)	17 (58.6)
Hospital Discharge on Weekend, N (%)	45 (37.5)	27 (42.9)	17 (58.6)
Physician Follow-up Appointment Documented, N (%)	17 (14.2)	12 (19.0)	3 (10.3)
Physician Follow-up Appointment Status, N (%):			
Cancelled	1 (1.0)	2 (3.2)	0 (0)
Completed	85 (70.8)	47 (74.6)	20 (69.0)
Deceased (In Hospital or Before Appointment)	6 (5.0)	3 (4.8)	3 (10.3)
Missed (No Show)	2 (1.7)	1 (1.6)	0 (0)
Never Scheduled	9 (7.5)	2 (3.2)	1 (3.4)
Rehospitalized Before Appointment	15 (12.5)	3 (4.8)	4 (13.8)
Days to Visit, mean ± SD	11.1 ± 8.9	10.4 ± 9.9	9.0 ± 5.9
Medications Changed or Adjusted	17 (14.2)	7 (11.1)	1 (3.4)
Days to Next Hospitalization, mean ± SD		182 ± 233	221 ± 311
<30 Days From Discharge to Next Hospitalization, N (%)		14 (22.2)	12 (41.4)

Notes: N = number; % = percentage; SD = standard deviation

Research Question 2: What characteristics (demographic, health and clinical status, service utilization) are predictive of hospital readmissions for MCCD patients in the intervention group with CHF?

A total of 63 individuals (53%) were hospitalized two or more times at Carle Foundation Hospital during the study period. These patients averaged 3.6 + 2.2 hospitalizations (range 2–11), and 15.3 + 12.6 hospital days (range 2–70). Results of the logistic regression model predicting significant characteristics for hospital readmissions are shown in Table 4. Patients on Beta Blockers at the time of their first hospital discharge had a 61% reduction in the likelihood of readmission (odds ratio [OR], 0.39; 95% confidence interval [CI], 0.15 – 0.98; P = .048), and patients that had a follow-up visit with their physician after their first hospital discharge had a 6% reduction in the likelihood of readmission (OR, 0.94; 95% CI, 0.89 – 0.99; P = .012).

Table 4. Logistic Regression Results of Characteristics Predictive of Multiple Hospital Admissions of MCCD Intervention Patients with CHF

Characteristics	Odds Ratio	95% Confidence Interval	*P* Value
Age ≥80 Years at First Hospitalization	0.59	0.24 – 1.45	.252
Male	0.89	0.41 – 1.94	.769
COPD	0.84	0.33 – 2.12	.709
Taking ACE Inhibitor at First Hospital Discharge	0.65	0.26 – 1.62	.352
Taking Beta Blocker at First Hospital Discharge	0.39	0.15 – 0.98	.048
First Hospital Discharge on Weekend	1.24	0.54 – 2.82	.616
Any Nursing Home Admission	2.21	0.94 – 5.18	.068
Patient Follow-up Physician Visit After First Hospital Discharge	0.94	0.89 – 0.99	.012
Total Months Enrolled in the MCCD	1.03	1.00 – 1.07	.051

Research Question 3: What characteristics (demographic, health and clinical status, service utilization) are predictive of all-cause mortality for MCCD patients in the intervention group with CHF?

A total of 42 individuals (35%) died during the study period. These patients were enrolled in the MCCD for an average of 20 months. Results of the Cox proportional hazard model predicting significant characteristics of all-cause mortality are shown in Table 5. Patients on ACE Inhibitors at the time of their first hospital discharge had a 58% reduction in the likelihood of all-cause mortality (hazard ratio [HR], 0.42; 95% CI, 0.20 – 0.88; *P* = .022), and patients on Beta Blockers at the time of their first hospital discharge also had a 58% reduction in the likelihood of all-cause mortality (HR, 0.42; 95% CI, 0.21 – 0.86; *P* = .018). Patients that had a follow-up visit with their physician after their first hospital discharge had an 8% reduction in the likelihood of all-cause mortality (HR, 0.92; 95% CI, 0.87 – 0.97; *P* = .004), and patients who were discharged to a nursing home after their first hospitalization had a 98% increase in the likelihood of all-cause mortality (HR, 1.98; 95% CI, 1.04 – 3.79; *P* = .039).

Table 5. Cox Proportional Hazard Results of Characteristics Predictive of All-cause Mortality of MCCD Intervention Patients with CHF

Characteristics	Hazard Ratio	95% Confidence Interval	*P* Value
Age ≥80 Years at First Hospitalization	0.95	0.47 – 1.93	.896
Male	0.74	0.37 – 1.47	.389
COPD	0.61	0.27 – 1.38	.231
Taking ACE Inhibitor at First Hospital Discharge	0.42	0.20 – 0.88	.022
Taking Beta Blocker at First Hospital Discharge	0.42	0.21 – 0.86	.018
First Hospital Discharge on Weekend	0.78	0.38 – 1.58	.486
Nursing Home Admission at First Hospital Discharge	1.98	1.04 – 3.79	.039
Patient Follow-up Physician Visit After First Hospital Discharge	0.92	0.87 – 0.97	.004

Discussion

This study evaluated the characteristics and health service utilization patterns of patients with CHF who were enrolled in the intervention group of the Carle MCCD and were hospitalized at least once at Carle Foundation Hospital. We were interested in identifying patient-related characteristics that were predictive of multiple hospital admissions and all-cause mortality. We were also interested in the documentation of several inpatient performance measures that have been shown to positively impact clinical outcomes for discharged patients with CHF.

This retrospective study had several significant findings. The most significant was that medication therapy, the documentation of taking ACE Inhibitors and Beta Blockers at the first hospital discharge, reduced the likelihood of all-cause mortality and subsequent re-hospitalizations. These findings are consistent with the medical literature on the pharmacological management of patients with CHF. Patients who had a follow-up appointment with their physician after their first hospitalization had a reduced likelihood of mortality and repeat admissions. [1,3-5,7,11,12,14,15]

The abstraction of information from the patient's EMR by the three physician co-investigators also revealed several significant findings. During the study period documentation of the patient's weight at hospital admission and discharge was almost always missing, as was a record of the patient's ejection fraction. Documentation of patients on an ACE Inhibitor at the first hospital discharge was only 63%, but for those not on an ACE, contraindications were usually found in the EMR. Once these contraindications were accounted for, almost all patients were taking an ACE Inhibitor. Only 47% of patients were on a Beta Blocker at the first hospital discharge, but this percentage increased to 59% by the third hospitalization. We believe that if the patient's ejection fraction had been documented (<40%) potentially more patients would have been prescribed a Beta Blocker at the first hospital discharge. Also, less than 20% of patients had a documented physician follow-up appointment, and for those whose documentation was missing, almost 50% were discharged on a weekend. Despite this lack of documentation, over 70% of patients had a physician follow-up visit. These findings are consistent with the published literature suggesting that the documentation process of inpatient quality of care measures for patients with CHF is variable and quite often suboptimal.[27,28]

This study also highlights existing literature on resource use, through multiple hospital admissions and ED visits patients with CHF place on the healthcare system. During the study period 66% of patients experienced two or more hospitalizations, 24% were hospitalized at least three times, and 68% had at least one ED visit. For those patients who experienced a second hospital admission, 22% were re-hospitalized within 30 days of their first hospital discharge, and 41% who had a third hospitalization were admitted within 30 days of the second hospital discharge.

These study findings have implications for NCMs and other nursing personnel who have responsibilities for patients with CHF and experience a hospitalization. Because these patients are at high risk for adverse outcomes, especially during the transition from hospital to home, we recommend that the NCMs consider using the following protocol, described briefly below, with all their CHF patients.[29]

The NCM should visit the patient in the hospital, if possible, and in their home within 24 to 48 hours following discharge. Before the home visit the NCM should review the patient's hospital discharge summary. During the home visit the NCM should compare the medications in the discharge instructions with those in the discharge summary, and if there are any discrepancies between the two documents contact the discharge physician. If the discharge physician does not respond within 48 hours, then the patient's PCP should be contacted.

At the home visit the NCM should again review the patient's new medication regime, if changed at discharge and, if necessary, help the patient and caregiver with strategies to alleviate non-adherence. If a patient is not taking an ACE Inhibitor and a Beta Blocker, and there are no contraindications noted, the patient's PCP should be contacted immediately. The NCM should stress the importance of daily weighing and have the patient record his/her weight. They should make sure the patient and his/her caregiver(s) know what to do if there is a weight gain of more than three or four pounds in a day. Patients should take their daily weight log with them to every physician visit.

The NCM should review the date of the physician follow-up appointment with the patient and make every effort to attend the visit. If the patient has frequent PCP visits, the NCM should attend as many of these visits as possible.

This study had several limitations. The study was limited to only MCCD intervention patients with CHF, and did not include control group patients. This reduced our overall sample size and analysis approach, and might have limited our ability to detect significant characteristics predictive of the major

study outcomes. A second limitation was that we only abstracted information from the patient's EMR, and did not review paper copies of the clinic or hospital record. Some of the non-documented, missing patient information may have been contained in these records. A third limitation was that we were limited in the analysis to only those variables that had been collected as part of the original study or were readily available from the EMR system. From the EMR we were not able to identify specific diagnoses or conditions that might have provided further insight into reasons for multiple hospital admissions and/or mortality. Finally, the results may not be generalizable to other patient populations with CHF in different geographical areas or patients hospitalized in different hospitals. Other hospitals may have different forms or types of EMR systems that are capable of capturing or tracking different kinds of information.

Conclusion

This retrospective study identified several significant predictors of multiple hospital admissions and all-cause mortality in patients with CHF. The results suggest that an evidence-based approach to care, especially through medication therapy and regular physician follow-up and continuity, can reduce the likelihood of repeat hospitalizations and increase survival time. The findings highlight the opportunities and difficulties that providers face with patient education, symptom identification, and treatment plan adherence in an increasing elderly patient population with CHF.

Completed as an Addendum to Carle IRB Medicare Coordinated Care Demonstration Study 01-25

Suma Peter, MD, Department Head, Geriatrics, Carle Clinic, Urbana, IL; Program Director, Geriatric Fellowship, Carle Foundation Hospital, Urbana, IL

Nallu Reddy, MD, Fellow in Geriatrics, Carle Foundation Hospital, Urbana, IL

Nazneen Hashmi, MD, Fellow in Geriatrics, Carle Foundation Hospital, Urbana, IL

Cheryl Schraeder, RN, PhD, FAAN, Head, Health Systems Research Center, Carle Foundation Hospital, Urbana, IL; Director, Carle Medicare Coordinated Care Demonstration

Christine Kucera, BFAID, Systems Developer, Health Systems Research Center, Carle Foundation Hospital, Urbana, IL

Paul Shelton, EdD, Outcomes Analyst, Health Systems Research Center, Carle Foundation Hospital, Urbana, IL

References

1. Tsao L, Gibson CM. Heart failure: an epidemic of the 21st century. Crit Pathw Cardiol 2004;3:194-204.
2. Rosamond W, Flegal K, Friday G, Furie K, Go A, Greenlund K, et al. Heart disease and stroke statistics -2007 update. A Report From the American Heart Association Statistics Committee and Stroke Statistics Subcommittee [published erratum appears in Circulation 2007;115(5):e172]. Circulation 2007;115(5):e69 - e171.
3. Gwadry-Sridhar FH, Flintoft V, Lee SD, Lee H, Guyatt GH. A systematic review and meta-analysis of studies comparing readmission rates and mortality rates in patients with heart failure. Arch Intern Med 2004;164(21);2315-20.
4. Lee DS, Austin PC, Rouleau JL, Liu PP, Naimark D, Tu JV. Predicting mortality among patients hospitalized for heart failure: Derivation and validation of a clinical model. JAMA 2003;290(19):2581-87.
5. Levy D, Kenchaiah S, Larson MG, Benjamin EJ, Kupka MJ, Ho KK, et al. Long-term trends in the incidence of and survival with heart failure. N Engl J Med 2002;347(18):1397-402.
6. Aghababian RV. Acutely decompensated heart failure: Opportunities to improve care and outcomes in the emergency department. Rev Cardiovasc Med 2002;3(Suppl 4):S3-9.
7. Berkowitz R, Blank LJ, Powell SK. Strategies to reduce hospitalization in the management of heart failure. Lippincotts Case Manag 2005;10(Suppl 6):S1-15.
8. Francis GS, Tang WH. Pathophysiology of congestive heart failure. Rev Cardiovasc Med 2003;4(Suppl 4):S14-20.
9. Fuat A, Hungin AP, Murphy JJ. Barriers to accurate diagnosis and effective management of heart failure in primary care: qualitative study. BMJ 2005;326(7382):196-201.
10. Ezekowitz JA, van Walraven C, McAlister FA, Armstrong PW, Kaul P. Impact of specialist follow-up in outpatients with congestive heart failure. CMAJ 2005;172(2):189-94.
11. Bonow RO, Bennett S, Casey DE Jr, Ganiats TG, Hlatky MA, Konstam MA, et al. ACC/AHA clinical performance measures for adults with chronic heart failure: a report of the American College of Cardiology/American Heart Association Task Force on Performance Measures endorsed by the Heart Failure Society of America. J Am Coll Cardiol 2005;46(6):1144-78.

12. Fonarow GC, Abraham WT, Albert NM, Stough WG, Gheorghiade M,Greenberg BH, et al. Association between performance measures and clinical outcomes for patients hospitalized with heart failure. JAMA 2007;297(1):61-70.
13. Clark AM, Hartling L, Vandermeer B, McAlister FA. Meta-analysis: secondary prevention programs for patients with coronary artery disease. Ann Intern Med 2005;143(9):659-72.
14. Packer M. Do angiotensin-converting enzyme inhibitors prolong life in patients with heart failure treated in clinical practice? J Am Coll Cardiol 1996;28(5):1323-27.
15. Lechat P, Packer M, Chalon S, Cucherat M, Arab T, Boissel JP. Clinical effects of beta-adrenergic blockade in chronic heart failure: a meta-analysis of double-blind, placebo-controlled, randomized trials. Circulation 1998;98(12):1184-91.
16. Higashi T, Shekelle PG, Solomon DH, Knight EL, Roth C, Chang JT, et al. The quality of pharmacologic care for vulnerable older patients. Ann Intern Med 2004;140(9):714-20.
17. Rich MW, Beckham V, Wittenberg C, Leven CL, Freedland KE, Carney RM. A multidisciplinary intervention to prevent the readmission of elderly patients with congestive heart failure. N Engl J Med 1995;333(18):1190-95.
18. Naylor MD, Brooten DA, Campbell RL, Maislin G, McCauley KM, Schwartz JS. Transitional care of older adults hospitalized with heart failure: a randomized, controlled trial. J Am Geriatr Soc 2004;52(5):675-84.
19. Seow H, Phillips CO, Rich MW, Spertus JA, Krumholz HM, Lynn J. Isolation of health services research from practice and policy: the example of chronic heart failure management. J Am Geriatr Soc 2006;54(3):535-40.
20. Holland R, Battersby J, Harvey I, Lenaghan E, Smith J, Hay L. Systematic review of multidisciplinary interventions in heart failure. Heart 2005;91(7):899-906.
21. Congress of the United States, Congressional Budget Office. High-cost Medicare beneficiaries. Washington; 2005.
22. Institute of Medicine (US). Crossing the quality chasm: a new health system for the twenty-first century. Washington: National Academy Press; 2001.
23. Chen A, Brown R, Archibald, Aliotta S, Fox P. Best practices in coordinated care. Princeton, NJ: Mathematica Policy Research; 2000. Reference No.: 8534-004.
24. Bodenheimer T, Wagner EH, Grumbach K. Improving primary care for patients with chronic illness. JAMA 2002;288(14):1775-9.
25. Bodenheimer T, Wagner EH, Grumbach K. Improving primary care for patients with chronic illness: the chronic care model, Part 2. JAMA 2002;288(15):1909-14.
26. Schraeder C, Dworak D, Stoll JF, Kucera C, Waldschmidt V, Dworak MP. Managing elders with comorbidities. J Ambul Care Manage 2005;28(3):201-9.
27. Fonarow GC, Yancy CW, Heywood JT, ADHERE Scientific Advisory Committee, Study Group, and Investigators. Adherence to heart failure quality-of-care indicators in US hospitals: analysis of the ADHERE registry. Arch Intern Med 2005;165(13):1469-77.
28. Luthi JC, McClellan WM, Fitzgerald D, Herrin J, Delaney RJ, Krumholz HM, et al. Variations among hospitals in the quality of care for heart failure. Eff Clin Pract 2000;3(2):69-77.
29. Naylor MD. Transitional care of older adults. Annu Rev Nurs Res 2002;20:127-47.