

Congestive Heart Failure: Attributable Costs Within the Managed Care Setting

Caron Ory
Ann Vanderplas
Christopher Dezii
Eunice Chang

ABSTRACT. To evaluate the economic burden of CHF within a managed care organization, patients with CHF were matched to a comparable control and 1-year healthcare expenditures were examined. Cases were patients who possessed at least one medical claim representing CHF during 01/01/00-6/30/00. Controls consisted of patients who did not possess any CHF medical claims during 07/01/99-06/30/01. All patients were ≥ 18 years of age on 01/01/00 and continuously enrolled during 07/01/99-06/30/01. Patients were matched using age, gender, and Chronic Disease Score. Outcomes were pharmacy, medical, total healthcare charges and utilization.

Mean pharmacy charges (ingredient costs) for patients with CHF were significantly higher than the control subjects (\$1,490 vs. \$1,209, $p < 0.0001$), as were mean medical charges (\$39,071 vs. \$8,872, $p < 0.0001$) and mean total healthcare charges (\$40,561 vs. \$10,081, $p < 0.0001$). Patients diagnosed with CHF had a significantly higher mean

Caron Ory, R.N., M.S.N., Ann Vanderplas, M.S., and Eunice Chang, Ph.D., are all affiliated with Prescription Solutions, Costa Mesa, CA.

Christopher Dezii is affiliated with Bristol-Myers Squibb.

Address correspondence to: Caron Ory, R.N., M.S.N., Research Scientist, Prescription Solutions, Health Informatics and Outcomes Research, 3515 Harbor Boulevard, LC07 264, Costa Mesa, CA 92626 (E-mail: caron.ory@rxsol.com).

This study was funded by Bristol-Myers Squibb Company, Princeton, NJ.

Journal of Pharmaceutical Finance, Economics & Policy, Vol. 14(2) 2005

Available online at <http://www.haworthpress.com/web/JPFEP>

© 2005 by The Haworth Press, Inc. All rights reserved.

doi:10.1300/J371v14n02_07

number of outpatient encounters when compared to the control subjects (8.90 vs. 5.19; $p < 0.0001$), emergency department encounters (0.69 vs. 0.23; $p < 0.0001$), and acute hospitalizations (0.86 vs. 0.17; $p < 0.0001$).

Patients with CHF incurred approximately 5 times higher medical charges and 4 times higher total healthcare charges compared to control subjects due to significantly higher hospitalizations, ED encounters, and outpatient physician encounters. [Article copies available for a fee from The Haworth Document Delivery Service: 1-800-HAWORTH. E-mail address: <docdelivery@haworthpress.com> Website: <<http://www.HaworthPress.com>> © 2005 by The Haworth Press, Inc. All rights reserved.]

KEYWORDS. CHF, healthcare expenditure, healthcare costs, economic analysis, economic evaluation

INTRODUCTION

Heart failure is a chronic and progressive clinical syndrome induced by an abnormality of the heart. It is identified by a pattern of hemodynamic, renal, neural, and hormonal adaptive, maladaptive, and counter-regulatory activation of responses (1). Currently 5 million Americans have been diagnosed with congestive heart failure (CHF), and approximately 550,000 new cases are diagnosed each year (2). The survival rate for those diagnosed with heart failure is unacceptably poor: less than 15% survive more than eight to twelve years after diagnosis (2).

Since CHF is the single most frequent cause of hospitalization among individuals age 65 and greater, the economic burden this clinical syndrome poses is tremendous (1). Multiple hospital readmission, a frequent occurrence among patients with CHF, contributes substantially to the economic burden of treating this condition. More than 40% of patients with CHF experience a hospital readmission within 3 to 6 months of discharge (3,4). As a result, the total economic costs of CHF in 2005 was estimated to be 27.9 billion (2).

Objective

The objective of this study was to determine the economic impact of CHF among patients enrolled within a managed care organization.

METHODS

This study utilized the longitudinal database from Prescription Solutions, a large pharmacy benefit and medical management organization serving approximately 1.2 million covered lives located in California. Electronic pharmacy, medical claims, and enrollment claims from July 1, 1999 through June 30, 2001 were examined.

Cases–Patients Diagnosed with CHF

Inclusion Criteria

- Patients must have a medical claim with an *International Classification of Disease, Ninth Revision, Clinical Modification* (ICD-9-CM) code representing CHF (398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.91) during the identification period, 01/01/00 through 06/30/00

Exclusion Criteria

- Patients less than 18 years of age on 01/01/00
- Patients not continuously enrolled during the entire review period, 07/01/99 through 06/30/01

The date of the first qualifying claim within the identification period was defined as the index date and each patient was followed for one year.

Controls–Patients Who Have Not Been Diagnosed with CHF

Inclusion Criteria

- Patients continuously enrolled between 07/01/99 through 06/30/01

Exclusion Criteria

- Patients with any medical claim including an ICD-9-CM code representing CHF between 07/01/99 through 06/30/01
- Patients less than 18 years of age on 01/01/00

A matched control cohort was identified to draw comparisons of economic outcomes between those diagnosed with and those not diagnosed with CHF. After meeting inclusion and exclusion criteria, a random sample of a control cohort was identified. A logistic regression model was conducted to estimate the propensity score for each subject with independent variables of age, gender, and Chronic Disease Score (5) (CDS). The CDS provides a measure of co-morbidity using automated prescription claims. Scores are weighted based on the number of different chronic diseases under treatment and they increase with the complexity of the regimen used to treat a given chronic disease, thus the higher the score, the greater the burden of co-morbidity (5). For this study, the CDS was one of the contributing factors used in calculating the overall propensity score. Controls were then matched 1:1 to cases using the overall propensity score.

Since each patient diagnosed with CHF had a different index date, for the purpose of matching, age as of 01/01/2000 was calculated for each heart failure patient and each of the potential controls. In addition, the CDS was calculated for the fixed 6-month period of 07/01/1999 to 12/31/1999. Once the matching was complete, each control was assigned the index date of its matched heart failure patient and followed for one year.

A washout period of 6-months prior to the index date was used to categorize patients as newly diagnosed or previously diagnosed. Newly diagnosed CHF patients were defined as those without any medical claims with an ICD-9-CM code representing congestive heart failure during the 6-month period prior to index date. Previously diagnosed CHF patients were those possessing a medical claim with an ICD-9-CM code representing CHF during the 6-month period prior to their index date.

Pharmacy claims were analyzed to determine pharmacy charges. Medical claims were analyzed to determine healthcare utilization and charges. Outcomes of interest included: number of acute hospitalizations, emergency department (ED) encounters, ED encounters that resulted in an acute hospitalization, outpatient physician encounters, pharmacy charges (ingredient costs), medical charges (submitted amounts), and total healthcare (pharmacy charges + medical charges) charges.

Sub-analyses were conducted examining the CHF/cardiac-related healthcare charges incurred by newly diagnosed and previously diagnosed CHF patients. In addition, for the subset of CHF patients whose index medical claim was for an acute hospitalization (length of stay greater than 1 day) with a primary diagnosis of CHF, the primary diag-

nosis of the first subsequent medical claim for an acute hospitalization (length of stay greater than 1 day) during the follow-up period was identified. This diagnosis was classified into three major categories. These included: (1) CHF; (2) other de-compensating factors; and (3) all others. Other de-compensating factors included the following diseases: angina, chronic obstructive pulmonary disease (COPD), cerebrovascular accident, dysrhythmias, myocardial infarction, and pneumonia/sepsis/severe infection (6). Patients with a re-hospitalization and without a diagnosis of interest in the primary position of the medical claim were categorized as “all other diagnoses.” Lastly, time (in days) to CHF re-admission was calculated. Given that the time to re-hospitalization varied between patients, the median time to CHF re-hospitalization was presented.

RESULTS

Patient Characteristics

A total of 17,835 patients with CHF met study criteria. The CHF cohort characteristics are shown in Table 1. The mean age of this cohort was $76.4 \pm .3$, 53.0% (n = 9,459) were female, 91.5% (n = 16,320) had selected the Medicare+Choice product for their insurance coverage and the mean CDS was 5.7 ± 3.3 . In addition, patient characteristics stratified as those who were newly diagnosed and those who were previously diagnosed are displayed in Table 1. Of the entire heart failure cohort, 62.2% (n = 11,092) were newly diagnosed and 37.8% (n = 6,743) were previously diagnosed. There was a significant difference in age and burden of co-morbidity when comparing these between newly diagnosed patients and previously diagnosed patients as previously diagnosed patients were more advanced in age and had a greater burden of co-morbidity.

Healthcare Charges and Utilization of CHF Cohort—Newly Diagnosed vs. Previously Diagnosed

CHF and cardiac-related healthcare charges for both the newly diagnosed and previously diagnosed heart failure cohorts were quite high at \$17,921 vs. \$14,174, respectively. After adjusting for age at index date, gender and pre-index CDS, newly diagnosed patients had significantly

higher CHF/cardiac-related healthcare charges when compared to previously diagnosed patients (\$17,744 vs. \$14,465; $p < 0.0001$) (Table 2). The only significant predictor of these charges was age at index date.

Of the entire CHF cohort, 26.3% ($n = 4,683$) of the patients' index medical claim represented an acute hospitalization for CHF (Table 3). For this subset, the first hospitalization during the follow-up period was defined as a re-hospitalization. Among these, 44.9% ($n = 2,103$) experienced a re-hospitalization during the follow-up period. Reasons for re-hospitalization were classified into three categories: (1) CHF; (2) other

TABLE 1. Patient Characteristics of CHF Cohort

		COHORT		All	p-Value
		NEW CHF*	PREV CHF		
N		11,092	6,743	17,835	--
%		62.19	37.81	100.00	
Female Gender	N	5,943	3,516	9,459	0.0624
	%	53.58	52.14	53.04	
Age at Index Date	Mean	75.81	77.42	76.42	< 0.0001
	Std Dev	10.61	9.74	10.32	
Product Type					
Commercial	N	1,069	446	1,515	< 0.0001
	%	9.64	6.61	8.49	
Medicare+Choice	N	10,023	6,297	16,320	
	%	90.36	93.39	91.51	
Chronic disease score for pre-index period 6 mos. prior to index date	Mean	5.27	6.30	5.66	< 0.0001
	Std Dev	3.27	3.12	3.25	

*Includes 2 patients for which matched controls could not be found.

TABLE 2. Adjusted CHF/Cardiac-Related Medical Charges and 95% Confidence Intervals for the CHF Cohort*

	Cohort		p-value
	NEW CHF	PREV CHF	
Adjusted CHF/Cardiac-related medical charges (95% CI)	\$17,744 (\$16,800, \$18,687)	\$14,465 (\$13,251, \$15,679)	< 0.0001

*Adjusted for age at index, gender and pre-index CDS.

TABLE 3. Characteristics of Patients with CHF Who Were Re-Hospitalized

	COHORT		All	p-Value	
	NEW CHF	PREV CHF			
N	3,009	1,674	4,683	--	
%	64.25	35.75	100.00		
Had a Re-Hospitalization*	N	1,333	770	2,103	--
	% of CHF Cohort	44.30	46.00	44.91	
Reason for Re-Hospitalization					
Angina	N	8	7	15	0.0011
	%	0.60	0.91	0.71	
CHF	N	305	243	548	
	%	22.88	31.56	26.06	
COPD Exacerbation	N	4	1	5	
	%	0.30	0.13	0.24	
Cerebrovascular Accident	N	13	6	19	
	%	0.98	0.78	0.90	
Dysrhythmia	N	90	36	126	
	%	6.75	4.68	5.99	
MI	N	62	34	96	
	%	4.65	4.42	4.56	
Pneumonia/Sepsis/Severe Infection	N	74	49	123	
	%	5.55	6.36	5.85	
All Other diagnoses	N	777	394	1,171	
	%	58.29	51.17	55.68	
Time (days) from initial CHF inpatient hospitalization to re-hospitalization (n = 548)	Median	59	68	62	--
	Min	2	2	2	
	Max	355	350	355	

*Re-hospitalization was defined as the first acute inpatient hospitalization following the initial CHF acute inpatient hospitalization. All re-hospitalization diagnoses were the primary diagnosis.

de-compensating factors which included angina, COPD exacerbation, cerebrovascular accident, dysrhythmia, myocardial infarction, and pneumonia/sepsis/severe infection and; (3) all other diagnoses. Of the 2,103 patients that experienced a re-hospitalization, 26.1% (n = 548) were re-hospitalized with a primary diagnosis of CHF. The median time to re-hospitalization was 62 days. For those newly diagnosed the median time to re-hospitalization was 59 days and among those previously

diagnosed, 68 days. Of the patients that experienced a re-hospitalization for other de-compensating factors, 6.0% (n = 126) were hospitalized for dysrhythmias followed by pneumonia/sepsis/severe infection, myocardial infarction, cerebrovascular accident, angina, and COPD exacerbation (5.9%, 4.6%, 0.9%, 0.7% and 0.2%, respectively). The remaining 55.7% (n = 1,171) were re-hospitalized for other diagnoses.

Healthcare Charges and Utilization of Cases vs. Controls

Matched controls could not be found for two newly diagnosed heart failure patients. These included one male and one female, aged 78 and 77, possessing chronic disease scores of 17 and 19, respectively. These two cases were included in the general description of CHF patients but were excluded from all further outcome analyses. Therefore, the CHF cohort and control cohort each consisted of 17,833 patients.

Patients with CHF had a significantly higher mean number of outpatient physician encounters when compared to the control subjects (8.9 vs. 5.2; $p < 0.0001$) (Table 4). This trend continued for emergency department (ED) encounters and acute hospitalizations (0.69 vs. 0.23; $p < 0.0001$ and 0.86 vs. 0.17; $p < 0.0001$, respectively). Moreover, patients diagnosed with CHF possessed a significantly higher proportion of patients who had ED encounters that advanced to an acute hospitalization when compared to control subjects (39.3% vs. 18.4%; $p < 0.0001$; Table 5).

TABLE 4. Healthcare Utilization for Cases vs. Control Cohort

		COHORT		All	p-Value
		CHF	CONTROL		
N		17,833	17,833	35,666	--
%		50.00	50.00	100.00	
Physician encounters during follow-up period	Mean	8.90	5.19	7.04	< 0.0001
	Std Dev	6.71	4.98	6.19	
ED encounters during follow-up period	Mean	0.69	0.23	0.46	< 0.0001
	Std Dev	1.57	0.67	1.23	
Acute hospitalizations during follow-up period	Mean	0.86	0.17	0.52	< 0.0001
	Std Dev	1.27	0.50	1.03	

Mean pharmacy charges (ingredient costs) for the CHF patients were significantly higher than the control subjects (\$1,490 vs. \$1,209; $p < 0.0001$), as were mean medical charges and mean total healthcare charges (\$39,071 vs. \$8,872; $p < 0.0001$ and \$40,561 vs. \$10,081; $p < 0.0001$, respectively; Table 6).

CONCLUSIONS

The findings of this study validate the tremendous economic burden posed by CHF as published in previous studies (3,4). In this managed

TABLE 5. ED Encounter Detail During the Follow-Up Period

		COHORT		All	p-Value
		CHF	CONTROL		
N		6,195	2,689	8,884	
%		69.73	30.27	100.00	
Average occurrence of having an ED encounter that advanced to an acute hospitalization during the follow-up period	Mean	0.52	0.21	0.42	< 0.0001
	Std Dev	0.79	0.46	0.72	
ED encounters that advanced to acute hospitalization	N	2,432	494	2,926	< 0.0001
	%	39.26	18.37	32.94	

TABLE 6. Healthcare Charges—Cases vs. Control Cohort

		COHORT		All	p-Value
		CHF	CONTROL		
N		17,833	17,833	35,666	--
%		50.00	50.00	100.00	
Total Pharmacy Charges (ingredient costs)	Mean	\$1,490	\$1,209	\$1,350	< 0.0001
	Std Dev	\$1,437	\$1,241	\$1,350	
Total Medical Charges (submitted charges)	Mean	\$39,071	\$8,872	\$23,971	< 0.0001
	Std Dev	\$80,995	\$22,881	\$61,398	
Total Healthcare Charges	Mean	\$40,561	\$10,081	\$25,321	< 0.0001
	Std Dev	\$81,144	\$23,074	\$61,567	

care organization, patients diagnosed with CHF incurred nearly 5 times higher medical charges and 4 times higher total healthcare charges compared to those incurred by control subjects. This was due to the significantly higher number of hospitalizations, ED encounters, and outpatient physician encounters incurred by heart failure patients.

When examining medical charges incurred by newly diagnosed patient versus previously diagnosed patients, newly diagnosed patients incurred significantly higher medical charges. This could be due to diagnostic and laboratory testing performed to obtain a definitive diagnosis. In addition, within approximately 59 days, 22.9% of these patients experienced another acute hospitalization for CHF.

As with all observational, retrospective studies, biases or unknown confounders may have influenced our study findings. When utilizing ICD-9-CM codes to represent a healthcare encounter or specific diagnosis there is the potential for misclassification. In addition, our including only patients with private insurance and full health and drug benefits may limit the generalizability of the results to patients with other types of insurance or those without health insurance.

However, there are strengths of this study. The study was performed in a managed care organization with a large heart failure population. We were able to observe healthcare utilization patterns of heart failure patients in comparison to a matched control cohort within a naturalistic or “usual care” setting. We found that 44.9% of the heart failure patients with an initial hospitalization experience a re-hospitalization (for any reason) within approximately two months. Our study result corroborates the high rate of re-hospitalization among heart failure patients noted in previous studies (3,4). Finally, our study confirmed the findings from previously conducted research that heart failure poses a tremendous economic burden primarily due to substantially more outpatient and ED encounters, as well as acute hospitalizations and re-hospitalizations (2,3).

In this managed care organization, patients diagnosed with CHF incurred significantly higher healthcare utilization, pharmacy, medical, and total healthcare charges when compared to a comparable control cohort. Many healthcare organizations have turned to disease management, through either internally developing programs or outsourcing to companies who specialize in managing patients with select diseases, to improve care and control charges. These programs focus on diseases of high prevalence, high utilization, and/or high charges. While various programs show improved quality of life and reduction in healthcare expenditures, these programs are a secondary prevention strategy. It is im-

perative that healthcare providers and organizations give attention to managing risk factors for CHF such as smoking, dyslipidemia, diabetes, obesity, and physical inactivity as well as recognition and treatment of conditions that are known precursors in the development of CHF such as hypertension, cardiomyopathy, and other cardiovascular diseases. Aggressive management of these risks may aid in preventing the development of CHF and thereby maintain quality of life while minimizing future healthcare expenditures.

REFERENCES

1. Poole-Wilson PA. Chronic heart failure: Definition, epidemiology, pathophysiology, clinical manifestations and investigations. In: Julian DG, Camm AJ, Fox KM, et al. *Diseases of the Heart*. 2nd ed. London: WB Saunders Co., Ltd., 1996:467-481.
2. American Heart Association. *Heart Disease and Stroke Statistics-2005 Update*. Dallas, Texas: American Heart Association; 2005. ©2005, American Heart Association.
3. Krumholz HM, Parent EM, Tu N, et al. Readmission after hospitalization for CHF among Medicare beneficiaries. *Arch Intern Med* 1997;157:99-104.
4. Rich MW, Beckham V, Wittenberg C, et al. A multidisciplinary intervention to prevent the readmission of elderly patients with congestive heart failure. *N Engl J Med* 1995;333:1190-1195.
5. Von Korff M, Wagner EH, Saunders K. A chronic disease score from automated pharmacy data. *J Clin Epidemiol* 1992; 45: 197-203.
6. Bennett SJ, Saywell RM, Zollinger TW, et al. Cost of hospitalizations for heart failure: Sodium retention versus other de-compensating factors. *Heart & Lung* 1999; 28(2):102-109.

RECEIVED: January 2005
REVISED: February 2005
ACCEPTED: March 2005