10-2007

Psychiatric Comorbidity and Greater Hospitalization Risk, Longer Length of Stay, and Higher Hospitalization Costs in Older Adults with Heart Failure

Steven L. Sayers
University of Pennsylvania

Nancy Hanrahan

Ann Kutney Lee
University of Pennsylvania

Sean P. Clarke

Brendali F. Reis

See next page for additional authors

Recommended Citation

Sayers, S. L., Hanrahan, N., Kutney Lee, A., Clarke, S. P., Reis, B. F., & Riegel, B. (2007). Psychiatric Comorbidity and Greater Hospitalization Risk, Longer Length of Stay, and Higher Hospitalization Costs in Older Adults with Heart Failure. *Journal of the American Geriatrics Society, 55* (10), 1585-1591. http://dx.doi.org/10.1111/j.1532-5415.2007.01368.x

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Abstract

OBJECTIVES: To explore associations between psychiatric comorbidity and rehospitalization risk, length of hospitalization, and costs.

DESIGN: Cross-sectional study of 1-year hospital administrative data.

SETTING: Claims-based study of older adults hospitalized in the United States.

PARTICIPANTS: Twenty-one thousand four hundred twenty-nine patients from a 5% national random sample of U.S. Medicare beneficiaries aged 65 and older, with at least one acute care hospitalization in 1999 with a Diagnostic-Related Group of congestive heart failure.

MEASUREMENTS: The number of hospitalizations, mean length of hospital stay, and total hospitalization costs in calendar year 1999.

RESULTS: Overall, 15.8% of patients hospitalized for heart failure (HF) had a coded psychiatric comorbidity; the most commonly coded comorbid psychiatric disorder was depression (8.5% of the sample). Most forms of psychiatric comorbidity were associated with greater inpatient utilization, including risk of additional hospitalizations, days of stay, and hospitalization charges. Additional hospitalization costs associated with psychiatric comorbidity ranged up to $7,763, and additional days length of stay ranged up to 1.4 days.

CONCLUSION: Psychiatric comorbidity appears in a significant minority of patients hospitalized for HF and may affect their clinical and economic outcomes. The associations between psychiatric comorbidity and use of inpatient care are likely to be an underestimate, because psychiatric illness is known to be underdetected in older adults and in hospitalized medical patients.

Keywords

heart failure, psychiatric comorbidity, depression, hospitalization costs, economic analysis, Medicare, sex, socioeconomic status, race, ethnicity

Disciplines

Cardiology | Cardiovascular Diseases | Circulatory and Respiratory Physiology | Geriatrics | Health and Medical Administration | Medical Humanities | Medicine and Health Sciences | Nursing | Psychiatry | Psychiatry and Psychology

Author(s)

Steven L. Sayers, Nancy Hanrahan, Ann Kutney Lee, Sean P. Clarke, Brendali F. Reis, and Barbara Riegel

Psychiatric Comorbidity and Increased Hospitalization Risk, Length of Stay, and Hospitalization Costs in Older Adults with Heart Failure

Steven L. Sayers, PhD,*† Nancy Hanrahan, PhD RN, ‡ Ann Kutney, RN MSN, ‡

Sean P. Clarke, PhD, RN, , FAAN ‡ Brendali F. Reis, Ph.D.,§ and Barbara Riegel, DNSc, RN, FAAN‖

*VISN 4 Mental Illness, Research, Education and Clinical Center, Philadelphia Veterans Affairs Medical Center, †Department of Psychiatry of the University of Pennsylvania, ‡Center for Health Outcomes and Policy Research, School of Nursing, University of Pennsylvania, §Institute for Graduate Clinical Psychology, Widener University, ‖School of Nursing and Leonard Davis Institute, University of Pennsylvania

Word count of text: 2988

Running head: Heart Failure and Psychiatric Comorbidity

Corresponding author:
Steven L. Sayers, Ph.D.
Philadelphia VA Medical Center
MIRECC 116
3900 Woodland Avenue
Philadelphia, PA 19104
(215) 823-5196
steven.sayers@va.gov

Alternate corresponding author:
Nancy Hanrahan, PhD RN
nancyp@nursing.upenn.edu

Preparation of the current report was supported by grants from the American Heart Association. We also appreciate the support of the VISN 4 Mental Illness Research, Education, and Clinical Center (MIRECC), Veterans Affairs Medical Center, Philadelphia, Pennsylvania. Portions of the current findings were presented at the 9th Annual Meeting of the Heart Failure Society of America, September, 2005, Boca Raton, FL. We acknowledge the support from the Center for Health Outcomes and Policy Research, School of Nursing, University of Pennsylvania, under the National Institute for Nursing Research grants "Center for Nursing Outcomes Research" (P30-NR-005043, Linda H. Aiken, PI) and "Advanced Training in Nursing Outcomes Research" (T32-NR-007104, Linda H. Aiken, PI).

Abstract

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PARTICIPANTS: 21,429 patients from a 5% national random sample of U.S. Medicare beneficiaries, aged 65 and older, with at least one acute care hospitalization in 1999 with a Diagnostic-Related Group of Congestive Heart Failure.

MEASUREMENTS: The number of hospitalizations, mean length of hospital stay, and total hospitalization costs in calendar year 1999.

RESULTS: Overall, 15.82% of patients hospitalized for heart failure had a coded psychiatric comorbidity; the most commonly coded comorbid psychiatric disorder was depression (8.5% of the sample). Most forms of psychiatric comorbidity were associated with increases in inpatient utilization, including risk of additional hospitalizations, additional days of stay, and additional hospitalization charges. Additional hospitalization costs associated with psychiatric comorbidity ranged up to $7763 and additional days length of stay ranged up to 1.4 days.

CONCLUSION: Psychiatric comorbidity appears in a significant minority of patients hospitalized for heart failure and may affect their clinical and economic outcomes. The associations of psychiatric comorbidity with utilization of inpatient care are likely to be an underestimate because psychiatric illness is known to be underdetected in older adults and in hospitalized medical patients.

KEYWORDS: Heart failure, psychiatric comorbidity, depression, hospitalization costs, economic analysis, Medicare, gender, socioeconomic status, race/ethnicity

Word count of abstract: 214 words

INTRODUCTION

Currently, over 5 million Americans have heart failure,[1] with increasing prevalence in older cohorts of adults, largely due to the aging U.S. population and increased survival of patients with heart failure. Despite medical advances[2] and the positive impact of heart failure management programs,[3] the cost of care for heart failure remains high. Heart failure is responsible for $33.2 billion in health care costs in the U.S., approximately 1.5% of total health care expenditure.[3] Hospitalizations account for 65% of the costs of treating heart failure.[3]

There is significant evidence that comorbid psychiatric disorders contribute to increased risk of hospitalization among patients with heart failure and increased costs of these hospitalizations.[4] Depression is common among hospitalized older adults with heart failure,[5] and likely leads to increased outpatient utilization, higher health care costs, and to a doubled risk of rehospitalization and death within 1 year.[6] Few studies have examined the consequences of a broad range of psychiatric disorders for hospitalized older adults with heart failure (e.g., anxiety disorders, alcohol abuse), despite evidence of increased rates of these problems in the heart failure population.[7]

The goal of this study was to examine the effects of identified comorbid psychiatric disorders on healthcare utilization and costs in a sample of Medicare beneficiaries hospitalized at least once with a primary diagnosis of heart failure in 1999. Our major hypothesis was that having a psychiatric disorder would be associated with increased rates of hospitalization, length of hospitalizations, and hospitalization costs in older adults with heart failure. Consistent with existing findings we hypothesized that identified comorbid psychiatric disorders might vary across groups defined by gender, socioeconomic status,[8] and race[9] and that these variables, as well as

medical comorbidities, would require controls in our models examining the association between psychiatric comorbidities and health care utilization.

METHODS

Study Sample

The study sample was drawn from a 5% random national sample of Medicare beneficiaries hospitalized during the 1999 calendar year. Using the Denominator and MedPAR files obtained from the Center for Medicaid and Medicare Services (CMS), we extracted records of hospitalizations in 1999 that were assigned the Congestive Heart Failure Diagnostic-Related Grouping (DRG 127). Records of different hospitalizations for the same patients were then collapsed so that the patient became the unit of analysis for most analyses. Because we used hospital DRGs to identify target patients, we excluded patients for whom heart failure was not a primary cause of any admission during 1999, even though it might have been a contributory cause for an admission during that year. This approach was used to limit the extent to which we included patients without a chronic heart failure condition. We excluded patients with comorbid dementia or organic brain syndrome diagnosis from the sample because they might exhibit less variability in their clinical course and the associated costs compared to those with other psychiatric disturbances.[10, 11]

Of the 5% national sample of 357,232 unique patients, a total of 27,949 patients had a CHF DRG during at least one of their hospitalizations for that year. About one-fifth of these patients were excluded due to dementia or organic brain syndrome (n=3,123, 11.1%), or an age less than 65 years (n=2,628, 9.4%) because persons younger than 65 years may have qualified for Medicare coverage on the basis of physical or mental disability. A further 2.8% (n = 769) were excluded on the basis of having been admitted before the year 1999, hospitalization costs suggesting data entry errors, or stays longer than 365 days suggestive of long-term care rather than acute

hospitalizations. The final sample included 21,429 individuals with a CHF DRG for at least one of their hospital stays during the year 1999.

Measures

We used the definitions of medical comorbidity indices as described by Elixhauser and colleagues[12] and used their algorithm as applied in publicly-available software code distributed by the Agency for Healthcare Research and Quality (AHRQ).[13] The algorithm places emphasis on comorbidities that could increase resources used or the risk of poor outcomes that are not directly related to the reason for admission.[12] Because of our focus on heart failure, it was not analyzed as a separate comorbidity in our analyses.

For the current study we expanded Elixhauser and colleagues'[12] categories of comorbid psychiatric disorders based on the initial work by Hanrahan,[14] as well as evidence for inclusion of disorders not represented in the system.[7] Psychiatric diagnoses within each category were identified using AHRQ's Clinical Classifications Software[15] (available from the first author upon request). Our final list of psychiatric comorbidity categories was as follows: alcohol abuse, drug abuse, psychosis, depression, bipolar disorders, anxiety disorders, and other psychiatric conditions. The variable we analyzed was presence vs. absence in any hospitalizations in 1999 of each type of comorbid medical and psychiatric condition.

The following demographic variables were analyzed: age, gender, and race. In addition, we used the receipt of Medicaid benefits anytime during the year 1999 as a proxy for socioeconomic status because so-called "dual" eligibility for Medicaid and Medicare requires falling below poverty levels defined by the U.S. Department of Health and Human Services.[16]

Our primary health care utilization and outcome included the patient's total number of hospitalizations in 1999, average length of stay (LOS) of all hospitalizations in 1999, and total hospitalization charges in 1999. All indices were collapsed across patients' hospitalizations for the year and represented the values for individual patients.

Statistical Analyses

Rates of psychiatric comorbidity were calculated, along with 95% confidence intervals. Relative proportions of the sample of patients with psychiatric diagnosis by gender, race, and low-income status were examined using 2 X 2 chi-square tests. The continuous outcomes of number of hospitalizations, average LOS, and total charges were all markedly positively skewed, but after logarithmic data transformation they approximated the normal distribution. These transformations were reversed for presentation purposes in the tables. The data were evaluated for amount, distribution, and patterns of missing data, out-of-range values, plausible means, and univariate outliers. Missing values were randomly scattered throughout and were less than 5% of the data points. Cases with incomplete data on the variables relevant for each analysis were dropped. Group differences were examined using *t*-tests and Satterthwaite's[17] method for estimating degrees of freedom for unequal variances where appropriate.

Presence of each type of psychiatric comorbidity was tested as a predictor of each outcome using regression modeling where the patient was the unit of analysis. Generalized linear modeling was used to test the hypothesis that psychiatric comorbidity explained a greater number of hospitalizations, mean LOS, and total hospitalization charges. Each of these analyses included the binomial variables (presence/absence) of each type of medical comorbidity as defined by Elixhauser et al.,[12] entered as a block along with the expanded psychiatric comorbidity categories. Because the continuous outcomes of hospitalizations, average LOS, and total charges

were all positively skewed, we considered log transformation, but we were concerned about retransformation bias. In order to select the correct model, we examined the distributions of the log-scale residuals from GLM models with a log link function following the method of Manning and Mullahy.[18] There was little kurtosis on the log-scale residuals (i.e., kurtosis < 3) so we chose GLM over ordinary least squares regression. Modified Park tests on the raw-scale residuals indicated that $\lambda=2$ for each outcome, so the gamma family was selected for the final GLM models. To illustrate the impact of comorbidities on the outcome variables, estimates of effects of all comorbidity parameters from these models were transformed from the log values used for the analysis and then presented in a table. For parameters that were statistically significant, entries tabled were calculated using the parameter estimate for each effect and the intercept values of the major outcomes of interest that resulted from the significant model.

RESULTS

Sample characteristics

Table 1 presents the demographic and clinical characteristics of the final sample of 21,429 heart failure patients. Over half of the patients were female (58.8%), and most were white (84.9%), and all were at least 65 years of age. Approximately one-fifth of the sample was designated as low-income and 33.8% died during the 1999 year. As shown in Table 1, the mean total hospitalization charges was $40,048 but this outcome was highly skewed—the median value was $22,934.

Prevalence of psychiatric comorbidities in the sample

Table 2 presents prevalence estimates of identified psychiatric comorbidity, drawn from every hospitalization of each patient in the sample. A significant minority of patients had at least one psychiatric comorbid condition recorded. Within this subset of patients, 15.8% (N=518) of patients had 2 or more different psychiatric diagnoses within or across any of their hospitalizations in that year. However, these patients did not have systematically greater patterns of hospitalization utilization. Those with more than one psychiatric diagnosis, compared to those with only one, had a greater number of hospitalizations, $M = 5.5$, $SD = 3.4$, vs. $M = 4.0$, $SD = 2.6$, $t(639) = 9.86$, $p < .0001$, but lower average costs per hospitalization, $M = \$11{,}845$, $SD = \$8{,}566$, vs. $M = \$12{,}914$, $SD = \$10{,}766$, $t(835) = -2.51$, $p < .05$. The two groups did not differ on the mean length of hospitalizations, $M = 8.8$, $SD = 6.1$, vs. $M = 8.6$, $SD = 7.5$, $t(835) = 0.58$, $p > .05$.

Psychiatric comorbidities in relation to gender, socioeconomic status, and race

Women were more likely than men to have a comorbid psychiatric diagnosis, 16.8% vs. 13.3%, $\chi^2[1] = 48.82$, $p < .0001$, N = 21,429. Depression and anxiety disorders were more common in women (10.0% vs. 6.3%, $\chi^2[1] = 89.77$, and 5.0% vs. 2.1%, $\chi^2[1] = 114.01$,

respectively, both p's < .0001). Male patients were more likely than female patients to have an alcohol abuse diagnosis (2.5% vs. 0.5%, $\chi^2[1] = 157.57$, $p < .0001$). No differences in rates of bipolar disorder, psychoses, drug abuse, or other psychiatric problems were observed by gender.

A higher proportion of low-income beneficiaries had psychiatric diagnoses, compared to all other beneficiaries, 18.7% vs. 14.4%, $\chi^2[1] = 50.74$, $p < .0001$, N = 21,429. Specifically, more low-income patients had diagnoses of psychosis (3.4% vs. 2.2%, $\chi^2[1] = 21.38$, $p < .0001$), depression (10.1% vs. 8.1%, $\chi^2[1] = 18.33$, $p < .0001$), drug abuse (0.9% vs. 0.5%, $\chi^2[1] = 10.36$, $p < .005$), anxiety disorders (4.7% vs. 3.6%, $\chi^2[1] = 14.17$, $p < .001$), and other psychiatric diagnoses (1.8% vs. 1.0%, $\chi^2[1] = 21.24$, $p < .0001$). There were no differences in the likelihood of bipolar disorder or alcohol abuse disorders by income status.

Proportionally more White patients had a recorded psychiatric diagnosis than non-White patients (Black and other non-White categories combined), 15.8% vs. 12.4%, $\chi^2[1] = 23.25$, $p < .0001$). Fewer Black patients had psychiatric diagnoses than those in the White or other race categories combined, 12.5% vs. 15.7%, $\chi^2[1] = 16.3$, $p < .0001$.

Psychiatric comorbidities as predictors of outcomes

Number of hospitalizations. Consistent with our hypotheses, all types of psychiatric comorbidity were associated with a greater risk of hospitalizations, $\chi^2(38) = 4008.30$, $p < .0001$, after adjusting for medical comorbidities (see Table 3). All forms of psychiatric comorbidity were associated with having at additional risk of hospitalization, ranging from .20 to .39 additional hospitalizations, on average. Sensitivity analyses excluding patients who had died during 1999 revealed very similar findings indicating no significant effects due to an increase in number of hospitalizations at end of life.

Follow-up analyses indicated psychiatric comorbidity was associated with increased risk of hospitalizations specifically attributed to heart failure exacerbation (i.e., with a DRG of heart failure). The mean heart failure hospitalizations for patients with psychiatric comorbidity versus no psychiatric comorbidity, were M=1.59 (SD=1.11), M=1.35 (SD=.80) and respectively, $t(3921)$= -12.16, $p < .0001$.

Mean length of stay (LOS). In partial support of our hypothesis, alcohol abuse, psychoses, major depression, and bipolar disorder were significant predictors of increased mean LOS, after adjusting for the effects of all significant types of medical comorbidity, χ^2 (38) = 1383.76, $p <$ .0001. Significantly, having bipolar disorder as a comorbid diagnosis was associated with 1.4 additional days of stay per hospitalization on average, holding other factors constant. The effects of each type of psychiatric comorbidity were independent of each other and were similar in magnitude when tested individually, indicating no significant multicollinearity effects. Sensitivity analyses showed no impact of excluding patients who died during the study year, suggesting that the findings could not be attributed to an "end-of-life" effect.

Total hospital charges. Consistent with our hypotheses, psychiatric comorbidities, as a group, were associated with higher total hospitalization costs, χ^2 (38) = 7294.32, $p < .0001$. As shown in Table 3, the additional hospitalization costs specifically attributable to each diagnosis, ranged from $1,8433.89 - $7,763.47. Again, parallel analyses indicated that the effects of psychiatric comorbidity were not dependent on the multicollinearity of the variables. Sensitivity analyses indicated no effect associated with hospital charges by patients at the end of life.

DISCUSSION

These findings represent the first comprehensive examination of psychiatric comorbidity and hospitalizations of older patients with heart failure. We have presented evidence that the negative effects of depression on the course of heart failure[19] may extend to other psychiatric disturbances. In a nationally representative sample we showed that psychiatric comorbidity was prevalent in Medicare recipients hospitalized for heart failure, with depression being the most common form. All forms of psychiatric comorbidity were associated with risk of additional hospitalizations comparable to medical comorbidities within a 1-year period and that the presence of alcohol abuse, depression, bipolar disorder, or psychoses predicted longer hospitalizations. All forms of psychiatric comorbidity were associated with increased health care costs that were at least comparable to other major forms of chronic illness. For example, diabetes with chronic complications was associated with 30% increased costs; depression and bipolar disorder were associated with cost increases of 25% and 52%, respectively. Analyses reported in this paper accounted for the effects of medical comorbidities using a method developed specifically to adjust for their impact on health care utilization, costs, and illness burden.[12]

There are several potential explanations for these effects. Heavy cardiac and noncardiac comorbidities in older adults with heart failure complicates their treatment.[20] It may be more difficult to stabilize patients who are depressed or psychotic, and the functional disability associated with these conditions is a barrier to effective treatment.[21] Those with psychiatric disturbances have poorer treatment adherence and self-care.[22] There is also evidence that even when psychiatric disturbances are recognized and initially treated in medical contexts, the psychiatric outcomes of these patients are no better than those who had psychiatric disturbance

unrecognized by their medical providers. [23, 24] Thus, research and clinical innovation will be needed to address the challenge of treating psychiatric problems in medical settings.

In addition, activation of the hypothalamic-pituitary-adrenocortical axis associated with psychiatric disturbance may play a role in poorer course within and between hospitalizations, although this type of explanation has most typically been applied to the role of depression in cardiovascular outcomes.[25] Our data do point to effects of psychiatric comorbidity on the course of HF, specifically; patients with psychiatric comorbidity had a greater number of HF hospitalizations. Although our data cannot specifically address the mechanisms involved, this is an important avenue for future research.

Although out findings are similar to those of Braunstein and colleagues[6] we used more restrictive criteria to identify patients with chronic heart failure (i.e., at least one hospitalization with a Congestive Heart Failure DRG). This likely resulted in a more severely ill patient sample. This restriction may explain why 35.3% of our sample died during the year on which the sample is based, compared to 18% of the sample defined by Braunstein. Our findings extend earlier work by showing that other psychiatric disorders in addition to depression have important associations with increased medical care utilization and costs.

There were limitations resulting from the use of claims-based administrative data. There might have been positive and/or negative biases in diagnosis and medical record coders that resulted from sources such as payment incentives and stigma associated with psychiatric diagnoses.[26] The diagnoses in the current study could not be validated against standardized criteria. Although other studies have reported adequate sensitivity and specificity for chart based psychiatric diagnoses in mental health settings,[27] it is likely that diagnoses obtained from claims-based records in the current study led to lower sensitivity for psychiatric disorders. Mood

disorders, and potentially other psychiatric problems, are significantly underdiagnosed and undertreated in older adults in medical settings.[24] The rates of depression we reported are lower than in interview studies of carefully diagnosed patients hospitalized for heart failure (i.e., ranging from 20 – 37%).[5, 28] In addition, the phenomenon of treatment of psychiatric disorders without chart documentation of a psychiatric disorder[29] indicate that psychiatric difficulties in our sample could be higher than the chart-based rates suggest.

No information was available regarding the severity of heart failure in the sample. However, our method of replicating analyses without patients who later died gave some control over illness severity. We cannot exclude the possibility that outcomes may be worse for patients with coded comorbid psychiatric diagnoses as opposed to the presence of the conditions themselves. In addition, only longitudinal designs, with more carefully diagnosed psychiatric conditions, can clarify the complex causal relationships between psychiatric conditions and the course of heart failure hospitalizations and outcomes.

CONCLUSION

Psychiatric comorbidity is prevalent among older adults with heart failure and our findings suggest that psychiatric illness has a demonstrable impact on the utilization of acute inpatient medical care. Future research should focus on the how this effect occurs. Important changes in clinical practice with these patients may include routine screening for psychiatric disorder and increased access to pharmacological as well as cognitive-behavioral interventions, with modifications based on the needs of older adults. Future research also should be focused on how best to identify and treat psychiatric disturbance in older patients with heart failure. This line of research has promise in reducing the burden of illness on older adults with heart failure, and in reducing the high costs of treating patients with this condition.

ACKNOWLEDGMENT

Financial Disclosures:

Steven L. Sayers: Dr. Sayers appreciates the support of grants from the American Heart Association, as well as in-kind support from the VISN 4 Mental Illness Research, Education, and Clinical Center (MIRECC), Veterans Affairs Medical Center, Philadelphia, Pennsylvania.

Nancy Hanrahan, Ann Kutney, Sean Clarke: Drs. Hanrahan and Clarke, and Ms. Kutney appreciate the support from the Center for Health Outcomes and Policy Research, University of Pennsylvania School of Nursing and National Institute for Nursing Research grants "Center for Nursing Outcomes Research" (P30-NR-005043, Linda H. Aiken, PI) and "Advanced Training in Nursing Outcomes Research" (T32-NR-007104, Linda H. Aiken, PI).

Brendalis Reis: None

Barbara Riegel: Dr. Riegel acknowledges the support of grants from the National Institutes of Health and the Kynett Foundation.

Author Contributions:

Steven L. Sayers, Nancy Hanrahan, Ann Kutney, Sean Clarke, Brendalis Reis, and Barbara Riegel: These authors were involved in the concept and design of the study, as well as the interpretation of data analyses and preparation of the manuscript.

Steven L. Sayers, Nancy Hanrahan, Ann Kutney, and Sean Clarke: These authors were directly responsible for obtaining the data and performing the data analyses.

Sponsor's Role: Not applicable.

The Centers for Medicare & Medicaid Services (CMS) have reviewed the subject manuscript and approve its use as submitted. This approval is based on the use of CMS data and does not represent a CMS endorsement of, or comment on, the actual manuscript itself.

Timothy P. Cheney, Center for Health Outcomes and Policy Research, and John E. Marcotte, Ph.D., Center for Population Studies, University of Pennsylvania, contributed statistical and programming expertise to the study. Thanks are extended to Ira R. Katz, M.D., Ph.D., of the University of Pennsylvania and the VISN 4 MIRECC, Joseph Gallo, M.D., Ph.D., of the University of Pennsylvania, and Linda H. Aiken, Ph.D., FAAN, FRCN, RN, Center for Health Outcomes and Policy Research, University of Pennsylvania School of Nursing, for their comments and suggestions on a previous version of the manuscript.

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Table 1. Demographic and Clinical Characteristics of Patients in the 5% Sample With a CHF DRG At Any Hospitalization During 1999

Characteristic			
Gender (*N*, %)	Male	8830	41.2
	Female	12599	58.8
Race (*N*, %)	White	18188	84.9
	Black	2301	10.7
	Other	940	4.4
Low-income *(N, %)*		4637	21.6
Age (*M, SD)*	Male	77.5	7.2
	Female	80.0	7.9
Died during 1999 (*N*, %)		7571	35.3
# of hospitalizations (*M, SD)*		2.96	2.20
# of CHF hospitalizations (*M, SD)*		1.38	0.86
Avg. Length of Stay (*M, SD)*		7.3	6.9
Total Charges $ US (*M, SD)*		40,048	52,916

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Table 2. Estimates of Psychiatric Comorbidity For Patients With Heart Failure DRG At Any Hospitalization During 1999 (N = 21,429)

Type of Psychiatric Disorder	N	%	95% confidence interval
Any Psychiatric Disorder	3287	15.34	
Alcohol abuse	290	1.4	1.2-1.5
Drug Abuse	122	0.6	0.5-0.7
Psychosis	534	2.5	2.3-2.7
Depression	1821	8.5	8.1-8.9
Bipolar Disorders	58	0.3	0.2-0.3
Anxiety Disorders	816	3.8	3.6-4.1
Other Psychiatric Condition	243	1.1	1.0-1.3

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299 Note: A minority of patients received more than one type of psychiatric diagnosis in 1999.

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Table 3. Estimated Effects of Demographics, Medical and Psychiatric Comorbidities on Length of Stay, Number of Hospitalizations, and Total Hospitalization Charges For Patients With Heart Failure DRG (N = 21,429)

	Estimated Additional Number (% change) of Hospitalizations		Estimated Additional Mean Length of Stay (% change) in Days		Additional Total Hospitalization Charges Estimate (US Dollars)	
Effect	Parameter Estimate	*p* value	Parameter Estimate	*p* value	Parameter Estimate	*p* value
Demographics						
Age 70-79*	—	.408	0.39 (+ 9%)	<.0001	-1001.29 (-7%)	.006
Age 80-89*	0.09 (+7%)	<.0001	1.37 (+31%)	<.0001	-1662.65 (-11%)	<.0001
Age 90+*	0.15 (+11%)	<.0001	2.30 (+51%)	<.0001	2827.77 (+19%)	<.0001
Female	-0.03 (-2%)	.016	0.39 (+ 9%)	<.0001	-813.87 (-5%)	.001
Black race**	-0.09 (-7%)	<.0001	—	.713	—	.159
Other race**	—	.317	—	.101	3261.55 (+22%)	<.0001
Medicaid	0.08 (+6%)	<.0001	0.37 (+ 8%)	<.0001	—	.682
Medical Comorbidities						
Hypertension	0.39 (+30%)	<.0001	-0.30 (- 7%)	<.0001	5295.26 (+35%)	<.0001
Valvular Disease	0.21 (+16%)	<.0001	—	.455	4901.10 (+33%)	<.0001
Pulmonary Circulation Disease	0.17 (+13%)	<.0001	0.38 (+ 9%)	<.0001	2806.30 (+19%)	<.0001
Peripheral Vascular Disease	0.29 (+23%)	<.0001	0.24 (+ 5%)	.003	4320.65 (+29%)	<.0001
Paralysis	0.40 (+31%)	<.0001	1.75 (+39%)	<.0001	6613.03 (+44%)	<.0001

Other Neurological Disorders	0.22 (+17%)	<.0001	1.06 (+24%)	<.0001	3987.54 (+27%)	<.0001
Chronic Pulmonary Disease	0.30 (+23%)	<.0001	0.45 (+10%)	<.0001	5548.66 (+37%)	<.0001
Diabetes without Chronic Complications	0.16 (+12%)	<.0001	—	.08	1731.00 (+12%)	<.0001
Diabetes with Chronic Complications	0.27 (+21%)	<.0001	0.81 (+18%)	<.0001	4784.63 (+32%)	<.0001
Hypothyroidism	0.16 (+13%)	<.0001	—	.102	2390.93 (+16%)	<.0001
Renal Failure	0.22 (+17%)	<.0001	0.39 (+ 9%)	<.0001	3993.25 (+27%)	<.0001
Liver Disease	0.23 (+18%)	<.0001	0.53 (+12%)	.035	2506.64 (+17%)	.019
Lymphoma	0.15 (+12%)	.004	—	.772	2854.62 (+19%)	.019
Peptic Ulcer Disease and Bleeding	—	.141	—	.777	—	.723
Metastatic Cancer	0.29 (+23%)	<.0001	0.65 (+14%)	.002	3801.28 (+25%)	<.0001
Solid tumor without Metastasis	0.31 (+24%)	<.0001	—	.311	4355.15 (+29%)	<.0001
Rheumatoid arthritis/ Collagen Vascular Diseases	0.27 (+21%)	<.0001	0.71 (+16%)	<.0001	3330.07 (+22%)	<.0001
Coagulation Deficiency	0.24 (+19%)	<.0001	0.82 (+18%)	<.0001	8465.06 (+56%)	<.0001
Obesity	0.15 (+12%)	<.0001	0.41 (+ 9%)	.002	1896.18 (+13%)	.001
Weight Loss	0.36 (+28%)	<.0001	1.91 (+43%)	<.0001	11497.23 (+76%)	<.0001
Fluid and electrolyte Disorders	0.43 (+33%)	<.0001	0.83 (+18%)	<.0001	7381.35 (+49%)	<.0001
Chronic Blood Loss Anemia	0.31 (+24%)	<.0001	0.33 (+7%)	.021	4485.02 (+30%)	<.0001
Deficiency Anemias	0.30 (+24%)	<.0001	0.22 (+5%)	.001	4202.99 (+28%)	<.0001
Acquired Immune Deficiency Syndrome	—	.307	—	.744	—	.478
Psychiatric Comorbidities						
Alcohol abuse	0.21 (+16%)	<.0001	0.58 (+13%)	.026	3461.25 (+23%)	.002

Drug Abuse	0.32 (+25%)	<.0001	—	.819	3723.24 (+25%)	.031
Psychoses	0.30 (24%)	<.0001	1.06 (+24%)	<.0001	3611.95 (+24%)	<.0001
Depression	0.39 (+30%)	<.0001	0.89 (+20%)	<.0001	3815.85 (+25%)	<.0001
Bipolar Disorders	0.38 (+30%)	.001	1.43 (+32%)	.021	7763.47 (+52%)	.005
Anxiety Disorders	0.34 (+27%)	<.0001	—	.371	1843.89 (+12%)	.005
Other Psychiatric Condition	0.37 (+29%)	<.0001	—	.702	3694.33 (+25%)	.003

Notes:

Entries in Table 3 were calculated from GLM models and presented as actual hospitalizations, average LOS in days, and total charges for ease of interpretation following the methods of Zhou, Stroupe and Tierney[30]. For parameters that were statistically significant, estimates represent the increased/decreased utilization associated with the characteristic, in relation to the intercept value. In addition, the percent increase in the estimate relative to the intercept value is also presented. The intercept values for the outcomes in the table were as follows: 1.28 hospitalizations, 4.47 days of length of stay, and total charges of $15,037.21.

* Age 65-69 is reference category.

**White race is reference category.

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