

Depression Effects on Hospital Cost of Heart Failure Patients in California: An Analysis by Ethnicity and Gender

Baqar A. Husaini, Deborah Taira¹, Keith Norris², S. Vivek Adhish³, Majaz Moonis⁴, Robert Levine⁵

Center for Prevention Research, Tennessee State University, Nashville, TN, ¹Department of Pharmacy Practice, Daniel K. Inouye College of Pharmacy, University of Hawaii at Hilo, Honolulu, Hawaii, ²Department of Health Sciences, University of California, Los Angeles, CA, ⁴Department of Neurology, University of Massachusetts, Worcester, MA, ³Department of Family and Community Medicine, Baylor College of Medicine, Houston, TX, USA, ⁵Department of Community Health Administration, National Institute of Health and Family Welfare, New Delhi, India

Abstract

Background: Depression often interferes with self-management and treatment of medical conditions. This may result in serious medical complications and escalated health-care cost. **Objectives:** Study distribution of heart failure (HF) cases estimates the prevalence of depression and its effects on HF-related hospital costs by ethnicity and gender. **Methods:** Secondary data files of California Hospital Discharge System for the year 2010 were examined. For patients with a HF diagnosis, details regarding depression, demographics, comorbid conditions, and hospital costs were studied. Age-adjusted HF rates and depression were examined for whites, blacks, Hispanics, and Asians/Pacific Islanders (AP) by comparing HF patients with depression (HF^{+D}) versus HF without depression (HFND). **Results:** HF cases ($n = 62,685$; average age: 73) included nearly an equal number of males and females. HF rates were higher ($P < 0.001$) among blacks compared to Hispanics, AP, and whites and higher among males than females. One-fifth of HF patients had depression, higher among females and whites compared to males and other ethnic groups. Further, HF hospital costs for blacks and AP were higher ($P < 0.001$) compared to other groups. The cost for HF^{+D} was 22% higher compared to HFND, across all gender and ethnic groups, largely due to higher comorbidities, more admissions, and longer hospitalization. **Conclusion:** Depression, ethnicity, and gender are all associated with increased hospital costs of HF patients. The higher HF and HF^{+D} costs among blacks, AP, and males reflect additional burden of comorbidities (hypertension and diabetes). Prospective studies to assess if selective screening and treating depression among HF patients can reduce hospital costs are warranted.

Keywords: Depression, ethnicity, gender, heart failure, hospital cost

INTRODUCTION

It is estimated that depression often interferes with treatment of medical conditions, largely due to nonadherence to medical recommendations.^[1] This may result in serious medical complications.^[2] Studies report between 20% and 48% of heart failure (HF) patients who experience depression^[3] which adversely affects their quality of life,^[4] produces uncertain treatment outcomes,^[5] and leads to increased service utilization/hospital re-admissions and premature mortality.^[6,7]

While only 14% of Medicare patients have HF, they consume approximately 43% of annual Medicare spending.^[8] Evidence suggests that compared to nondepressed patients, depression among HF patients adds between 30% and 48% to their hospital cost,^[9,10] but data according to ethnicity are sparse. This paper examines two-related issues by ethnicity and gender among

California patients: (i) prevalence of depression and HF and (ii) depression effects on HF cost within each ethnic/gender group by comparing HF patients with depression (HF^{+D}) patients with HF without depression (HFND) patients.

METHODS

Sample and data characteristics

Hospital Discharge Data files are administrative files that provide

Address for correspondence: Dr. S. Vivek Adhish, Department of Community Health Administration, National Institute of Health and Family Welfare, New Delhi, India. E-mail: vivekadhish@gmail.com

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patients' basic demographics along with the International Classification of Diseases, Ninth Revision (ICD-9) diagnostic codes (both primary and secondary) for each hospital discharge. Data from licensed general acute care facilities of California were obtained from the California's Office of Statewide Health Planning and Development for the year 2010. A total of 62,685 patients (aged 20+) with a primary diagnosis of HF (ICD-9 codes 402,404,428) along with their demographics, diagnoses of depression and anxiety, length of stay, and charges for each discharge were analyzed.

Since 48%–91% of symptoms overlap between depression and anxiety,^[11,12] we combined them as a single variable of depression for analyses. Two indices of comorbidities were computed: (i) a simple count of all secondary diagnoses as comorbidities that were identified by ICD-9-Clinical Modification codes for each patient and (ii) Charlson index of comorbidity,^[13] which measures severity of comorbidity for each patient. Further, two types of hospital costs were developed: (i) costs for HF alone (HF cost \$) when a patient was discharged with a primary diagnosis of HF and (ii) total hospital cost for the year 2010 (total cost \$), that is, when the same patient was discharged with diagnoses other than HF.

Statistical analysis

Age-adjusted HF rates per 100,000 adults (2010 Census) were developed per Center for Disease Control and Prevention (CDC) methodology.^[14] The prevalence of HF and risk factors by race/ethnicity and age were all evaluated with Pearson's Chi-square and Fisher's exact tests. Cost differences between groups were evaluated with ANOVA.

RESULTS

Prevalence of depression and heart failure by ethnicity and gender

Table 1 provides details regarding the prevalence and distribution of HF, depression, and comorbidities. Overall

prevalence of HF was 255.5/100,000 and the rates were higher ($P < 0.001$) among males compared to females (313.1 vs. 223.4), highest ($P < 0.001$) among blacks (617.9), and least among Asians/Pacific Islanders (AP) (189.6). Depression was more prevalent among HF patients than non-HF patients (21% vs. 15%, $P < 0.001$). Further, among HF patients, depression was also higher among females than males (25% vs. 16%, $P < 0.001$) and higher ($P < 0.001$) among whites (33%) than other groups. Compared to non-HF patients, HF patients were older in age (73 vs. 66 years) and had more comorbidities (3.92 vs. 2.68, $P < 0.001$).

Overall heart failure hospital cost and effect of depression

Hospital costs are affected by numerous factors including severity of medical condition (as measured by Charlson index of severity), number of comorbidities, number of hospital admissions, length of stay, and treatment procedures provided to the patients. Table 1 shows that the average cost per patient of HF alone was \$77,417 and total cost for the year was 45% higher among HF patients compared to non-HF patients (\$150,500 vs. \$94,811). Further, among the HF patients, both HF cost alone and the total costs for the year were higher ($P < 0.001$) for males (\$83,564 and \$158,050) than females (\$71,106 and \$142,740). The higher costs among males were largely due to greater number and severity of the comorbidities. Further, HF cost as well as the total cost varied by ethnicity in that both costs were higher ($P < 0.001$) for AP (\$83,469 and \$165,960, respectively), compared to other ethnic groups including blacks (\$82,929 and \$165,390), Hispanics (\$80,981 and \$158,360), and whites (\$73,985 and \$141,980). It may be noted that in all groups, HF cost alone added 50% to their total cost that year.

The effect of depression on hospital costs varied substantially by ethnicity and gender. Table 2 shows that the cost of HF^{+D} patients was 22% higher compared to HFND patients (\$91,880 vs. \$73,667). In fact, the higher costs for HF^{+D} patients

Table 1: Clinical characteristics, heart failure rates (per 100 K), and hospital costs of California heart failure patients by ethnicity and gender, 2010

Variable	All non-HF cases	HF						
		Total	White	Black	Hispanic	AP	Males	Female
<i>n</i>	14,322	62,685	36,178	8,279	12,762	5,466	31,756	30,929
Age	66	73	76	64	70	74	73	72
HF rate		255.5	230.4	617.9	294.4	189.6	313.1	223.4
Depression percentage	15	21	33*	17	20	12	16	25*
Comorb	2.68	3.92*	3.90	3.80	3.99	3.99	3.97	3.89
Charlson		3.62	3.49	3.76	3.80	3.87	3.72*	3.53
Admin	1.16	2.32*	2.21	2.80	2.37	2.23	2.34	2.30
Hospital days	7.2	13.9*	13.3	15.4	14.8	13.8	13.7	14.2
HF cost		77,417	73,985	82,929	80,981	83,469*	83,564*	71,106
Total cost	94,811	150,500*	141,980	165,390	158,360	165,960*	158,050*	142,740

*Differences between two adjacent columns (e.g., 1 vs. 2) significant at $P < 0.001$; non-HF=cases without HF diagnosis. Percentage value between 2 values (e.g., \$71,850 and \$41,264=54%) was calculated with percentage calculator formula: $([V1-V2]/[V1+V2/2]) \times 100$; see percent difference, the free encyclopedia. Comorb: Number of comorbidities. Charlson: Charlson index of illness severity, Admin: Number of admissions, HF cost: Cost of HF alone, Total cost: Total hospital cost for 2010 in dollars. HF: Heart failure, AP: Asians/Pacific Islanders

Table 2: Cost factors and effect of depression on hospital cost of heart failure cases by ethnicity and gender

Cost factors	Total No depression	Black		White		Hispanic		AP		Male		Female	
		Depression	No depression	Depression	No depression	Depression	No depression	Depression	No depression	Depression	No depression	Depression	No depression
Comorb	3.60	5.19*	3.53	3.60	5.32*	3.66	3.81	5.36*	3.81	5.3*	3.7	4.99*	3.49
Charlson	3.55	4.90*	3.69	3.41	4.23*	3.70	3.80	4.36	3.80	4.13	3.64	3.77	3.45
Admin	2.09	4.45*	2.45	1.98	3.32*	2.14	2.09	3.27*	2.09	3.5	2.1	3.07	2.05
Hospital days	11.80	25.9*	13.2	11.1	24.7*	12.4	12.7	22.3*	12.7	23.9*	11.7	20.9*	11.9
HF	73,667	119,340*	75,358	70,252	93,627*	77,870	82,034	94,326*	82,034	109,160*	78,568	80,273*	68,057
Total	133,640	279,900*	141,590	125,060	226,100*	141,720	154,730	250,900*	154,730	245,110*	141,060	195,100*	125,150

*Differences between two adjacent columns (e.g., 1 vs. 2) significant at $P < 0.001$. Comorb: Number of comorbidities, Charlson: Charlson index of severity, HF cost: Cost of HF alone, Total cost: Total hospital cost for 2010 in dollars. AP: Asians/Pacific Islanders, Admin: Number of admissions, HF: Heart failure

existed across all ethnic and gender groups with some variation. For example, black HF^{+D} cost was 45% higher compared to nondepressed black HFND patients (\$119,340 vs. \$75,358), followed by 21% among whites (\$86,466 vs. \$70,252), Hispanics 18% (\$93,627 vs. \$77,870), and AP who had the lowest (14%) cost difference (\$94,326 vs. \$82,034). Further, the cost for HF^{+D} males was 33% higher compared to HFND males (\$109,160 vs. \$78,568). Similar higher depression cost amounting to 17% also existed among HF^{+D} females compared to HFND females (\$80,273 vs. \$68,057). These data clearly indicate that depression increases cost of hospitalization significantly regardless of the patient’s gender or ethnicity.

DISCUSSION

HF is a leading cause of hospital admissions among the elderly in the United States and as such represents a great cost burden. Since patients with moderate-to-severe depression transit faster from a healthy state to HF,^[8] their risk of developing HF is estimated to increase by 40%.^[15] Our analyses show that costs for both HF and HF^{+D} patients are high compared to those without such clinical condition. Further, these costs were higher among minority patients and men. Further research is needed to examine other factors that may contribute to gender differences in hospital costs.

While one-fifth of our patients were depressed, their depression added 22% to their hospital cost. Depression is known to increase health-care costs^[15] along with other comorbidities that may increase hospitalization. However, our cost estimates are probably underestimates, in part, because of underdiagnosis. Future research should estimate the cost-effectiveness of screening and proper treatment of depression among HF patients.

Finally, minority HF patients had numerous notable comorbidities, such as hypertension, diabetes, and chronic kidney disease. The high prevalence of these medical disorders, particularly among males and underserved groups, underscores the use of both evidence-based preventive programs and optimal therapy to reduce costly hospitalization. Further reduction in HF hospitalization may be attained through coordination of community-based resources for HF patients with complex conditions.

CONCLUSION

Studies are needed to examine whether higher HF hospital costs could be reduced by:

- (i) Screening and treating depression along HF symptoms and
- (ii) Implementing community-wide proven preventive programs pertaining to hypertension and diabetes to reduce HF prevalence

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Conflicts of interest

There are no conflicts of interest.

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