

Risk Factors and Hospitalization Costs of Dementia Patients: Examining Race and Gender Variations

Baqar Husaini, Aashrai SV. Gudlavalleti¹, Van Cain, Robert Levine², Majaz Moonis¹

Center for Prevention Research, Tennessee State University, Nashville, Tennessee, ²Department of Preventive and Family Medicine, Meharry Medical College, Nashville, Tennessee, ¹Department of Neurology, University of Massachusetts, Massachusetts, USA

ABSTRACT

Aims: To examine the variation in risk factors and hospitalization costs among four elderly dementia cohorts by race and gender. **Materials and Methods:** The 2008 Tennessee Hospital Discharged database was examined. The prevalence, risk factors and cost of inpatient care of dementia were examined for individuals aged 65 years and above, across the four race gender cohorts - white males (WM), black males (BM), white females (WF), and black females (BF). **Results:** 3.6% of patients hospitalized in 2008 had dementia. Dementia was higher among females than males, and higher among blacks than whites. Further, BF had higher prevalence of dementia than WF; similarly, BM had a higher prevalence of dementia than WM. Overall, six risk factors were associated with dementia for the entire sample including HTN, DM, CKD, CHF, COPD, and stroke. These risk factors varied slightly in predicting dementia by race and gender. Hospital costs were 14% higher among dementia patients compared to non-dementia patients. **Conclusions:** There exist significant race and gender disparities in prevalence of dementia. A greater degree of co-morbidity, increased duration of hospital stay, and more frequent hospitalizations, may result in a higher cost of inpatient dementia care. Aggressive management of risk factors may subsequently reduce stroke and cost of dementia care, especially in the black population. Race and gender dependent milestones for management of these risk factors should be considered.

Keywords: Cost, dementia, race-gender cohort

Introduction

Dementia is a chronic disease characterized by progressive cognitive decline that interferes with independent functioning.⁽¹⁾ Dementia affects 5% to 10% of elderly aged 65 and above,⁽²⁾ and its prevalence varies by race and gender. Generally, the prevalence of the disease is higher in women.⁽³⁾ Out of the 5 million individuals aged 65 and above with Alzheimer's disease, which is the most common type of dementia in the United States, 3.2 million are women.^(4,5) A

nationwide prevalence study found that the cumulative prevalence of dementia among elderly aged 65 and above was higher in women than in men (9.9% vs. 6.4%).⁽⁶⁾ This may be due to the fact that women tend to live longer.^(7,8) However, some studies suggest that socio-cultural and hormonal differences may also have a role to play.⁽³⁾

Studies have reported racial differences whereby black elderly were reported to have a higher prevalence of dementia compared to their white peers of the same age.⁽⁹⁻¹¹⁾ These differences may occur due to a higher prevalence of cardiovascular risk factors, lower levels of education, lower socio-economic status, and may not be due to genetic variation.⁽⁵⁾ In another study, the racial differences were not significant when the analysis was adjusted for demographics, socioeconomic status, and co-morbidities such as stroke, hypertension, diabetes mellitus and myocardial infarction.⁽⁹⁾

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Address for correspondence:

Dr. Baqar Husaini, Center for Prevention Research, Tennessee State University, Nashville, Tennessee, USA. E-mail: bhusaini@tnstate.edu

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The healthcare cost of dementia has risen nearly sixteen-fold, from \$13.26 billion in 1988 to \$214 billion in 2014.^(5,12) The Alzheimer's association reported that the total per person payment from all sources of health care for Medicare beneficiaries suffering from dementia, was three times as great as payments for other Medicare beneficiaries (\$46,669 vs. \$14,772).⁽⁵⁾ Although a large share of the expenditure seems to be associated with unpaid informal care giving,⁽¹³⁾ this high out of pocket (OOP) expenditure also raises concerns. After controlling for demographics and co-morbidities, Delevande and colleagues found that dementia patients had more than three times the yearly OOP expenditure, as compared to those with normal cognition (\$8216 vs. \$2570).⁽¹⁴⁾

Racial disparities in the cost of dementia care are quite prominent. A study demonstrated that blacks had a significantly higher cost of care as compared to whites, primarily due to more frequent inpatient care and a greater severity of illness.⁽⁵⁾ An analysis of Medicare beneficiaries in Tennessee demonstrated that the average Medicare costs for black patients with dementia were \$4,645 higher than those for white patients.⁽¹⁵⁾ Gender comparisons of cost of dementia, however, are scarce and require more attention.

In this study, we explore the variation in prevalence, risk factors, and cost of dementia in four race-gender cohorts of Medicare beneficiaries in Tennessee, aged 65 years and above.

Materials and Methods

Data

Our study was approved by the Institutional Review Board of the Tennessee State University. We used Tennessee Hospital Discharge Data files on elderly patients (aged 65 and above; $n = 154,945$) discharged in 2008. These files were administrative files submitted for reimbursement; they provided both the primary and secondary diagnoses (ICD-9 codes for which a patient was treated), along with limited demographic such as age, race, sex. These files neither provided clinical data nor data on education, income, or occupation. The ICD-9 diagnosis was provided by the attending physician. Since the Tennessee population is largely composed of whites (82%) and blacks (16%), we used four race-gender cohorts of patients with dementia ($n = 5556$): White Males (WM; $n = 1778$), White Females (WF; $n = 3069$), Black Males (BM; $n = 253$), and Black Females (BF; $n = 456$).

We combined the primary and secondary diagnosis of dementia per ICD-9 codes of 290.00, 290.20, 290.40-290.42, 291.2, 294.10, 294.11, and 294.20. Secondary diagnoses of patients were used as risk factors which included hypertension (HTN), diabetes mellitus (DM),

hyperlipidemia (CHOL), atrial fibrillation (AFib), congestive heart failure (CHF), myocardial infarction (MI), chronic kidney disease (CKD), chronic obstructive pulmonary disease (COPD), and stroke. Finally, the proportion of dementia for various race-gender cohorts was computed, and age-adjusted dementia prevalence rates (of 690.6 per 100000 elderly) were developed. They were indexed to the Year 2000 Census as per the guidelines provided by CDC for the population at risk.⁽¹⁶⁾

To examine the cost of care, an age-adjusted analysis was performed, first for individuals with and without dementia, and across four race-gender cohorts in individuals with dementia. Only the cost incurred during hospitalization was considered. Since all individuals in the analyses were aged 65 and above, inpatient-costs were covered by Medicare benefits under Medicare Part-A benefits for all elderly aged 65 years and above.

Statistical analysis

The prevalence of risk factors among patients with dementia across the race-gender cohorts were evaluated with Pearson Chi Square (χ^2) and the Fisher's Exact Tests. We also used multivariate logistic regression to examine the contribution of all risk factors on dementia. The age-adjusted logistic models for each race-gender cohort separately examined the likelihood of dementia associated with each risk factor. Estimating separate equations for each race-gender cohort allowed for the effects of each risk factor to vary across all cohorts.

Results

Dementia prevalence and risk factors

The overall prevalence of dementia was 3.6% [Table 1, col. 2]. The mean age of dementia patients was 82.5 years (SD = 9.1). Black males were younger in age (78.4 ± 8.8 years) compared to other cohorts. Among discharged patients, dementia was significantly higher among blacks as compared to whites (4.2% vs 3.5%, $P < 0.001$, cols. 3 and 4). A greater proportion of females than males had dementia (3.9% vs 3.2%, $P < 0.001$, cols. 6 and 5). Among the four race-sex cohorts, dementia was significantly higher ($P < 0.001$) in black females (4.2%), followed by black males (4.1%), white females (3.8%) and white males (3.1%; cols. 7-10). The age-adjusted prevalence of dementia (per 100,000 population) was highest among black males (902.2), followed by black females (811.4), white males (619.9), and white females (617.5).

While one third of all dementia patients had DM, CHD, AFib, CHD, CHF, and COPD, nearly 60% had stroke and 80% had hypertension [Table 1, col. 2]. These risk factors also varied across four cohorts. Black patients had significantly higher prevalence than whites for HTN, DM, CKD, and stroke, whereas white patients

had a significantly higher prevalence of CHD [Table 1, cols. 3 and 4]. Male patients had a significantly higher prevalence of DM, CHD, CKD, AFIB, CHF, MI, COPD, and stroke [Table 1, cols. 5 and 6]. Figure 1 shows the distribution of comorbidities according to gender. In multivariate regression modeling, six risk factors having significant odds ratios (OR) emerged predicting dementia: HTN (OR = 1.11), DM (OR=1.16), CKD (OR = 1.26), CHF (OR = 1.16), COPD (OR = 1.29), and stroke (OR = 8.54; Table 2, col. 1). Among males, CHF (OR=1.30) was an additional contributor [Table 2, col. 4].

Dementia hospital costs

Healthcare cost is affected by a number of factors including the number and complexity of co-morbidities, number of re-admissions, and the duration of stay in the hospital. We examined these factors when comparing patients with dementia ($n = 5,556$) and those without dementia ($n = 149,389$). The dementia patients had significantly greater number of co-morbidities (3.7 vs. 2.9, $P < 0.001$, Table 3, cols. 1 and 2). These co-morbidities included HTN (84% vs. 77%, $P < 0.001$), DM (36% vs. 32%, $P < 0.001$), CKD (26% vs. 17%, $P < 0.001$), CHF (34% vs. 25%, $P < 0.001$), COPD (32% vs. 28%, $P < .0001$), and

Table 1: Prevalence of cardiovascular risk factors among non-dementia and dementia cohorts aged 65+

Features	Non-dementia <i>n</i> = 149389	All dementia <i>n</i> = 5556	Dementia all B <i>n</i> = 709	All W <i>n</i> = 4849	All M <i>n</i> = 2031	All F <i>n</i> = 3525	BM <i>n</i> = 253	WM <i>n</i> = 1778	BF <i>n</i> = 456	WF <i>n</i> = 3069
Col ->	1	2	3	4	5	6	7	8	9	10
Age	77	82	81	83*	80	83	78	81	82	84*
Dementia%	—	3.6	4.2	3.5	3.2	3.9	4.1	3.1	4.2	3.8
Risk Factors	—	—	—	—	—	—	—	—	—	—
HTN%	77	84*	90**	83	82	84	86	82	92*	83
DM%	32	36*	51**	33	39**	33	47	38	53*	31
CHOL%	12	10	9	10	11**	9	9	11	9	9
CHD%	42	44	41	44**	54**	38	47	55*	37	38
CKD%	17	26*	36**	24	33**	22	42*	30	31	21
AFib%	33	38*	34	39*	42**	36	36	42*	33	36
CHF%	25	34*	35	34	36**	33	32	37*	36	33
MI%	6	6	7	6	8**	5	8	8	6	5
Stroke%	14	59*	67**	58	64**	56	73*	63	63	55
COPD	28	32*	23	34*	40**	28	27	41*	20	30

BM: Black males, WM: White males, BF: Black females, WF: White females, All B: All dementia blacks, All W: All dementia whites, Total: All dementia patients, HTN: Hypertension, DM: Diabetes mellitus, Chol: Cholesterol, CHD: Coronary heart disease, AFib: Atrial Fibrillation, CHF: Congestive heart failure, MI: Myocardial infarction, COPD: Chronic pulmonary obstructive disease, *race-sex cohort differences significant at $P < .001$, **black-white differences significant at $P < .001$, **Male-female differences significant at $P < .001$

Table 2: Odd Ratios (OR) of risk factors predicting dementia in patients

Features	Total <i>n</i> = 5556	All B <i>n</i> = 709	All W <i>n</i> = 4849	All M <i>n</i> = 2031	All F <i>n</i> = 3525	BM <i>n</i> = 253	WM <i>n</i> = 1778	BF <i>n</i> = 456	WF <i>n</i> = 3069	
Col>	1	2	3	4	5	6	7	8	9	
Risk factors										
HTN	1.11*	1.11*	1.14*	1.05-1.23	1.15*	1.05ns	0.62	1.20*	1.07	1.08
C.I.	1.03-1.19	1.03-1.20		1.01-1.30				1.05-1.37	ns	ns
DM	1.16*	1.16*	1.14*	1.07-1.22	1.15*	1.16*	1.11	1.15*	1.16*	1.14*
C.I.	1.09-1.23	1.09-1.23		1.05-1.27	1.07-1.25	ns	1.04-1.28	1.07-1.25	1.04-1.24	
CHOL C.I.	0.77	0.77	0.76	0.77	0.76	0.77	0.79	0.75	0.73	
CHD C.I.	0.89	0.89	0.88	0.84	0.93	1.13ns	0.82	0.94	0.94	
CKD	1.26*	1.26*	1.25*	1.28*	1.26*	1.54*	1.23*	1.26*	1.27*	
C.I.	1.18-1.35	1.18-1.35	1.16-1.34	1.15-1.42	1.15-1.38	1.15-2.06	1.09-1.38	1.15-1.38	1.15-1.40	
AFib	0.90	0.90	0.89	0.92	0.89	1.00ns	0.91	0.90	0.89	
C.I.										
CHF	1.16*	1.16*	1.17*	1.30*	1.08	1.03	1.33*	1.08	1.07	
C.I.	1.09-1.24	1.09-1.24	1.09-1.25	1.16-1.45	ns	ns	1.19-1.50	ns	ns	
MI	0.87	0.87	0.86	0.90	0.85	1.03ns	0.88	0.83	0.83	
C.I.										
Stroke	8.54*	8.54*	8.29*	10.34*	7.68*	13.4*	9.97*	7.68*	7.48*	
C.I.	8.57-9.04	8.07-9.04	7.80-8.80	9.39-11.4	7.15-8.24	10.0-17.9	9.01-11.0	7.15-8.24	6.93-8.07	
COPD	1.29*	1.29*	1.33*	1.36*	1.25*	0.99	1.43*	1.25*	1.27*	
C.I.	1.21-1.31	1.21-1.37	1.24-1.42	1.23-1.50	1.15-1.36		1.28-1.58	1.15-1.36	1.17-1.39	

AA B: All black dementia patients, All W: All white dementia patients, All M: All male, All F: All female patients, BM: Black male dementia patients, WM: White male, BF: Black female, WF: White female dementia patients, *OR values are significant at $P < .001$ in each dementia group. CI values for OR that not significant are not shown

Stroke (59% vs. 14%, $P < 0.001$, see Table 1, cols. 1 and 2). In contrast to patients without dementia, dementia patients [Table 3, col. 1 and 2] had more re-admissions (2.48 vs. 1.69, $P < 0.001$), longer hospitalizations (17.3 days vs. 9.6 days, $P < 0.001$), and nearly 14% higher hospital costs in 2008 (\$55,938 vs. \$49,285, $P < 0.001$).

Hospitalization costs, however, varied by race. Table 3 (cols. 3 and 4) indicates that the cost of care for blacks was 48% higher compared to their whites peers (\$78,081 vs. 52,699, $P < 0.001$). Blacks also had significantly more number of comorbidities, (3.9 vs. 3.65, $P < 0.001$), higher re-admissions (2.60 vs. 2.46, $P < 0.001$), and longer hospital stay (21.4 days vs. 16.7 days, $P < 0.001$).

With respect to gender, the cost of inpatient care for males with dementia was 22% higher than that of females (\$63,264 vs. 51,718, $P < 0.001$). These higher costs for males appear to reflect higher costs for both white and black males who, relative to females, had more co-morbidities, and longer hospitalization (19 days vs. 16 days, $P < 0.001$) [Table 3, cols. 5 and 6].

Discussion

In our study, we noted that age was correlated to both stroke and dementia in that the rates of stroke and

dementia increased with increasing age for all race-gender cohorts. This corroborated the well-known fact that age is a significant risk factor for both dementia and stroke.^(5,17)

Our study supports the findings of previous studies which demonstrated that dementia is more prevalent in blacks.^(18,19) This may be attributable to a higher prevalence of stroke and diabetes in these individuals.^(18,19) Race dependent criteria for initiating treatment for diabetes and hypertension should be considered in policies aimed to prevent neuro-cognitive disorders.

Among the risk factors associated with dementia in our study, HTN, DM, CKD, CHF, COPD and stroke, are known to be associated with initial diagnosis of dementia.^(18-24,25) Out of these, hypertension and diabetes were highly prevalent in all cohorts. Additional research is needed to examine their role in small and large vessel strokes among patients with dementia. It is plausible that repeated small vessel infarcts combined with infarcts of large vessel may contribute to dementia. In our study, the association between the cardiovascular risk factors and dementia was not robust among black males because of their smaller numbers ($n = 253$). These individuals are those who survived a stroke and may have had dementia

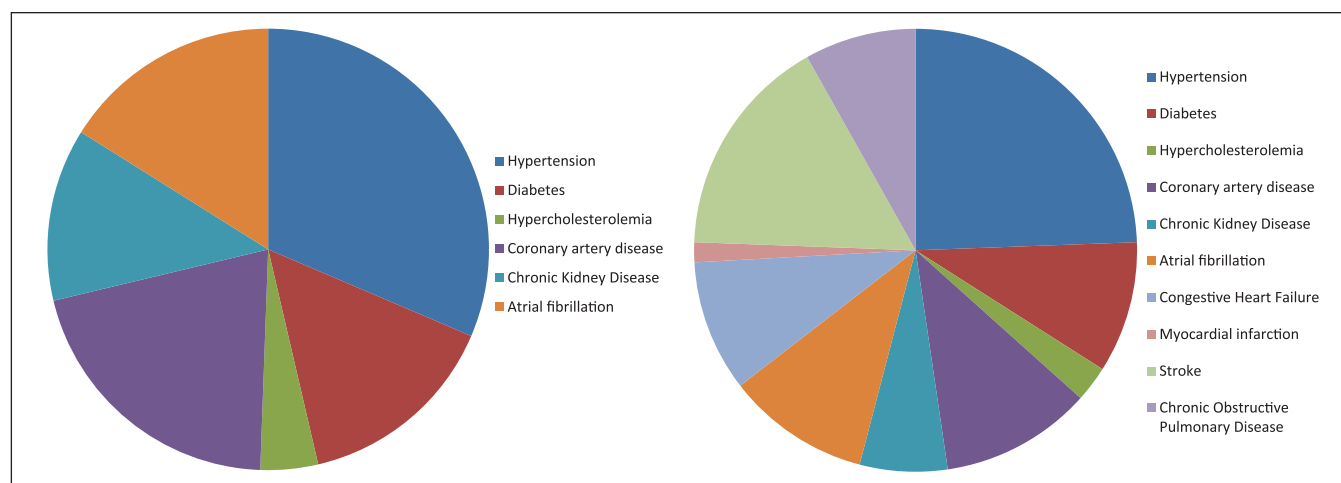


Figure 1: Comorbidities in males and females

Table 3: Number of co-morbidities, re- admissions, hospital days, and total hospital costs of dementia and Non-dementia patients in 2008

Features	Non-dementia	All dementia	Dementia ALL B	→ ALL W	→ ALL M	→ ALL F	Dementia BM	→ WM	→ BF	→ WF
Col>	1	2	3	4	5	6	7	8	9	10
Cost fact factors										
# of Comorb	2.9	3.7*	3.90**	3.65	4.0**	3.0	4.1*	4.1	3.8	3.4
# of Admis.	1.69	2.48*	2.60**	2.46	2.6**	2.4	2.64*	2.09	2.58	2.38
Hospital days	9.6	17.3*	21.4**	16.7	19.2**	16.2	24*	19	20	16
Total Cos Cost \$	49,285	55,938*	78,081**	52,699	63,264**	51,718	89,755*	59,494	71,605	48,763

of co-morb: Number of co-morbidities, # of Admis: Number of hospital admissions, Hospital days: Number of days in hospital, Total cost \$: All hospital cost for 2008, *dementia-No-dementia differences significant at $P < .000$, Race-sex cohort differences significant at $P < .001$, **Black-white differences significant at $P < .001$, ***Male-Female differences are significant at $P < .001$

as an outcome of that vascular event.⁽²⁾ It may also be noted that there is a higher mortality among elderly males with stroke. Thus, the fewer number of surviving black males in our sample, appears to be consistent with the longevity data on Tennessee population (72.5 years).⁽²⁾ In general, black females live longer compared to black males (76 years vs. 68.7 years).⁽²⁾ Hence the number of black males in our sample, though small, appears to be consistent with the population data on longevity.

Patients with dementia spent approximately \$55,938 for total cost of care as compared to patients without dementia, who spent \$49,285. This may have been partly due to more co-morbidity, higher rates of admission and almost twice the duration of hospital stay. Further, in the dementia group, black patients tended to have significantly higher cost of care than the whites. The higher costs for blacks (black males particularly) appear due to their higher co-morbidity, higher frequency of re-admission, and longer hospitalization.

In our study, males tended to have a significantly higher cost of care than females (approx \$11,000). This seems counter-intuitive since our study supported the fact that women have a higher prevalence of dementia as compared to men. This again, could partly be explained by the fact that men had greater number of co-morbidities, more number of admissions, and a longer duration of stay at the hospital. Our results are supported by past studies^(26,27) which showed that in patients with dementia, women avail lesser hospital care. This may be due to the fact that they may have a lower prevalence of co-morbid conditions or it may also be due to socio-cultural reasons. These studies also showed that women tended to avail more long term care than men. Since our study was not designed to analyze long term care, we were unable to address the issue. Further research addressing the differences in short-term and long-term care is required.

Finally, hypertension and diabetes appeared consistently as significant risk factors across all race and gender cohorts, and since both DM and HTN are amenable to effective management, our findings point to the need for aggressive primary and secondary prevention strategies which may reduce hospitalization costs for both stroke and dementia among the elderly.

Limitations

Our study has a few limitations. This was a hospital based study and hence the findings cannot be generalized to the entire community. The diagnostic criteria used for dementia was ICD-9. After the publication of ICD-10 and DSM-5, the prevalence of dementia, and hence the cost of care, might have changed. Lastly, the study looked at only the cost for short-term inpatient care and not at

the care given to these individuals in the community. The total cost of care is bound to be higher than what we found in our study.

Summary

In summary, our study demonstrated a significant race-gender disparity in prevalence of dementia and the related cost of care. Special focus needs to be given in prevention and management of modifiable risk factors such as hypertension and diabetes, which are highly prevalent in the black population. Race and gender dependent milestones for management of these risk factors should be considered. Further, insurance coverage for hospitalization could be tailored to ensure that those being admitted frequently or for a longer duration would be adequately covered by insurance services. Further research into the community based cost differences in dementia amongst race and gender cohorts, would broaden our understanding about the disparities in total cost of care across race and gender, in individuals suffering from dementia.

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