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Age and Race Specific Trends and Mortality for Dementia Hospitalization in the US

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Abstract

Objective: To explore ethnoracial and gender specific mortality associated with dementia hospitalizations from 1997 to 2008, using a nationally representative database.

Design: Cross-sectional.

Participants: 354,949,163 from the Nationwide Inpatient Sample (NIS) database using appropriate ICD-9 and procedure codes.

Measurements: Descriptive, univariate and multivariable analysis (Linear, Cox) adjusting for comorbidity, hospital factors and socio-demographics were used.

Results: Mortality was higher for dementia hospitalizations for all age groups (35-64 years and ≥ 65 years) vs. non-dementia hospitalizations (2.7% vs. 1.5% and 5.5% vs. 4.5%). For individuals aged 35-64 years, dementia hospitalizations were more common among males vs. females (53.8% vs. 46.2%). Crude in-hospital mortality was higher among Whites and males for all age groups and overall mortality declined from 1999 to 2008. Adjusted relative risk of mortality was higher among men as compared to women of all age groups (RR 2.87, 95% CI 2.82-2.92) and also higher among Hispanics and African Americans as compared to Whites (African Americans: RR 2.35, 95% CI 2.21-2.51; Hispanics: RR 2.15, 95% CI 2.06-2.23).

Conclusion: African Americans, Hispanics and men bear a disproportionate burden from dementia in the hospital setting. Interventions to improve care outcomes in these populations are important.

Keywords: Dementia; Aging; Gender; Race; In-hospital mortality

Introduction

Dementia is a grave and costly public health issue affecting 5.3 million elderly in the U.S., with the number projected to triple by 2050 [1]. It is frequently complicated by multiple co-morbidities, thereby increasing the risk for hospitalizations and adverse outcomes [2,3]. There is mixed evidence regarding the role of gender on dementia incidence, morbidity and mortality. While some studies report higher risk in women compared to men [4,5], others report greater [6] or no difference in incidence among men [7-12]. Though there is evidence of greater mortality rate among men with dementia [13-18]. Others have higher mortality among women [19-20] especially the oldest old women. However, there seems to be insufficient data to conclude that mortality difference exists based on gender when adjusted for comorbidity and age.

While incident dementia is more common among whites, some evidence suggests that differences in incidence, morbidity and mortality may exist based on race and ethnicity. Some studies suggest that the minority populations may be disproportionately affected. For example, Alzheimer's Association has estimated the prevalence of Alzheimer dementia (ALZ-D) and other dementias in African Americans 65 years and above to be twice that seen among whites of the same age group, while the prevalence among Hispanics is one and half times greater than in Whites [21]. Other studies have corroborated these findings [22-25]. Few studies in contrast report no difference [26,27]. To the best of our knowledge, no study that we know of has looked at hospitalization by race and ethnicity, especially exploring the trends over the past decade.

Finally there is a dearth of data regarding dementia-associated comorbidities among hospitalized patients, and any change in trend over time. In this study, we propose to examine ethnicity, race, gender, and comorbidity specific outcomes associated with dementia hospitalization in the US, including any trends or changes in these outcomes over the past decade (1999-2008).

Methods

Data was obtained from the Nationwide Inpatient Sample (NIS), developed as part of the Healthcare Cost and Utilization Project, a Federal-State-Industry partnership sponsored by the Agency for Healthcare Research and Quality (AHRQ). NIS is designed to approximate a stratified 20% sample of all non-federal, short-term, general, and specialty hospitals serving adults in the United States [28]. The sampling strategy selects hospitals nationwide from State Inpatient Database according to defined strata based on ownership, bed size, teaching status, urban or rural location, and region. All discharges from sampled hospitals for the calendar year are then selected for inclusion into NIS. To allow extrapolation for national estimates, both hospital and discharge weights are provided. Detailed information on the design of the NIS is available at http://www.hcup-us.ahrq.gov.

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From 1999-2008, NIS captured discharge-level information on primary and secondary diagnoses and procedures, discharge vital status, and demographics on discharges per year. Data elements that could directly or indirectly identify individuals were excluded; we thus considered all discharge encounters to be independent. The unit of analysis was the discharge/encounter rather than the individual. A unique hospital identifier allows for linkage of discharge data to an NIS data set with hospital characteristics. To analyze Dementia hospitalizations, we identified all discharge codes, for which an ICD9-CM code of 290.X (X including 290.0, 290.10, 290.11, 290.12, 290.13, 290.20, 290.21, 290.3, 290.40, 290.41, 290.42 ,290.43, 294.0), 294.X (X including 294.1), 331.0, 331.X (X including 331.11, 331.19, 331.82, 331.89), 332.0, and 333.0 were all designated as 'Dementia' as the primary diagnosis. This approach has been employed by other studies and was taken to specifically focus on encounters with Dementia as the primary diagnosis and not those encounters for which dementia was a secondary diagnosis. The total numbers of Dementia hospitalizations were obtained by summing across all identified ICD9-CM codes. For encounters which had more than one reported code, only the first reported code was used. Similar coding algorithms were utilized for in-hospital procedures and other medical co-morbidity that were analyzed. We were careful to account for code changes if they occurred per NIS guidelines. The burden of co-morbidities was assessed using the Charlson-Deyo Index (CDI) methodology [29].

Statistical Analysis

Descriptive analysis and normalization of non-normal variables including the primary outcome (mortality) and predictor/independent variables were conducted. We also examined trends in the distribution of these variables from 1999 to 2008. Next we examined crude in-hospital mortality by gender, age-group and race/ethnicity. We also explored the relationship between age-groups, gender, race/ethnicity and in-hospital mortality using univariate and multivariable Cox proportional Hazards analysis. Finally, we examined the trends in in-hospital mortality from 1999 to 2008. Adjustments in the multivariable models were made for socio-demographic factors, clinical comorbidity and hospital characteristics. Appropriate NIS sampling and design parameters were applied during this analysis. All data analyses were conducted using SPSS (version 20.0 with the complex samples module) and SAS version 9.2 (SAS Institute, Inc., Cary, NC). This study was deemed exempt by the Cedars-Sinai and Loma Linda University Institutional Review Board.

Results

Baseline characteristics of the population are outlined in Table 1. We identified 221,071 young dementia hospitalization and 7,219,708 old dementia hospitalization. Dementia was greater among Whites when compared to other ethnicities (35-64: 65.1%, ≥ 65: 82.4%). Among individuals aged between 35-64 years, there were more women with non-dementia hospitalization (54.3%), but more men were hospitalized with dementia (Men 53.8%, Women 46.2%). Among those between 35-64 years of age, inflation adjusted hospital charges was greater for dementia cases in comparison to non-dementia cases (Dementia $25,050, non-dementia $23,689), yet among those ≥ 65 years of age, inflation-adjusted charges were significantly lower among the dementia patients (Dementia $20,229, non-dementia $26,048). As demonstrated in Table 2, the Comorbidity Index score was higher among non-dementia hospitalization compared to dementia hospitalization among those ≥ 65 years of age (1.93 vs. 1.45). Significant differences were observed in the distribution of medical comorbidities. Of particular importance was the high occurrence of chronic obstructive pulmonary disease (COPD), hypertension (HTN), heart failure, diabetes mellitus (DM) with complications, chronic renal disease, and HIV/AIDS among the younger group (age 35-64 years). For example, COPD occurred more among individuals with dementia compared to non-dementia (14.7% vs. 9.7%), HTN was also higher (51.7% vs. 37.3%), and heart failure almost three times higher (10.09% vs. 3.7%).

The same variations were not observed in similar magnitude among

Variables	Age 35-64years		Age ≥65years	
	No Dementia %/Mean SE	Dementia %/Mean SE	No Dementia %/Mean SE	Dementia %/Mean SE
n	232,961,023	221,071	114,547,361	7,219,708
Age	50.03[0.32]	58.59[0.04]	77.4[0.03]	83[0.03]
Gender				
Male	45.6	53.8	42.9	35.7
Female	54.3	46.2	57.1	64.3
Primary payer				
Medicare	16.9	49.3	89.3	92.8
Medicaid	15.8	23.3	1.5	1.4
Private*	53.8	21.3	7.8	4.7
Other	13.5	6.1	1.4	1.1
Race/Ethinicity				
White	71.4	65.1	84.4	82.4
African American	17.8	24.7	9.1	11.2
Hispanic	10.8	10.2	6.6	6.4
Total in-Hospital Charge	$23,689.94 [338]	$25,050.28 [524]	$26,048.05 [343]	$20,229.44 [315]
Length of Hospital Stay (mean days)	4.72[0.03]	8.50[0.11]	5.68[0.03]	6.50[0.05]

*=including HMO

All p-values are statistically significant using p<0.05 as the level of statistical significance

Table 1: Baseline characteristics of NIS subjects Aged 35-64 and ≥ 65 years old with and without ICD-9 CM diagnosis of Dementia.

Variables	Age 35-64years			Age ≥65years		
	No Dementia %/Mean SE	Dementia %/Mean SE	P value (trend change)	No Dementia %/Mean SE	Dementia %/Mean SE	P value (trend change)
n	232,961,023	221,071		114,547,361	7,219,708	
Chronic Medical Comorbidity	1.43[0.01]	1.53[0.02]		1.93[0.01]	1.45[0.01]	
COPD	9.7	14.7		21.7	16.4	
Stroke	7.4	10.9		10.4	18.1	
Heart Failure	3.7	10.9		24.0	21.1	
DM with no complications	14.1	20.6		20.0	17.1	
DM with complications	6.7	11.2		6.6	5.3	
Hypertension	37.3	51.7		58.5	54.7	
Paraplegia	1.5	2.4		1.4	1.4	
Chronic Renal Disease	4.6	8.6		6.4	4.3	
Valvular Heart Disease	3.6	3.4	0.075	10.2	6.9	
HIV/AIDS	1.6	0.7		0.1	0.0	
UTI	5.0	16.9		12.1	24.8	
Depression	10.4	15.8	0.01	6.9	11.4	
Anxiety	4.7	4.0		3.1	2.8	
Hospital Type						
Rural	12.4	15.2		16.8	19.2	
Urban non-teaching	40.9	43.1		45.0	47.2	
Urban teaching	46.7	41.7		38.2	33.5	
Discharge Disposition						
Routine	80.0	35.9		53.7	23.9	
Short-term hospital	2.6	2.9		3.1	2.1	
Another type of facility/HHC	14.2	57.9		38.3	68.4	
Against medical advice	1.6	0.6		0.4	0.2	
Died	1.5	2.7		4.5	5.5	

SE=standard error, COPD: Chronic Obstructive Pulmonary Disease, DM: Diabetes mellitus, UTI: Urinary Tract Infection, HHC: Home Health Care, All p-values are statistically significant using p<0.05 as the level of statistical significance

Table 2: Distribution of medical comorbidities by age-group among subjects with and without Dementia.

		% Mortality				
Age	Year	Male	Female	White	African American	Hispanic
35- 64 yrs	1999-2000	4.0	3.4	4.1	3.7	3.8
	2001-2002	3.3	3.5	3.6	3.7	2.9
	2003-2004	2.9	2.2	2.5	2.8	4.0
	2005-2006	2.6	2.6	3.2	2.2	2.3
	2007-2008	2.3	1.8	2.5	1.5	1.5
	TOTAL	2.9	2.5	3.1	2	2.8
65-74 yrs	1999-2000	5.5	3.9	4.8	4.9	3.4
	2001-2002	4.9	3.4	4.1	4.2	4.4
	2003-2004	3.7	3.1	3.7	3.4	3.9
	2005-2006	3.7	2.7	3.6	2.6	2.6
	2007-2008	3.1	2.6	2.9	3.2	2.7
	TOTAL	4.0	3.1	3.8	3.6	3.3
≥ 75 yrs	1999-2000	8.0	6.2	6.9	6.7	7.2
	2001-2002	7.5	5.8	6.5	6.4	6.5
	2003-2004	7.0	5.3	6.1	5.3	6.2
	2005-2006	6.2	4.9	5.7	4.4	5.3
	2007-2008	5.7	4.5	5.2	4.4	5.1
	TOTAL	6.8	5.3	6.1	5.3	5.9

Table 3: Crude in-hospital Dementia mortality by age-group, gender and race/ethnicity.

the older age group (age ≥ 65 years). Mortality was higher for dementia hospitalizations for all age groups (35-64 years and ≥ 65 years) vs. non-dementia hospitalizations (2.7% vs. 1.5% and 5.5% vs. 4.5%).

Crude In-Hospital Mortality by Age-group, gender and Race/Ethnicity (Table 3).

Crude in-hospital mortality was observed among three age groups including: 35-64 years, 65-74 years, and ≥75 years of age (Table 3). Crude in-hospital mortality was higher among among males vs. females for all age groups (2.9% vs. 2.5%, 4.0% vs. 3.1% and 6.8% vs. 5.3%, respectively). Mortality appeared to decline for all age groups among males and females from 1999 to 2008. Mortality was also higher among Whites when compared with African Americans and Hispanics of all ages. Not surprisingly mortality was highest among the older

population (75 years or older). Mortality appeared to decline for all age groups among Whites and African Americans from 1999 to 2008. A consistent decline for Hispanics only appeared in the oldest age category (≥75 years of age).

Hazard Ratio of Mortality Associated with Dementia Hospitalization by Age-group (Table 4).

Unadjusted Cox proportional hazards analysis demonstrated overall higher in-hospital mortality for patients ≥ 75 years of age when compared with 35-64 year olds and 65-74 year olds (HR 4.65 CI: 4.56-4.73, HR 1.114 CI: 0.98-1.27, HR 1.24 CI: 1.17-1.31, respectively). Multivariable analysis controlling for the influence of demographic characteristics, medical co-morbidity and hospital characteristics demonstrated similar mortality among the three different age groups. Trends in mortality did not demonstrate any significant change from 1999-2008.

Hazard Ratio of Mortality Associated with Dementia Hospitalization for Whites vs. African Americans and Hispanics (Tables 5).

Multivariable Cox regression analysis demonstrated lower overall mortality for African Americans and Hispanics when compared to Whites hospitalized for dementia.

Discussion

We believe our study adds to our knowledge of in-hospital mortality associated with dementia, especially as it relates to gender, age and ethnoracial correlates. One important discovery was that higher proportion of African American and Hispanic patients suffering from dementia were hospitalized. Several studies have explored the differences in prevalence and incidence of dementia between the different ethnic groups and to date, most studies have demonstrated greater prevalence of dementia amongst African Americans and Hispanics as compared to whites [23-25,30]. Though our understanding of the biologic and pathophysiologic basis for this disparity in dementia prevalence is still lacking, some reports suggest that environmental factors may play an important role. Literature indicates that African Americans and Hispanics have a higher risk for vascular dementia [12,31] and other cardiovascular diseases, which could account for some of the disparities in the dementia prevalence and mortality. Additionally, there is evidence that minority populations (African Americans, Hispanics) with a diagnosis of dementia often receive delayed or inadequate healthcare services, [32] and specifically, they are less likely than non-Hispanic Whites to be prescribed medication for dementia and related complications [33-35]. This may lead to more admission of more advanced and compromised cases to the hospital, as well as greater mortality in the hospital setting. Given the profound expansion of dementia among the minority population, this difference in hospital mortality necessitates investigation into causal paradigms and potential mitigating interventions.

A notable finding is the increased hospital mortality among men with dementia as compared to women with dementia. Potential explanatory hypotheses regarding this observation may be related to several factors, namely a) neurodegenerative diseases, such as frontotemporal dementia, neurosyphilis and Cruetfeldt Jakob disease, b) infectious diseases including syphilis and AIDS, c) vascular dementia, d) and post-traumatic dementia, among many other causes all being more common in men, and on the average, having an earlier age of onset. Further studies are required to explore the unique presentation, care process, and pathophysiological differences between the genders and age groups.

In our analysis, the younger dementia patients had higher comorbidity index as opposed to the older group with dementia. One reason for our findings could be related to the types of dementias and the comorbidities associated with them. As an example, patients with vascular dementia had the highest comorbidity scores, related to conditions associated with cardiovascular risk: hypertension, hyperlipidemia, stroke, peripheral vascular disease and others [36-39].

Age Group	Unadjusted HR (95% CI)	R^2 for Trend	Adjusted HR (95% CI)*	R^2 for Trend
35- 64 yrs	1.11 (0.98-1.27)	0.09	1.08 (0.93-1.25)	0.05
65-74 yrs	1.24 (0.98-1.27)	0.22	1.24 (1.16-1.32)	0.08
≥ 75 yrs	4.65 (4.56-4.73)	0.48	1.20 (1.18-1.23)	0.15
Total	1.18 (1.16-1.20)	0.22	1.15 (1.13-1.18)	0.41

*Model adjusted for demographic characteristics, medical co-morbidity and hospital characteristics.

Table 4: Unadjusted and adjusted cox proportional hazard ratios of Dementia hospitalization by age group from 1999-2008.

Age Group	Unadjusted Cox Proportional Hazards Analysis					
	African American			Hispanic		
		1999-2008		1999-2008		
	HR	95% CI	R^2 for Trend 1999-2008	HR	95% CI	R^2 for Trend 1999-2008
35- 64 yrs	0.76	(0.63-0.92)	0.14	0.85	(0.65-1.13)	0.04
65-74 yrs	0.86	(0.78-0.93)	0.15	0.83	(0.73-0.95)	0.19
≥ 75 yrs	0.77	(0.74-0.81)	0.004	0.91	(0.85- 0.98)	0.05
Total	0.73	(0.70-0.77)	0.01	0.87	(0.81-0.93)	0.09
Adjusted Cox Proportional Hazards Analysis[a]						
35- 64 yrs	0.78	(0.65-0.94)	0.002	0.92	(0.69-1.22)	0.003
65-74 yrs	0.87	(0.79-0.98)	0.13	0.86	(0.75-0.98)	0.25
≥ 75 yrs	0.79	(0.75-0.82)	0.01	0.92	(0.86- 0.98)	0.09
Total	0.77	(0.73-0.80)	0.01	0.89	(0.83-0.95)	0.14

a. Model adjusted for demographic characteristics, medical co-morbidity and hospital characteristics.
*Whites = reference

Table 5: Unadjusted and adjusted cox proportional hazard ratios for in-hospital Dementia mortality by nis year and age group: african americans, hispanics vs. whites*.

The same increased comorbidity-disease relationship is seen in post-traumatic dementia and HIV dementia. Of interest, heart failure, HTN, DM without complications and HIV were also seen in significantly higher rates in the young dementia group, but not in the older group.

Another cause ascribed to these disparities has been under-recording of comorbidities in older subjects afflicted with cognitive impairment [40-42]. Some of this may be under recording of co morbidities amongst those with do not resuscitate (DNR), do not intubate (DNI) status, but if the under recording goes beyond the DNR and DNI status then it should be explored for a systematic pattern of under treatment in this population group.

In both age groups, COPD had the strongest association with dementia. De Carolis et al. have previously postulated that chronic hypoxia facilitates objectively measured cognitive decline [43]. Our findings are probably the first demonstration of such strong correlation between COPD and dementia in a large population, and may highlight new causal paradigms. In agreement with previous studies, UTI was significantly more common in the dementia group. It is a well-known fact that UTI is one of the most frequent causes for hospitalizations of dementia patients, and is associated with high mortality and morbidity [44].

When looking at in-hospital costs, we observed what ostensibly appeared to be paradoxical results. When comparing the younger and the older dementia groups, despite longer hospital stay in the older dementia group, in-hospital costs were greater in the younger dementia population. As discussed earlier, this could be due to higher level of comorbidities seen in the younger dementia patients. But there could be another reason for this cost disparity; it could attribute it to the tacit beliefs, within the healthcare community, regarding necessity of high level of care in the elderly dementia patients. This is especially interesting in lieu of the fact that length of stay was longer in this group. There is evidence that dementia in the older population, especially in its advanced stages, is viewed as a terminal diagnosis by the families, who often opt for palliative care instead of perceived heroic measures [45]. One reason proposed for prolonged hospital stay in the older dementia patients is that, due to their needs for greater level of care, they often cannot be discharged home, and therefore, finding appropriate placement may lead to delays in discharge. Securing appropriate placement may create delays in placement. Given the aging of our society and significantly greater number of dementia patients coming to the hospital, the questions of quality of care, cost, and appropriate placement will need greater attention.

Limitations

This study is subject to important limitations including the use of administrative data that extrapolates Dementia occurrence using ICD-9 coding. Coding errors may be over- or under reported. Medical comorbidity patterns described in this study are also dependent on appropriate coding, and coding errors may also affect observed outcomes. Though rare, discharge disposition and mortality estimates may not account for transfer between hospitals or facilities for the selected population. Despite these limitations, we believe this study presents an important insight into the ethnoracial, gender and comorbidity correlates associated with dementia hospitalizations.

Conclusion

We were able to demonstrate that Whites and men face a disproportionate risk of mortality in the hospital setting. It is also evident that younger dementia patients have more comorbidities compared to older dementia patients. Yet it is not clear if this is related to differences in level of care or type of disease. Paradoxically, though hospital stay for the older dementia group as compared to the younger group was longer, cost of hospitalization was lower. It is important to elucidate whether this is due to causal differences or level of care. As the population is getting older at an unprecedented rate, and we will face an epidemic of dementia and dementia related hospitalization, we will need to better understand the comorbid risks, and the level and limitations of care in the hospital setting.

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