

Surviving confusion- differences in survival among older African Americans and whites hospitalized with delirium diagnoses in the United States

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Abstract: *Background:* Little is known regarding in-hospital mortality for older African Americans hospitalized with delirium diagnoses. *Objectives:* To estimate the in-hospital mortality for older African Americans hospitalized with delirium diagnoses based on a national representative sample; differences in this outcome and other determinants of morbidity (i.e. length of stay) between well studied populations (non-Hispanic Whites) and African Americans was also the focus. *Design:* Retrospective cohort study. *Setting:* Database of hospital discharges from the 2006 Nationwide Inpatient Sample (NIS), a subset of the Healthcare Cost and Utilization Project (HCUP) from the Agency for Healthcare Research and Quality (AHRQ). *Participants:* Represented 54,003 hospital discharges for those 65 years old and above, both African Americans and non-Hispanic Whites discharged from US hospitals. *Key Outcomes:* In-hospital mortality and length of stay. *Results:* Among delirious patients, African Americans had a longer mean length of stay (LOS) than non-Hispanic Whites (7.8 vs. 7.3 days, $p=0.005$). A larger percentage of non-Hispanic White patients (7.4%) compared to African American patients (6.6%) died during their stay in the hospital, however this was not statistically significant ($p=0.076$). *Limitations:* Suspected under-detection of delirium by providers and the subsequent diminished diagnostic capture by evidence of paid billing claims. *Conclusion:* The in-hospital mortality rate for non-Hispanic White patients hospitalized with diagnoses of delirium was also significantly less than that found in other studies (7.3 vs. 9%) indicating that detection of delirium and its subsequent diagnostic capture in these claims data may have been very low. The most likely explanation is that determining mortality estimates for an already under-diagnosed syndrome based on claims diagnostic data may be suboptimal. Alternatively, these results may indicate that delirium is profoundly under-diagnosed in elderly hospitalized African Americans as compared to their non-Hispanic White counterparts.

Keywords: Vulnerable Populations, Delirium, Disparities

1. Introduction

As many as 14 to 56% of older persons hospitalized in the US experience delirium [1], affecting at a minimum nearly 2 Million adults older than 65 years of age who experience delirium and its complications during their inpatient length of stays [2]. These adverse outcomes include prolonged hospitalization, functional decline and dependence, increased rates of re-hospitalization within 30 days of discharge, and death [3, 4]. The financial cost alone to the

United States healthcare system was recently estimated to range from \$38 billion to \$152 billion annually [5].

In certain well-studied populations, the important determinants of delirium (its risk factors, prevention, etiology, and consequences) have been well documented in the literature. Moreover the foundational work conducted has led to the development of a validated diagnostic tool (Confusion Assessment Method or CAM) and significant primary prevention strategies that have been tested and broadly implemented in acute care settings [6,7]. However, such tools have not been explicitly validated in less well-studied

populations such as African American elders. Furthermore there are no published peer-reviewed systematic reviews regarding prevention, treatment, or outcomes of delirium in hospitalized African American older persons. Neither is there any national estimate of in-hospital mortality for older African Americans hospitalized with delirium diagnoses nor any study of modifiable risk factors specific to this potentially vulnerable group.

The main objective of this study is to estimate the in-hospital mortality for older African Americans hospitalized with delirium diagnoses based on a national representative sample. The primary outcome measure will be differences in mortality rate. Secondary outcome measures will be other determinants of morbidity (i.e. length of stay) between well-studied populations (non-Hispanic Whites) and African Americans.

Hospital discharges from the 2006 Nationwide Inpatient Sample (NIS), a national data set that is part of the Agency for Healthcare Research and Quality's (AHRQ) Healthcare Cost and Utilization Project (HCUP) [8] were used to examine the above outcomes.

2. Methods

The primary aim of the investigation was to determine an in-hospital mortality estimate for African Americans and identify any racial disparity from the majority population. Our study population was drawn from the 2006 Nationwide Inpatient Sample (NIS) which contains data for all inpatient US hospital stays from approximately 1,045 community hospitals. Community hospitals in the 2006 Nationwide Inpatient Sample (NIS) included academic medical centers, public hospitals, specialty hospitals (obstetrics/gynecology, ear-nose-throat, orthopedic, pediatric) and long-term acute care facilities (also known as long-term acute care hospitals or LTACHs). Excluded from the 2006 Nationwide Inpatient Sample (NIS) were short-term rehabilitation hospitals, long-term non-acute care hospitals (or nursing homes), psychiatric hospitals, alcoholism/chemical dependency treatment facilities, Veterans hospitals, Department of Defense healthcare facilities, Indian Health Service, and hospital discharges from 12 states as they chose or were prohibited for undisclosed reasons from participating in the NIS (Alabama, Alaska, Delaware, Idaho, Louisiana, Maine, Mississippi, Montana, New Mexico, North Dakota, Pennsylvania, and Wyoming).

These administrative data cover all hospital inpatient stays from states that voluntarily participate in the Healthcare Cost and Utilization Project (HCUP) annually. The Nationwide Inpatient Sample (NIS) dataset is de-identified, where all direct identifiers are eliminated from this limited data set to comply with the Health Insurance and Portability and Accountability Act (HIPAA) [9]. The number of hospitals in the 2006 NIS is 5,124 and represents over 8 million (un-weighted) hospital discharges (weighted discharges = 39,450,216).

We restricted our investigation to African Americans and

non-Hispanic Whites 65 years of age or older, and, using the 2006 Nationwide Inpatient Sample (NIS), we assembled a data set of all hospital discharges inclusive of delirium diagnoses from 29 states during 2006 drawn from a representative sample of all hospital discharges with validated claims for that year. In order to maintain our focus on reversible and readily treatable causes of delirium, we excluded discharges with diagnoses of alcohol withdrawal, drug overdose, nonorganic psychoses, head trauma and terminal cancer. Our final un-weighted sample included 54,003 observations (at the level of a hospital discharge) representing a weighted sample of 266,047 observations. Then we conducted a population-based retrospective cohort analysis to measure in-hospital mortality and length of stay in order to quantify the risk of mortality and prolonged hospitalization for African Americans and whites hospitalized with delirium diagnoses.

The Nationwide Inpatient Sample (NIS) with its diagnostic data linked to billing claims has been used in other retrospective cohort studies to evaluate racial disparities in other important diseases [10], to evaluate prevalence, complications, and costs for novel therapies [11], and to identify mortality rates for rare but severe diseases [12]. Although "under-detection" of some diagnoses is recognized as a limitation to outcomes research using claims-based or other administrative data sets, the under-detection is actually improving and there is recent evidence that claims data can match the diagnostic capture found in studies with direct access to the clinical record, perhaps because of increasing feedback to providers from payers [13]. Even with the above limitation, there is still a precedent to conduct such studies because large national datasets allow substantial power to study under-studied and vulnerable populations. Furthermore, the specificity of claims diagnoses is usually 95% or greater, based on a recent study where claim diagnoses were compared to medical record documentation of highly prevalent and readily recognizable chronic diseases [14].

For inclusion criteria, 12 ICD-9 codes were used to capture all hospital discharges for which a diagnosis of delirium had been claimed (Table 1). Diagnoses of delirium linked to alcohol withdrawal, head trauma, terminal cancer, non-organic psychoses, or drug overdose were excluded. Our predictor variable was RACE, (coded as white or black), but nine states did not have available data for this variable for the 2006 NIS. Therefore, approximately three states per region of the NIS (West- OR, NV, WA; Midwest- IL, MN, OH; South- GA, KY, WV) with the exception of the Northeast had data not available for the RACE variable. These states were excluded from the analysis. Fifty records were missing mortality information and were excluded from the analyses. (Regression models excluded any records with missing values for any of the covariates).

Our outcome variables of interest included: 1. In-hospital death (yes-no); 2. Length of stay (LOS) in days. Confounding variables used for adjusted analyses included: 1. *Urban-rural designation for patient's county of residence,*

[categorized as large metropolitan area, small metropolitan area, micropolitan area, not metropolitan or micropolitan (rural)]; 2. *Primary payer* (Medicare, Medicaid, private insurance, self-pay, no charge /charity, or other); 3. *Age in years*; 4. *Median household income quartiles for patient's Zip code* 5. *Disease severity*.

2.1. Table 1

Table 1a. ICD-9 Codes for FY 2006 Used for NIS Analysis

ICD-9 codes	Delirium Diagnoses
780.99	[Alteration (of)/Altered] mental status
290.11	Pre-senile dementia with delirium
290.3	Senile dementia with delirium
290.41	Vascular dementia, with delirium
292.81	Drug-induced delirium
293.0	Delirium due to conditions classified elsewhere
293.1	Subacute delirium
293.89	Chronic Delirium
348.31	Metabolic encephalopathy
349.82	Toxic encephalopathy
586	Uremic delirium
780.09	General symptoms (Other): drowsiness, stupor, unconsciousness, somnolence, semi-coma

Table 1b. ICD-9 codes for Diagnoses excluded

ICD-9 codes	Delirium Diagnoses
199.0	Disseminated [Malignant neoplasm without specification of site]
303.9	Alcoholism
291.0	Alcoholic Delirium-acute
291.1	Alcoholic Delirium-chronic
298.9	Psychosis
900.9/900.82	Head injury/multiple head injury
E850-E869	"Accidental" overdose of drug

The study size assures sufficient power to detect a significant difference of in-hospital mortality between African Americans and whites based on an estimated in-hospital mortality of 9 % from the literature for majority populations including patients diagnosed with delirium [15, 16]. Based on estimates that African Americans had a 21% increase in the odds of dying from pneumonia [17], we predicted that the in-hospital mortality rate for African Americans hospitalized with diagnoses of delirium (pneumonia as a common cause) would be 11%. In our current sample there were 5797 hospital discharges where a patient was designated by the RACE variable as African American. Therefore the current sample size met the minimum requirement to have at least 3626 African American patients who met our study inclusion criteria.

2.2. Statistical Analysis

All analyses were done using the SAS-Callable version of SUDAAN (v. 10.0.1) (RTI International, Research Triangle Park, NC) to adjust for complex survey design and population weights. We first compared African Americans to non-Hispanic Whites looking at in-hospital death to identify any significant difference between groups. Using SAS-callable SUDAAN, we performed bivariate analyses

using the Chi square statistic to analyze for statistical differences between African Americans and Whites for in-hospital death.

To analyze any differences in the length of stay outcome, our data sample was divided into discharges versus deaths to address the problem of censoring due to death.

Finally we examined the effect of race on both outcomes of interest (in-hospital death and length of stay) to determine how each adjustment variable (age, gender, socioeconomic status, designated risk of mortality variable, rural/urban residence, and hospital characteristics (teaching/nonteaching), contributed to any observed race difference singularly or collectively. A base model for race adjusted for age and gender was first estimated. To determine the potential effect of each variable in a causal pathway between race and the outcome, we estimated a separate model for race, age, gender and each of the adjustment variables. We then assessed how much the race term changed from the base model when adjusted for each variable separately. A change of 10% in the race term was considered a substantial effect of the adjustment process. We then estimated a model including race, age, gender and all of the adjustment variables simultaneously. We subsequently assessed the change in the race term from the base model to estimate the combined effect of the adjustment variables on racial disparities for the outcome.

Morehouse School of Medicine Institutional Review Board approved the current study as exempt research based on use of a de-identified limited data set in accordance with the HIPAA privacy rule (45 CFR § 164.514 (e)).

3. Results

3.1. Table 2

Table 2 describes the patients whose discharges were included in our sample. Notably, African Americans comprised only 10% of our study population.

Table 2. Characteristics of Study Participants among African Americans and Whites >64 hospitalized with Delirium Diagnoses

Variable	AA ¹	W ²	P-value
Patients, n/%	5,628 (10)	48,375 (90)	-
Mean age at admission, y	78.5	80.6	<0.001
Gender- Women %	61.6	58.3	<0.001
Mean LOS, d	7.8	7.2	<0.01
DRG-risk of mortality, %			
Minor	11.3	13.1	
Moderate	36.9	42.1	<0.05
Major	36.0	32.9	
Extreme	15.8	11.9	
Urban/Rural Hospital, %			
Large Metro ³	72.4	50.6	<0.001
Small Metro	23.4	40.6	
Rural	4.2	8.8	
Median Household income, % ⁴			
\$1-35,999	51.6	22.7	
\$36,000-44,999	21.5	25.6	<0.001
\$45,000-58,999	14.9	24.9	
\$59,000 or more	12.0	26.8	

Variable	AA ¹	W ²	P-value
Payer, %			
Medicare	91.2	93.5	<0.001
Medicaid	3.0	<1	
Private Insurance	4.3	5.0	
Self Pay & Charity Care	<1	<1	

¹African American, ²White, ³ > 1 million residents, ⁴ for residents' zip code

Among patients with delirium, African Americans had a longer mean LOS than non-Hispanic Whites (7.8 vs. 7.3 days, $p=0.005$). A larger percentage of non-Hispanic White patients (7.4%) compared to African American patients (6.6%) died during their stay in the hospital, however this was not statistically significant ($p=0.076$). However among those who died during their stay, African Americans were younger than non-Hispanic Whites (79.0 vs. 81.9 years, $p<0.001$). For patients who did not die in the hospital African Americans had a longer LOS than their non-Hispanic White counterparts (7.7 vs. 7.2 days, $p=0.006$). For patients who died during their stay African Americans also had a longer stay (9.9 vs. 8.6 days) but results were not statistically significant ($p=0.099$).

Table 3 presents the results of the regression analysis. When adjusted for age and gender there was not an age or race disparity in risk of death (OR=0.95, 95% CI: 0.82,1.09). When the disease severity was adjusted for the black white odds ratio – risk of mortality changed substantially and became significant, with African Americans having a 23% lower risk of mortality (OR=0.77, 95% CI: 0.62,0.94). Adjustment for all of the variables simultaneously did not substantially further change the association with race. After adjustment for age and gender African Americans who died in the hospital had 0.8 day (95% CI: 0.75,2.32 days) longer stay than non- Hispanic whites who died in the hospital. The race difference in LOS changed and was no longer significant when adjustment for any of the other variables occurred. Among those alive at discharge, African Americans had a 0.4 day (95% CI: 0.04,0.76) longer age and gender adjusted stay. Adjustment for disease severity (DRG-risk of mortality measure) completely eliminated race difference in LOS.

4. Discussion

With the publication of effective delirium preventive strategies in 1999 [7], our goal was to examine whether practices had changed over the past decade, and whether any disparities in delirium outcomes might have occurred over time, such as in-hospital mortality and LOS. Overall our study did not find any statistically significant difference in mortality among African Americans hospitalized with delirium diagnoses as compared to their non-Hispanic White counterparts, among a national sample of patients in the US. Interestingly however, when our analyses were adjusted for disease severity, we did find a statistically significant reduction in mortality for African Americans. One should view this seeming survivor advantage very cautiously as the in-hospital mortality rate for whites was also significantly

less than that found in other studies (7.3 vs. 9%) indicating that detection of delirium and its subsequent diagnostic capture in these claims data may have been very low.

Our overall findings are similar to previous published studies looking at racial disparities between African Americans and non-Hispanic Whites using the Nationwide Inpatient Sample (NIS). Pippins and others [10] found no overall disparity in 30- day mortality for patients hospitalized for acute myocardial infarction, congestive heart failure, pneumonia, or cerebral vascular accident (although there was found for gastrointestinal hemorrhage). Pippins' NIS analysis did not explicitly adjust for age, morbidity, or gender because the level of the analysis was limited to the hospital. In our current investigation we did adjust for age, gender, and disease severity. The disease severity measure was an assigned measure implemented by 3M Health Information Systems software in the HCUP NIS database.

Lack of significant morbidity differences in terms of LOS, when adjusted for disease severity, was also an important finding; although age and gender adjusted analyses revealed that African Americans did have longer in-hospital stays.

The key limitation of our study is the under detection of delirium by providers and the subsequent diagnostic capture by evidence of paid billing claims. This is supported by previous studies where validation of delirium diagnoses via claims data analysis of relevant ICD 9 codes using subsequent chart review found delirium diagnostic capture in billing claims to be less than 3% [18]. Put simply, any incomplete task in the process of diagnosing delirium to generating a claim (and the successful payment as a result of the claim) would eliminate a particular hospitalization from the NIS data set. Furthermore, under-detection of cognitive impairment in African Americans with less severe functional impairment has been noted, particularly in primary care environments, in both Alzheimer dementia [19], and in delirium [20] resulting in misclassification and missed diagnosis. This tendency to miss delirium diagnoses in older African Americans would therefore skew the in-hospital mortality data significantly downward. This potential bias in the NIS database could infer a survival advantage for those hospitalized in academic and teaching institutions as compared to private facilities (presumably due to more informed healthcare personnel). However our adjusted analyses for teaching vs. non-teaching hospitals did not show a statistically significant mortality difference.

5. Conclusion

These results should be interpreted with caution given the above stated limitations. The most likely explanation is that determining mortality estimates for an already under-diagnosed syndrome based on claims diagnostic data may be suboptimal for the reasons outlined above. Another cause for the equivocal findings is that there simply were not enough discharges for African Americans, even in this large data set to really be generalizable to many environments where

African Americans would make up a larger percentage of the study population. One should be careful not to infer from these results that clinicians don't have to worry about their African American older patients who develop delirium in hospital. Rather, clinicians should have a very high index of clinical suspicion to detect and diagnose delirium in all of their patients as these results could point to the possibility that delirium is significantly under-recognized in elderly African Americans to a greater extent than in their

non-Hispanic White counterparts. Further studies comparing these findings with results from differing databases (i.e. the Center for Disease Control and Prevention's National Hospital Discharge Survey, NHDS) or with NIS datasets more inclusive of states with higher representations of African Americans (NIS 2008 includes Louisiana and Pennsylvania) are warranted to compare findings.

Table 3. Logistic and linear Regression Results for Race as a Predictor of Outcomes

Chosen Variable of Interest	AA/W Mortality Risk Ratio	W/AA LOS difference: died in hospital	W/AA LOS difference: alive at discharge
Unadjusted	0.89 (0.77,1.03)	1.22 (-0.30,2.74)	0.47 (0.11,0.83)
Age + gender	0.95 (0.82,1.09)	0.79 (0.75,2.32)	0.40 (0.04,0.76)
DRG-risk of mortality	0.77 (0.62,0.94)	0.50 (-1.00,2.00)	-0.03 (-0.38,0.33)
Zip code Median income	0.94 (0.81,1.08)	1.25 (-0.41,2.92)	0.53 (0.17,0.90)
Payer	0.93 (0.80,1.08)	0.74 (-0.77,2.24)	0.36 (0.00,0.73)
Urban/Rural, Teaching/nonteaching	0.95 (0.82,1.10)	0.63 (-0.90,2.16)	0.24 (-0.13,0.60)
All variables	0.76 (0.62,0.93)	0.57 (-1.06,2.20)	-0.12 (-0.48,0.24)

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