A National Perspective of Do-Not-Resuscitate Order Utilization Predictors in Intracerebral Hemorrhage

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Abstract

Nontraumatic intracerebral hemorrhage (ICH) is associated with substantial morbidity and mortality. Do-not-resuscitate (DNR) orders are linked to poorer outcomes in patients with ICH, possibly due to less active management. Demographic, regional, and social factors, not related to ICH severity, have not been adequately looked at as significant predictors of DNR utilization. We reviewed the Healthcare Cost and Utilization Project's Nationwide Inpatient Sample (NIS) database in 2011 for adult ICH admissions and DNR status. We generated hierarchical 2-level multivariate regression models to estimate adjusted odds ratios. We analyzed 25 768 ICH hospitalizations, 18% of which (4620 hospitalizations) had DNR orders, corresponding to national estimates of 126 254 and 22 668, respectively. In multivariable regression, female gender, white or Hispanic/Latino ethnicity, no insurance coverage, and teaching hospitals were significantly associated with increased DNR utilization after adjusting for confounders. There was also significantly more interhospital variability in the lowest quartile of hospital volume. In conclusion, demographic factors and insurance status are significantly associated with increased DNR utilization, with more individual hospital variability in low-volume hospitals. The reasons for this are likely qualitative and linked to patient, provider, and hospital practices.

Keywords

intracranial hemorrhages, cerebrovascular disorders, stroke, neurohospitalist, clinical specialty, outcomes, techniques

Introduction

Cerebrovascular disease is the fifth most common cause of mortality in the United States, with 130 000 deaths annually.¹ Spontaneous intracerebral hemorrhage (ICH) is the second most common cause of stroke, with high mortality and morbidity rates.² Although there are many factors that affect patient outcomes, there is increasing focus on the role of do-not-resuscitate (DNR) orders on clinical outcomes and quality of care. Recent studies have demonstrated that DNR orders may lead to less active management and poorer quality of care causing worse outcomes.^{3,4}

Do-not-resuscitate orders are implemented based on the wishes of the patient, family, or guardian, often after consultation with the physician, with the ultimate goal to respect the decision maker's wishes regarding end of life. Therefore, the threshold for such a decision varies individually, but the effect of such a decision can collectively influence attitudes

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of care and have a ripple effect beyond the individual patient level.⁵

The factors affecting DNR order utilization are poorly understood because of the heterogeneity of influences and the subjectivity of the decision. We aimed to explore predictors and variability of DNR order utilization independent of disease severity in ICH hospitalizations.

Methods

Nationwide Inpatient Sample (NIS) is part of a family of databases and software tools developed for the Healthcare Cost and Utilization Project (HCUP). Healthcare Cost and Utilization Project databases and supplemental files are available to purchase online through the HCUP Central Distributor. We reviewed the HCUP's NIS database in 2011 for adult ICH admissions using diagnosis code 431.xx. Data from 46 states were included in the database with data from 4941 hospitals.⁶ This study used the NIS, a deidentified patient database. Therefore, this study did not require institutional review board review in accordance with the Code of Federal Regulations, 45 CFR 46.

We defined DNR status with *International Classification of Diseases (ICD)* code—V49.86 as a secondary diagnosis and estimated severity by the All Patient Refined Diagnosis-Related Group (APR DRG) classification.⁷ The *ICD* codes used to define cerebral herniation, hemiplegia, cerebral edema, and ventilator use were 348.4, 342.xx, 348.5, and 96.72, respectively. Metastatic cancer was defined using the *ICD* codes, 196.0-199.1, as defined by the AHRQ (version 2) comorbidity software.⁶ We generated a hierarchical 2-level multivariate regression model to estimate adjusted odds ratios (OR) for DNR utilization predictors. We assessed predictor variables including patient demographics (age, sex, and ethnicity), hospital location (rural vs urban), hospital status (teaching vs non-teaching), hospital region (Northeast, Midwest or North Central, South, and West), APR DRG, insurance status (Medicare vs self- or no-pay vs private insurance), and confounders for ICH severity (cerebral edema/herniation, ventilator use, and hemiplegia). We divided hospitals into quartiles based on the volume of ICH admissions and then assessed heterogeneity within quartiles by calculating interclass correlation (ICC) and median OR (MOR). We considered a 2-tailed *P* value of <.05 to be significant. We utilized SAS 9.3 (SAS Institute Inc, Cary, North Carolina) for all analyses.

Results

We analyzed 25 768 patients with ICH (weighted national estimate [WNE] 126 254 patients), 18% of which (4620 patients; WNE 22 668) had DNR orders. In multivariable regression analysis, older age, female gender, insurance (self- or no-pay compared to private insurance), diagnoses (metastatic cancer/cerebral herniation), and the highest quartile of income were significantly associated with greater DNR

Table 1. Multivariable Logistic Regression of Significant Predictors of DNR Utilization.

	Odds Ratio (95% Confidence Interval)	<i>P</i>
Age		
<65 Years	Ref	
≥ 65 Years	2.82 (2.61-3.04)	<.001
Sex		
Male	Ref	
Female	1.21 (1.14-1.27)	<.001
Race		
White	Ref	
Black	0.59 (0.53-0.64)	<.001
Hispanic	0.71 (0.64-0.79)	<.001
Others	0.73 (0.66-0.82)	<.001
APR DRG Severity Scale		
Minor or moderate risk	Ref	
Major risk	1.78 (1.66-1.90)	<.001
Extreme risk	1.86 (1.72-2.01)	<.001
Concurrent diagnosis		
Metastatic cancer	1.93 (1.68-2.23)	<.001
Cerebral herniation	2.52 (2.30-2.75)	<.001
Median household income category by ZIP		
0-25th Percentile	Ref	
26-50th Percentile	1.00 (0.92-1.08)	.992
51-75th Percentile	1.07 (0.99-1.17)	.101
76-100th Percentile	1.12 (1.02-1.23)	.022
Hospital region		
Northeast	Ref	
Midwest or North Central	0.72 (0.42-1.25)	.240
South	0.64 (0.40-1.03)	.064
West	0.90 (0.53-1.52)	.699
Hospital teaching status		
Nonteaching	Ref	
Teaching	0.66 (0.46-0.95)	.025
Hospital bed size		
Small	Ref	
Medium	1.26 (0.74-2.15)	.390
Large	1.56 (0.95-2.57)	.078
Primary payer		
Private (including HMO)	Ref	
Medicare/Medicaid	1.08 (0.99-1.18)	.069
Self-pay/no charge/other	1.16 (1.03-1.30)	.017

Abbreviations: APR DRG, All Patient Refined Diagnosis-Related Group; DNR, do-not-resuscitate; HMO, Health Maintenance Organization.

utilization. In contrast, black and Hispanic/Latino ethnicity and hospital teaching status were associated with lower utilization (Table 1).

On analysis of quartiles by ICH volume, ICC and MOR were highest in the lowest quartile but did not differ significantly between the other quartiles (Table 2 and Figure 1). Thus, a patient admitted for ICH in a first quartile hospital had 6.8 times odds of having DNR orders than if admitted at another first-quartile hospital. This demonstrates significant

Table 2. Interclass Correlation and Median Odds Ratio by Quartiles of ICH Hospitalization Volume.

ICH Hospital Volume	ICC (95% CI)	MOR
Fourth (lowest) quartile	0.55 (0.53-0.58)	6.83 (6.13-7.55)
Third quartile	0.26 (0.22-0.30)	2.8 (2.49-3.10)
Second quartile	0.26 (0.20-0.31)	2.79 (2.39-3.19)
First (top) quartile	0.34 (0.21-0.43)	3.45 (2.42-4.53)

Abbreviations: CI, confidence interval; ICC, interclass correlation; ICH, intracerebral hemorrhage; MOR, median odds ratio.

Figure 1. Mean odds ratio of do-not-resuscitate (DNR) utilization by quartiles of hospitals. The quartiles were created by intracerebral hemorrhage (ICH) volume.

heterogeneity for DNR utilization within the hospitals with the lowest quartile of ICH volume.

Discussion

Literature on factors that may affect DNR utilization has focused on age and severity of ICH.⁸ Data on other possible predictors of DNR utilization that are not related to severity of ICH or underlying comorbidities are limited. A single-hospital experience assessed the impact of ethnicity and social factors on DNR utilization in 1988.⁹ Results from a single-center study in Sweden resulted in age (≥ 75 years), former stroke, Reaction Level Scale grades 2-3 and 4, and the presence of intraventricular hemorrhage as independent predictors of DNR utilization.¹⁰ Another single-center study found gender to be predictive of early DNR utilization, with women being more likely to receive early DNR orders.¹¹

To the best of our knowledge, our study is the first to demonstrate that demographic factors and insurance status play a significant role in DNR utilization in ICH admissions in a large, nationally representative inpatient sample.

Our analysis shows, understandably, that older and sicker patients have a greater rate of DNR utilization. It further indicates that DNR utilization rates are the highest in uninsured

patients in teaching centers, with least variability of results in hospitals with large volume. The reasons for this are likely multifactorial, qualitative, and linked to patient, provider, and hospital practices.

It seems likely that finances play a role in patients making this decision, with uninsured patients and families choosing DNR utilization. Moreover, it could be that patients in large teaching hospitals are better informed about their health status and therefore are more confident about such decisions. Our analysis also shows lower rates of DNR utilization in the African Americans as compared to whites, even after accounting for the severity of illness. This has been shown before in a large retrospective hospital-based cohort. This could be hypothesized to a difference in expectation in inpatient care.¹²

Our study is limited by the use of administrative data and lack of in-depth exploration of reasons for this discrepancy and any explanation of these results is, at best, speculative. The DNR order utilization has been linked to variation in the quality of care.^{3,4} In such a scenario, factors affecting DNR utilization could therefore be associated with heterogeneity in patient care. Further objective exploration and the understanding of the factors leading to this decision can help us not only improve outcomes but also possibly provide better care.

Patient care and decision making in critical conditions call for a fine balance between realistic expectations, patient wishes, family attitudes, social mores, and negativism toward outcomes. While the ultimate moral and legal right to make the final decision rests with the patient and/or the family, such a decision can be empowered with information, thereby helping them make an informed choice.

Authors' Note

Patel, Mahajan, Kar, Benjo, Sinha, Pathak and Nadkarni contributed to study concept and design. Annapureddy, Agarwal, Jani, Sinha, Pakanati, Konstantinidis, and Benjo contributed to the acquisition of data. Simoes, Sinha Konstantinidis, Pakanati, and Mahajan contributed to analysis and interpretation of data. Patel, Mahajan, Sinha, Simoes, and Nadkarni contributed to drafting of the manuscript. Annapureddy, Agarwal, Pakanati, Jani, Sinha, Simoes, Konstantinidis, Nadkarni, and Benjo contributed to critical revision of the manuscript for important intellectual content. Patel, Mahajan, Benjo, and Nadkarni contributed to statistical analysis. Annapureddy, Agarwal, Jani, Konstantinidis, Pathak and Benjo contributed to administrative, technical, and material support. Konstantinidis and Nadkarni contributed to study supervision.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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