

Racial and Socioeconomic Disparities in Access to Mechanical Revascularization Procedures for Acute Ischemic Stroke

Frank J. Attenello, MD,* Peter Adamczyk, MD,* Ge Wen, MS,† Shuhan He, BS,*
Katie Zhang, BS,* Jonathan J. Russin, MD,* Nerses Sanossian, MD,*
Arun P. Amar, MD,* and William J. Mack, MD*

Background: Mechanical revascularization procedures performed for treatment of acute ischemic stroke have increased in recent years. Data suggest association between operative volume and mortality rates. Understanding procedural allocation and patient access patterns is critical. Few studies have examined these demographics. *Methods:* Data were collected from the 2008 Nationwide Inpatient Sample database. Patients hospitalized with ischemic stroke and the subset of individuals who underwent mechanical thrombectomy were characterized by race, payer source, population density, and median wealth of the patient's zip code. Demographic data among patients undergoing mechanical thrombectomy procedures were examined. Stroke admission demographics were analyzed according to thrombectomy volume at admitting centers and patient demographics assessed according to the thrombectomy volume at treating centers. *Results:* Significant allocation differences with respect to frequency of mechanical thrombectomy procedures among stroke patients existed according to race, expected payer, population density, and wealth of the patient's zip code ($P < .0001$). White, Hispanic, and Asian/Pacific Islander patients received endovascular treatment at higher rates than black and Native American patients. Compared with the white stroke patients, black ($P < .001$), Hispanic ($P < .001$), Asian/Pacific Islander ($P < .001$), and Native American stroke patients ($P < .001$) all demonstrated decreased frequency of admission to hospitals performing mechanical thrombectomy procedures at high volumes. Among treated patients, blacks ($P = .0876$), Hispanics ($P = .0335$), and Asian/Pacific Islanders ($P < .001$) demonstrated decreased frequency in mechanical thrombectomy procedures performed at high-volume centers when compared with whites. While present, socioeconomic disparities were not as consistent or pronounced as racial differences. *Conclusions:* We demonstrate variances in endovascular acute stroke treatment allocation according to racial and socioeconomic factors in 2008. Efforts should be made to monitor and address potential disparities in treatment utilization. **Key Words:** Racial disparities—socioeconomic disparities—acute stroke—neurointerventional procedures—mortality—thrombectomy.

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From the *Department of Neurological Surgery, Keck School of Medicine, University of Southern California, Los Angeles, California; and †Department of Preventive Medicine, Keck School of Medicine, University of Southern California, Los Angeles, California.

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Address correspondence to Frank J. Attenello, MD, Department of Neurological Surgery, Keck School of Medicine, University of Southern California, 1200 North State St, Suite 3300, Los Angeles, CA 90015. E-mail: attenell@usc.edu.

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Introduction

The number of endovascular mechanical thrombectomy procedures performed for acute stroke in the United States has steadily increased.¹ Because of varied acceptance levels among medical professionals and requisition of substantial resources, only selected facilities currently offer this treatment. Although approved by the US Food and Drug Administration, the procedure is not currently recognized as standard of care. Further, considerable equipment, infrastructure, and technical requisites preclude universal accessibility. Thus, allocation and access to mechanical thrombectomy procedures vary considerably among medical centers and patients, respectively.

Differences in procedural utilization have been reported at the hospital level with respect to medical center size, teaching status, urban setting, and geographic location. Improved outcomes have been demonstrated in facilities performing substantial volumes of mechanical thrombectomy procedures, independent of hospital characteristics.² Few published reports have examined demographic factors among treated populations.^{1,3} This is the first study to evaluate racial and socioeconomic variations in the allocation of endovascular stroke procedures. We hypothesize that disparities may exist for patient access to endovascular stroke procedures and treatment at substantial volume centers. For our study, we have examined the same cohort used in a previous study to demonstrate improved outcomes at treatment centers with high mechanical thrombectomy volumes.²

Methods

Patient Population

The National Inpatient Sample (NIS) hospital discharge database for 2008, a cross-sectional representation of 20% of inpatient admissions to US hospitals, was evaluated for study patient cohort and relevant variables. A cohort of inpatients with ischemic stroke, associated with *International Classification of Diseases, Ninth Revision (ICD-9)*, codes 433, 434, 436, 437.0, and 437.1, were extracted. From this group, a subgroup of patients undergoing endovascular clot retrieval (*ICD-9* procedure code 39.74: "endovascular removal of obstruction from the head and neck") was evaluated using selection criteria previously described in Brinkji et al³ and Adamczyk et al.²

Statistical Analysis

National estimates were obtained by applying proper weights to variables as indicated in the Healthcare Cost and Utilization Project–NIS *Calculating NIS Variances Guide*.⁴ All statistical analysis was performed using the SAS 9.3 software (SAS Institute Inc., Cary, NC).

Demographic Data among Stroke Patients Undergoing Mechanical Thrombectomy Procedures

The populations extracted from the NIS database with *ICD-9* codes representing ischemic stroke and treated by mechanical thrombectomy were evaluated for patient and regional demographics.

Patients with a diagnosis of ischemic stroke according to the *ICD-9* codes mentioned earlier were examined. Individuals were stratified according to those who underwent mechanical thrombectomy and those who did not. Frequency of patients receiving the mechanical thrombectomy procedure (as a percentage of all stroke patients) was quantified according to race, socioeconomic classifications, and population determinants. All variables assessed were categorical.

The following characteristics were evaluated: race (RACE: white, black, Hispanic, Asian/Pacific Islander, Native American, other), expected payer (PAY1: Medicare, Medicaid, private, self-pay, no charge, other), median wealth of the individual's zip code (ZIPINC_QRTL: \$1-\$38,999, \$39,000-\$47,999, \$48,000-\$62,999, >\$63,000), and population density where the patient resided (PL_NCHS2006: Central counties with >1 million population, fringe counties with >1 million population, counties with 250,000-999,999 population, counties with 50,000-249,000 population, micropolitan counties, and nonmetropolitan or micropolitan counties). Note that as coders were choosing between 5 races, "other" was chosen when patients did not conform to categories listed, including multiracial and patients with unknown race. Central counties represented metropolitan areas, whereas fringe counties refer to suburbs.

Chi-square analysis was used to examine associations between these demographic variables and performance of mechanical thrombectomy procedures.

Stroke Admission Demographics to Centers with High Mechanical Thrombectomy Volume

Association between patient demographics and *admission* to substantial volume mechanical thrombectomy centers was examined. This analysis was performed for the entire cohort of stroke patients. Each center that performed mechanical thrombectomy procedures was categorized as "substantial volume" or "low volume" by the criteria previously described by Adamczyk et al.² Hospitals that performed 10 procedures or more were classified as "substantial volume," whereas those that performed less than 10 procedures were classified as "low volume."

Factors hypothesized to potentially affect treatment allocation in this data set were included in the model as covariates, including gender and age. Univariate logistic regression was performed with procedural volume status of the center providing care as the dependent variable (<10 or ≥10). Independent variables assessed were race (RACE), expected payer (PAY1), population density where

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