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Review article

Access disparities to Magnet hospitals for ischemic stroke patients

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ABSTRACT

Access disparities to centers of excellence can have detrimental consequences for population health. We investigated the presence of racial disparities in the access of stroke patients to hospitals recognized by the Magnet Recognition Program of the American Nurses Credentialing Center (ANCC). We performed a cohort study of all ischemic stroke patients who were registered in the New York Statewide Planning and Research Cooperative System (SPARCS) database from 2009 to 2013. We examined the association of African–American race with Magnet status hospitalization after ischemic stroke. A mixed effects propensity adjusted multivariable regression analysis was used to control for confounding. During the study period, 176,557 patients presented with ischemic stroke, and met the inclusion criteria. Overall, 4,624 (13.7%) African-Americans, and 27,468 (19.2%) non African-Americans with ischemic stroke were admitted to Magnet hospitals. Using a multivariable logistic regression, we demonstrate that African-Americans were associated with lower admission rates to Magnet institutions (OR 0.70; 95% CI, 0.68–0.73) (Table 2). This persisted in a mixed effects logistic regression model (OR 0.75; 95% CI, 0.71–0.78) to adjust for clustering at the county level, and a propensity score adjusted logistic regression model (OR 0.87; 95% CI, 0.83–0.90). Using a comprehensive all-payer cohort of ischemic stroke patients in New York State we identified an association of African–American race with lower rates of admission to Magnet hospitals.

1. Introduction

Stroke is one of the leading causes of death and disability in the United States [28]. In this setting, racial disparities in stroke-related mortality constitute a major public health problem [17,20,25]. Stroke incidence among young African-Americans is approximately two to four times higher than among whites, whereas related mortality is three times higher [13,20,25,30]. The etiologies underlying these disparities are only partially understood [9]. Hypothesized factors include differences in vascular risk factors, socioeconomic status, variability in quality of care, and differential access to care [9,12]. Stroke-specific, as well as general, centers of excellence have been associated with improved outcomes in this population [4,18,19]. They offer higher rates of timely and efficient goal-directed interventions, including neuro-critical care, use of thrombolytics and mechanical thrombectomy, which have all individually been associated with superior stroke outcomes [4,19].

Prior studies have investigated the access disparities to centers of excellence for stroke. Mullen et al. [23] demonstrated that non-whites were more likely to have access to primary stroke centers within an hour, in a geographic study of the United States. Lyerly et al. [21] did not find a differential effect of telemedicine on the access of different races to stroke care. The Magnet Recognition Program of the American Nurses Credentialing Center (ANCC) [2] is another regionalization initiative designed to identify health care facilities with a commitment to quality improvement, and excellent nursing care delivery, and has been associated with improved stroke outcomes. There has been no previous investigation attempting to answer this access question for Magnet hospitals in a comprehensive all-payer cohort, using advanced observational techniques.

We used the New York Statewide Planning and Research Cooperative System (SPARCS) [6] to study the association of African–

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American race with being hospitalized in a Magnet hospital for ischemic stroke patients. We utilized a battery of approaches to control for confounding, including regression adjustment, and propensity score adjustment, whereas mixed effects methods were employed to control for clustering at the hospital level.

2. Methods

2.1. New York Statewide Planning and Research Cooperative System (SPARCS)

This study was approved by the Dartmouth Committee for Protection of Human Subjects. All patients who were hospitalized for acute ischemic stroke, and were registered in the SPARCS (New York State Department of Health, Albany, NY) [6] database between 2009 and 2013 were included in the analysis. For these years, SPARCS contains patient-level details for every hospital discharge, ambulatory surgery, and emergency department admission in New York State as coded from admission and billing records. More information about SPARCS is available at https://www.health.ny.gov/statistics/sparcs/.

2.2. Magnet recognition program

The Magnet Recognition program of the ANCC was established in 1994 by a subsidiary of the American Nurses Association [2]. Magnet recognition lasts for four years. As of 2015, 402 facilities in the United States were recognized by the program. This program involves rigorous documentation and site visits to evaluate institutions across five core principles: transformational leadership, a structure that empowers staff, an established professional nursing practice model, support for knowledge generation and application, and robust quality improvement mechanisms [2]. More information on this process can be found at http://www.nursecredentialing.org/Magnet.

2.3. Cohort definition

In order to establish the cohort of patients, we used *International Classification of Disease-9-Clinical Modification* (ICD-9-CM) codes to identify patients in the database who were hospitalized for acute ischemic stroke (ICD-9-CM code 433.x1, 434.x1) between 2009 and 2013.

2.4. Outcome variables

The primary outcome variable was hospitalization in a Magnet institution for acute ischemic stroke. The program's website was used to identify hospitals in New York State that obtained Magnet recognition and the year this was achieved. Hospitals were classified as having Magnet recognition in the corresponding year of the analysis. Classifications were updated each year of the study period in case of mergers or closures.

2.5. Exposure variables

The primary exposure variable was African–American race.

Covariates (Table S1) used for risk-adjustment were age, gender, insurance (private, Medicare, Medicaid, uninsured, other), patient location during the stroke (inpatient versus outpatient setting) and stroke intervention either via administration of IV-tPA (intravenous tissue plasminogen activator) (ICD-9-CM 99.10, V45.88) or mechanical thrombectomy (ICD-9-CM 39.74).

The comorbidities used for risk adjustment were diabetes mellitus (DM), smoking, chronic lung disease, hypertension, hypercholesterolemia, peripheral vascular disease (PVD), congestive heart failure (CHF), coronary artery disease (CAD), history of transient ischemic attack (TIA), alcohol abuse, obesity, chronic renal failure (CRF), and coagulopathy. Only variables that were defined as "present on admission" were considered part of the patient's preadmission comorbidity profile.

We additionally controlled for hospital characteristics including primary stroke center or comprehensive stroke center status, hospital size, and Get with the Guidelines program participation.

2.6. Statistical analysis

The association of race with Magnet hospitalization was examined in a multivariable setting.

A logistic regression was used for our categorical outcome (admission to a Magnet hospital). The covariates used for risk adjustment in these models were: age, gender, insurance, and all the comorbidities and hospital characteristics mentioned previously. In order to control for regional clustering, we used mixed effects methods with patient county as a random effect variable. In an alternative way to control for confounding, we used a propensity adjusted (with deciles of propensity score) logistic regression model. We calculated the propensity score with a separate logistic regression model, using all the covariates mentioned previously. Mixed effects methods were also used for the propensity-adjusted model.

In order to demonstrate the robustness of our data in a sensitivity analysis, we used several categories of race (African-American, Hispanic, Asian, Caucasian, and other). The magnitude and direction of the observed associations did not change and therefore these results are not reported further.

Regression diagnostics were used for all models. All results are based on two sided tests, and the level of statistical significance was set at 0.05. This study, based on 176,557 patients, has sufficient power (80%) at a 5% type I error rate to detect differences in Magnet hospital admission, as small as 0.7%. Statistical analyses were performed using Stata version 13 (StataCorp, College Station, TX).

3. Results

3.1. Patient characteristics

In the selected study period there were 176,557 patients hospitalized for acute ischemic stroke (mean age was 71.3 years, with 53.0% females) who were registered in SPARCS. 33,794 (19.1%) were African-Americans, and 142,763 (80.9%) non-African-Americans. The characteristics of the two cohorts at baseline can be seen in Table 1.

3.2. Inpatient case-fatality

Overall, 4,624 (13.7%) African-Americans, and 27,468 (19.2%) non African-Americans with ischemic stroke were admitted to Magnet hospitals. African-Americans were associated with lower rates of admission to a Magnet hospital for acute ischemic stroke in comparison to non African-Americans (OR 0.66; 95% CI, 0.64–0.69) in unadjusted analysis. Likewise, using a multivariable logistic regression, we identified that African-Americans were associated with lower admission rates to Magnet institutions (OR 0.70; 95% CI, 0.68–0.73) (Table 2). This persisted in a mixed effects logistic regression model (OR 0.75; 95% CI, 0.71–0.78) to adjust for clustering at the county level, and a propensity score adjusted logistic regression model (OR 0.87; 95% CI, 0.83–0.90).