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Review article

Access disparities to Magnet hospitals for patients undergoing neurosurgical operations

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ABSTRACT

Background: Centers of excellence focusing on quality improvement have demonstrated superior outcomes for a variety of surgical interventions. We investigated the presence of access disparities to hospitals recognized by the Magnet Recognition Program of the American Nurses Credentialing Center (ANCC) for patients undergoing neurosurgical operations.

Methods: We performed a cohort study of all neurosurgery 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 and lack of insurance with Magnet status hospitalization for neurosurgical procedures. A mixed effects propensity adjusted multivariable regression analysis was used to control for confounding.

Results: During the study period, 190,535 neurosurgical patients met the inclusion criteria. Using a multivariable logistic regression, we demonstrate that African-Americans had lower admission rates to Magnet institutions (OR 0.62; 95% CI, 0.58–0.67). This persisted in a mixed effects logistic regression model (OR 0.77; 95% CI, 0.70–0.83) to adjust for clustering at the patient county level, and a propensity score adjusted logistic regression model (OR 0.75; 95% CI, 0.69–0.82). Additionally, lack of insurance was associated with lower admission rates to Magnet institutions (OR 0.71; 95% CI, 0.68–0.73), in a multivariable logistic regression model. This persisted in a mixed effects logistic regression model (OR 0.72; 95% CI, 0.69–0.74), and a propensity score adjusted logistic regression model (OR 0.72; 95% CI, 0.69–0.75).

Conclusions: Using a comprehensive all-payer cohort of neurosurgery patients in New York State we identified an association of African-American race and lack of insurance with lower rates of admission to Magnet hospitals.

1. Introduction

Regionalization of care to centers of excellence is at the core of recently enacted legislation [10–14,18]. The Magnet Recognition Program of the American Nurses Credentialing Center (ANCC) [2] is one such initiative recognizing rigorous quality improvement, and superior nursing care delivery. It focuses on 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]. This initiative is increasingly recognized by the public, after inclusion in US News and World Report rankings [34], and quality initiatives such as the Leapfrog Group [1]. Prior investigations have demonstrated that hospitalization in these institutions is associated with improved outcomes for neurosurgical patients. In this setting, access disparities among these patients to Magnet hospital can have detrimental effects for population health.

Prior studies have investigated the impact on racial and socioeconomic factors on the care of neurosurgical patients. Some groups have demonstrated that African-Americans and uninsured have limited access to various neurosurgical operations [3–5,7,30]. Others have shown that similar racial and socioeconomic disparities are associated with inferior outcomes after neurosurgical procedures [15–17,26,27,31,35]. There has been no previous study investigating potential access disparities to centers of excellence, such as Magnet hospitals, for neurosurgical patients.

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We used the New York Statewide Planning and Research Cooperative System (SPARCS) [19] to study the association of African-American race and lack of insurance with being hospitalized in a Magnet hospital for a neurosurgical operation. 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 regional 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 neurosurgical operations, and were registered in the SPARCS (New York State Department of Health, Albany, NY) [19] 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 [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 a neurosurgical operation (Table S1) between 2009 and 2013. Patients with incomplete information regarding insurance were excluded, when insurance status was the variable of interest, and patients with incomplete information regarding race were excluded, when race was the variable of interest. Finally, patients 65 years and older were excluded when insurance status was the variable of interest. This population is eligible for Medicare, which confounds the association of age and insurance with the decision to transfer.

2.4. Outcome variables

The primary outcome variable was hospitalization in a Magnet institution for a neurosurgical procedure. 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 variables were African-American race and lack of insurance.

Covariates (Table S1) used for risk-adjustment were age, gender, total number of cases per surgeon, insurance (private, Medicare, Medicaid, uninsured, other, when race was the exposure variable of interest), and race (African-American, Hispanic, Asian, other, when insurance status was the exposure variable of interest).

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.

3. Statistical analysis

The association of our exposure variables 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, total number of cases per surgeon, race (in the analysis where insurance was the variable of interest), insurance (in the analysis where race was the variable of interest), 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 all categories of race and insurance in the respective analyses, as indicated previously. Additionally, we repeated all the analyses in predefined subgroups of patients undergoing neurovascular procedures, tumor surgeries, or spine surgery. 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 190,535 patients, has sufficient power (80%) at a 5% type I error rate to detect differences in Magnet hospital admission, as small as 0.6%. Statistical analyses were performed using Stata version 13 (StataCorp, College Station, TX).

4. Results

4.1. Patient characteristics

In the selected study period there were 190,535 patients (Fig. 1) hospitalized for neurosurgical procedures (mean age was 55.1 years, with 50.7% females) who were registered in SPARCS. Of these patients, 141,279 patients had information regarding insurance status, and of those 137,380 had insurance coverage, and 3899 were uninsured. The respective distribution of exposure variables between the two groups can be found in Table 1a. Overall, there were 18,656 African-American patients in our cohort. The respective distribution of exposure variables between African-Americans and non-African-Americans can be found in Table 1b.

4.2. Association of Magnet hospitalization with insurance

Overall, 929 (23.8%) uninsured, and 48,045 (35.0%) insured patients undergoing neurosurgical procedures were admitted to