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Do outcomes in emergency general surgery vary for minority patients based on surgeons' racial/ethnic case mix?

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ABSTRACT

Background: We hypothesized that Black and Hispanic patients undergoing Emergency General Surgery (EGS) with surgeons who treat higher proportions of minority patients will experience better outcomes.
Methods: Using the Florida State Inpatient Database (2010–2014), we performed multivariable regression to assess complications in patients undergoing EGS as a function of patient race and the proportion of Black, Hispanic, or White patients treated by the surgeon during the study period. Analyses were clustered by hospital and adjusted for patient age, comorbidities, sex, insurance, and hospital-level variables.
Results: 5471 surgeons were distributed across 204 hospitals. Of the 520,024 patients included, 67% were White, 16.5% were Black, and 14.2% were Hispanic. For non-White patients undergoing EGS, the increased likelihood of sustaining a complication relative to White patients (OR 1.09, 95% confidence interval [CI] 1.07–1.11) decreased when treated by surgeons whose caseload consisted of higher proportions of Black/Hispanic patients (aOR 0.88, 95% CI 0.78–0.99).
Conclusion: Black patients undergoing EGS are at higher risk for experiencing complications when treated by surgeons whose caseload consists of higher proportions of White patients.

Introduction

Differential surgical outcomes for minority patients remain a significant source of healthcare disparities in the United States, despite a recent influx of research on the topic. Patients receiving emergency surgical care represent a particularly high-risk population, and racial/ethnic disparities have been identified in postoperative complications for this group as well.[1–3] Efforts to uncover the causal pathways underlying surgical disparities have mostly eschewed the role of the individual surgeon, instead citing patients' biological and social factors or the systemic barriers to receiving timely, high-quality care. The complexity of surgical care in the context of hospital infrastructure and healthcare policy makes it difficult to isolate and quantify the effect of the surgeon on his or her surgical outcomes.

There is also variability in surgeons' practice patterns, experience, training, and practice demographics that could play a role in the quality of care that minority patients receive. Prior work has demonstrated that racial/ethnic minority patients are geographically concentrated and therefore tend to cluster at a relatively small number of hospitals and providers.[4,5] Because of income and insurance disparities among minority populations, these minority-serving hospitals and providers tend to have limited resources and capabilities, contributing to the overall poorer quality of care for these patients.[6–8] Healthcare settings also vary across surgeons, and resource-poor settings that predominantly serve minority patients contribute to higher levels of cognitive load for surgeons, therefore increasing the likelihood that surgeons will rely on automatic processes to make clinical decisions. The relationship between cognitive load and implicit biases in clinical decision-making has been proposed as one mechanism by which healthcare disparities occur.[9] However, increased exposure to patients of

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different racial, ethnic, and cultural backgrounds could reduce the effects of unconscious biases in such settings through increased mindfulness.[10,11]

With these data in mind, we hypothesized that minority patients undergoing emergency general surgical (EGS) procedures would experience better clinical outcomes when treated by surgeons whose caseload consisted of higher percentages of minority patients, in contrast to the phenomenon of minority patients clustering within overall poorer-performing facilities.

Methods

Study population

We conducted a five-year (2010–2014) retrospective analysis of all adult patients in the state of Florida who were admitted to tertiary care centers with primary diagnoses that were defined *a priori* as EGS conditions. The identification of the diagnoses associated with these seven operations (appendectomy, cholecystectomy, operative repair of peptic ulcer disease, colectomy, small bowel resection, lysis of adhesions, and laparotomy) as the conditions accounting for the vast majority of the burden of EGS cases, morbidity, and mortality has been described elsewhere.[12] Admissions that were defined as elective were excluded from the analysis. Patient racial data was reported as White, Black, Hispanic, Asian/Pacific Islander, Native American, or other.

Data source

The Healthcare Cost and Utilization Project's Florida State Inpatient Database (SID) provides all of the state's inpatient care records. The SID files include clinical and non-clinical data for all patients, regardless of insurance coverage and/or payer, thus providing comprehensive data on the entirety of inpatient care in that state. The Florida SID was selected for this analysis not only because it is the fifth most populated state in the United States, but also because the data set designates a deidentified unique physician number to each discharge record. This physician identifier can be used to categorize patients by admitting physician or operating surgeon. The variable "MDNUM1_R" stores an arbitrarily chosen identifier that represents the attending physician, while the variable "MDNUM2_R" stores a similarly random number corresponding to the operating physician when applicable. These physician identifiers were encrypted during HCUP processing. For the purpose of our study, we restricted our analysis only to those records for which MDNUM1_R and MDNUM2_R were equivalent, thus increasing the likelihood that the physician assigned to the record was truly the physician overseeing that patient's care.

To obtain hospital-level information, we linked the Florida SID to the American Hospital Association (AHA) Annual Survey Database. This database, released annually, comprises hospital-specific data on approximately 6500 hospitals and over 400 systems. Due to data availability, were able to link the two data sets through the year 2012; for 2013–2014, the 2012 AHA survey data was linked to the Florida SID data for those years. Prior research has suggested that the individual hospital variables included in our analysis, such as bed size and trauma center designation, do not significantly vary over a five-year period.[13]

Outcome measures

Our primary outcome of interest was development of major complications. We selected ICD-9 diagnoses codes that have previously proven to have a strong association with mortality.[14] These include sepsis, surgical site infection, anastomotic leak, pulmonary embolism, acute renal failure, myocardial infarction, cerebrovascular accident, and pneumonia.

Covariates

Linkage of the Florida SID to the AHA database provided patient, surgeon, and hospital-level variables. We included patient demographic variables, such as age, sex, insurance payer, and year of admission, as well as clinical variables, including the age-adjusted Charlson comorbidity index, primary admission diagnosis, whether or not a procedure took place, and length of stay. We converted patient age to a categorical variable for the logistic regression, with 7 deciles starting from age 25. Patients' primary insurance coverage is defined as Medicare, Medicaid, private insurance, self-pay, no charge, or other.

Upon converting the data set to panel data by individual physician identifier, we generated variables to define surgeons' annual case volume, as well as the demographic characteristics of each surgeon's annual patient population. Based on the distribution of annual demographic percentages, the 75th percentile was defined *a priori* as the cut-point for identifying surgeons as high-minority-treating or low-minority-treating. Surgeons were classified as being low-minority-treating (LM) if their yearly caseload consisted of 90% or more white patients, which corresponded to the 75th percentile. Surgeons treating greater than 18% black and 14% Hispanic patients were considered high-minority (HM) surgeons. Overall annual case volume was used to distinguish high-volume surgeons (>250 cases per year) from lower-volume surgeons.

Similar variables were generated at the hospital level. Hospitals with greater than 10,000 operative cases per year were considered high surgical volume hospitals, while those with greater than 25,000 admissions of any variety were considered high-volume hospitals. We defined large hospitals as those with greater than 500 beds. Additional hospital-level variables such as academic status, trauma center designation, and rurality were included.

Statistical analysis

Differences in the unadjusted distribution of covariates between groups were compared using the chi-square test for categorical variables and the Kruskal-Wallis test for non-normally distributed continuous variables. Multivariable linear regression was performed to demonstrate the patient race-specific relationship between treatment by a HM surgeon and development of a major complication, adjusting for surgeons' case volume, patient age, Charlson comorbidity index, sex, and primary insurance payer, the number of procedures performed during the admission, admission type (emergent, urgent, elective, or trauma-related), whether the patient was transferred in from another facility, and hospital surgical volume, overall volume, bed size, teaching status, and trauma center designation. Hospital and surgeon fixed and random effects were included in the models to account for patient correlation within facilities and providers. Model outputs were reported as adjusted odds ratios (OR) and the corresponding 95% confidence intervals (CI). All analyses were performed in Stata, version 14 (StataCorp LLC, College Station, TX).

Results

A total of 520,024 nonoperative and operative EGS cases in the Florida SID met our inclusion criteria for the five-year study period, corresponding to 5471 surgeons at 204 hospitals. Of these, 10 hospitals were classified as academic facilities and 24 were designated trauma centers. Patients were mostly White (67%), older than 55 years (65.0%), and beneficiaries of Medicare coverage (51.1%). A

majority of the admitting diagnoses were conditions related to acute appendicitis (54.9%) and acute biliary disease (24.3%), and most patients' age-adjusted Charlson comorbidity index was in the 0–5 range, indicating relatively low burden of comorbid disease.

Over one-fifth of the surgeons in this study were low-minority treating (LM), while only 9.4% were high-minority treating (HM) (Table 1). The majority of Black (73.5%) and Hispanic (70.6%) patients did not receive their care from HM surgeons. Hospital characteristics also differed between groups; 53.8% of HM surgeons practiced at teaching hospitals, compared to 19.3% of other surgeons. Additionally, 65.8% of HM surgeons were clustered at the 24 designated trauma centers, compared to only 31.3% of surgeons who were classified as non-HM. Patients requiring emergent or trauma-related admissions were more likely to be treated by HM surgeons, as were Medicaid beneficiaries and patients without insurance (Table 2).

In the unadjusted analysis, non-white patients had an overall higher odds of sustaining a major complication (OR 1.09, 95% CI 1.07–1.1). For those nonwhite patients treated by HM surgeons, however, the increased unadjusted odds of complications reduced to non-significance (OR 1.04, 95% CI 0.99–1.09). After adjusting for patient age, comorbidities, sex, procedure type, admission type, and insurance, as well as hospital volume and bed size, teaching status, trauma center designation, and surgeon volume, multivariable logistic regression showed the relationship between development of complications and treatment by an HM surgeon stratified by race (Table 3). Black and Hispanic patients had a lower risk-adjusted odds of complications when treated by HM surgeons, even after controlling for hospital facility characteristics such as trauma center capability. On the other hand, for the small subset of Black and Hispanic patients treated by LM surgeons, adjusted analysis showed higher odds of complications, although these results were not significant.

Table 1
Surgeon, hospital, and patient demographic/clinical characteristics.

Demographic/clinical characteristic	
Surgeon (n = 5471)	
Annual EGS caseload, median (interquartile range [IQR])	63 (31–113)
High-minority treating, %	9.4
Low-minority treating, %	22.6
Hospital (n = 204)	
Annual overall caseload, median (IQR)	10,665 (6749–17,985)
Bed size, median (IQR)	395 (223–684)
Academic designation, %	20.7
Trauma center designation, %	32.5
Rural location, %	4.3
Patient demographic/clinical (n = 520,024)	
Race, %	
White	67
Black	16.5
Hispanic	14.2
Asian/Pacific Islander	0.7
Native American	0.1
Other	1.6
Age, median (IQR)	63 (50–74)
Charlson comorbidity index >6, %	28.7
Primary insurance payer, %	
Medicare	51.1
Medicaid	11.7
Private	22.1
Self-pay	8.2
No charge	2.5
Other	4.3
Admission type, %	
Emergent	73.4
Urgent	21.5
Trauma-related	5.1
Cases managed operatively, %	94.4
EGS procedure, %	
Appendectomy	54.9
Cholecystectomy	24.3
Small bowel resection	1.3
Colectomy	0.9
Peptic ulcer disease repair	1.9
Lysis of adhesions	13.3
Laparotomy	3.4

Discussion

Based on administrative data gathered on all inpatient hospitalizations in Florida, the racial/ethnic composition of a surgeon's caseload is associated with differential risk for adverse outcomes, such as major complications, for minority patients with EGS diagnoses. Surgeons accustomed to caring for higher proportions of minority patients tend to practice at overall better equipped facilities that see higher volume and higher acuity, which may explain why risk-adjusted odds of complications are decreased in this group. However, even within these relatively resource-rich settings, minority patients treated by HM surgeons have better outcomes than those treated by other surgeons.

To our knowledge, this is the first study to examine the relationship between racial disparities in surgical outcomes and surgeons' practice demographics. Several studies have established that minority physicians are more likely to care for non-white and non-English-speaking patients.[15–20] Our data set did not provide us with racial demographic information for the surgeons, but we did determine that HM surgeons were more likely to practice in academic settings. The societal role of academic medicine is multifaceted, and includes the provision of access to equitable care for underserved populations. HM surgeons may be more inclined to practice at academic centers due to shared values associated with serving the poor and uninsured.

At the individual surgeon level within those academic centers, HM surgeons may also especially well-positioned to engage in cognitive exercises to reduce implicit biases. Implicit racial biases refer to the subconscious, often automatic attitudes towards members of different racial/ethnic groups, of which the individual is often unaware and would not explicitly express.[21] In attempting to identify cognitive processes proven to reduce racial prejudice, the behavioral psychology literature defines affective processes such as frequent engagement with so-called outgroup members (or individuals from different racial/ethnic groups) and development of interpersonal relationships, including the physician-patient relationship, as effective strategies for measurably reducing implicit biases.[22] White physicians may also subconsciously display avoidant behaviors when interacting with non-white patients due to anxiety surrounding their own ability to engage with racially dissimilar individuals, leading to suboptimal physician-patient communication. Direct contact with outgroup patients has been shown to improve providers' confidence in their ability to successfully interact with diverse patients. One explanation for our findings is that HM surgeons are sufficiently comfortable engaging with non-white patients to effectively build trust, communicate, and counsel these patients, thus leading to better overall quality of perioperative care. Another possibility is that, through frequent interactions with non-white patients, HM surgeons are more attuned to the systemic prejudices leading to healthcare inequities, and are therefore more vigilant about how their own implicit racial biases could be influencing their clinical decision-making. Denial of the existence of unconscious biases at both the individual and societal level can have a negative impact on healthcare providers' approach to the treatment of outgroup patients, particularly those who are already vulnerable to adverse outcomes.[11] For example,

Table 2
Clinical and demographic characteristics of patients, hospitals, and surgeons stratified by attending surgeons' designation as high-minority treating (HM).

Characteristic	HM Surgeon	Non-HM Surgeon	p-value
Mean age, y	53.5	60.6	**<0.001**
Female, %	46.4	48.9	**<0.001**
Mean Charlson comorbidity index	2.9	3.5	**<0.001**
Procedure type, n			
Appendectomy	51,208	236,364	**<0.001**
Cholecystectomy	12,595	138,709	**<0.001**
Small bowel resection	226	4222	**<0.001**
Colectomy	43	5613	**<0.001**
Peptic ulcer disease repair	696	5257	**<0.001**
Lysis of adhesions	3053	51,117	**<0.001**
Laparotomy	290	10,631	**<0.001**
Primary insurance payer, %			
Medicare	37.9	53.1	**<0.001**
Medicaid	20.9	10.4	**<0.001**
Private	18.4	22.7	**<0.001**
Self-pay	12.5	7.6	**<0.001**
No charge	5.4	2.0	**<0.001**
Other	4.9	4.3	0.86
Admission type, %			
Emergent	76.4	72.9	**<0.001**
Urgent	9.8	23.3	**<0.001**
Trauma-related	13.8	3.8	**<0.001**
Teaching hospital, %	53.8	19.3	**<0.001**
Trauma hospital, %	65.8	31.3	**<0.001**
Rural hospital, %	4.7	4.7	0.91
Mean hospital annual case volume	20,144	16,072	**<0.001**
Mean hospital bed size	1104.4	572.0	**<0.001**
Mean surgeon annual EGS case volume	66.7	67.0	0.16

Bold indicates p<0.05.

Table 3
Risk-adjusted odds of complications when treated by a HM surgeon or LM surgeon, stratified by patient racial/ethnic group.

	Black	White	Hispanic
Non-HM surgeon (Hispanic and Black patients comprise <14% and <18% respectively total annual caseload)	Ref	Ref	Ref
HM surgeon	0.88 (0.78–0.99)*	0.92 (0.78–1.08)	0.91 (0.86–0.97)*
Non-LM surgeon (white patients comprise <90% total annual caseload)	Ref	Ref	Ref
LM surgeon	1.1 (0.84–2.45)	0.99 (0.95–1.05)	1.09 (0.78–1.53)

*p < 0.05.
**p < 0.001.

denial of unconscious bias is the cornerstone of so-called “aversive” racism, or the more contemporary, subtle, often unintentional form of subconscious anti-outgroup attitudes held by individuals who outwardly express egalitarian values. Healthcare providers, who are known to almost universally espouse overtly unbiased attitudes, may harbor beliefs consistent with aversive racism, which could manifest in delivery of poorer quality care. Individuals who demonstrate aversive racism tend to justify their behaviors on the basis of factors other than race, such as higher complication rates for Black patients due to biological factors alone, rather than overtly express prejudice.[23] Surgeons who treat a diverse group of patients are more likely to acknowledge their own unconscious biases, as well as the biases that permeate the structure of American society, and are therefore more likely to engage in both the affective and cognitive processes that lead to the reduction of such biases.

We chose to focus our analysis on patients undergoing emergency surgery only because this creates a pseudo-randomization effect, reducing the patient's capacity to choose his or her surgeon. The literature suggests that minority patients, when given the choice, are more likely to choose to receive care from minority physicians or other physicians who have a history of providing care to large proportions of minority patients.[24,25] While other factors, such as geographic proximity and primary insurance coverage, also influence patients' decisions regarding where to seek emergency care, this group represents a logical population in which to study surgeon-driven factors associated with racial disparities in outcomes.

There are, however, a few limitations to our analysis that should be acknowledged. First, the use of administrative data renders certain pertinent clinical information unavailable. There are many important clinical factors that contribute to the development of postoperative complications other than surgeons' experiences with treating minority patients. We attempted to account for some of these by controlling for procedure type, diagnosis, and patient comorbidities, as well as age, sex, and insurance provider, but the data set does not offer certain information on salient features of the operation that could explain differences in surgeons' complication rates for minority patients. Also, while our findings imply that homogeneity of a surgeon's patient population could be associated with worse outcomes for minority patients, we did not have sufficient numbers of Black and Hispanic patients to generate subgroups of homogenously non-white-serving surgeons to examine the opposite end of the “diversity spectrum”. This could represent an intriguing area for future research.

Conclusion

In the state of Florida, a small percentage of the surgeons provide the bulk of the emergency general surgical care to Black and Hispanic patients. When treated by these surgeons, Black and

Hispanic patients tend to fare better in terms of major complications than their counterparts treated by the remaining 90% of surgeons in that state. This suggests that high-minority-serving surgeons may be better equipped to provide safe, equitable emergency general surgical care to their Black and Hispanic patients due to a multitude of associated hospital-level and cognitive/behavioral factors.

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