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Racial/ethnic disparities in emergency general surgery: explained by hospital-level characteristics?



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Abstract

BACKGROUND: To quantify racial/ethnic differences in outcome after emergency general surgery (EGS).

METHODS: Patients receiving a representative EGS (colectomy, small bowel resection, or ulcer repair operation) performed within the first 24 hours of hospital admission were identified in the Nationwide Inpatient Sample between 2000 and 2008. Multivariable logistic regression was used to estimate the overall disparity in odds of death between African Americans (AAs) and Caucasians. Hierarchical models were then used to evaluate association of hospital-level factors and death after EGS.

RESULTS: A total of 116,344 patients were identified. AA patients had 10% higher odds of dying after EGS than Caucasian patients (adjusted odds ratio 1.10, $P = .02$). All patients treated at hospitals with greater than 6% AA EGS patients had higher odds of death than those at hospitals with fewer percentage of AA EGS patients (adjusted odds ratio 1.16 to 1.42, $P < .002$).

CONCLUSION: There is racial/ethnic disparity in outcome after selected EGS; however, this disparity is explained by hospital-level factors.

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Emergency general surgery (EGS) is an evolving surgical specialty with a unique set of considerations that may affect

patient outcome. Research into outcomes following EGS procedures has been hampered by a lack of a standard definition of EGS and centralized data collection systems specific for EGS.¹ Questions of race/ethnicity and outcome are particularly important to address given the disproportionate usage of emergency departments and decreased utilization of primary care and screening among African American patients, which may affect outcomes after EGS.²⁻⁵

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Previous research into racial/ethnic differences in outcomes after EGS has been limited to outcomes after trauma surgery. In the trauma population, African American race is associated with higher odds of in-hospital mortality and worse long-term outcomes.^{6–18} There is also evidence that some of the racial/ethnic disparities seen in trauma are because of worse outcomes for all patients at the hospitals where most African American patients are treated.¹⁹ In other words, the racial/ethnic disparity seen in trauma outcomes may be attributable to hospital-level factors rather than patient-level factors.

Our objectives were to investigate racial/ethnic disparity in outcome following 3 representative EGS procedures and to explore hospital-level factors and characteristics that may contribute to this disparity using a nationally representative sample.

Methods

Study population

We defined patients who received an EGS procedure as those patients with a nonroutine admission and primary or secondary International Classification of Diseases, 9th revision, Clinical Modification (ICD-9-CM) codes for colectomy (45.71, 45.72, 45.73, 45.74, 45.75, 45.76, 45.79), small bowel resection (45.61, 45.62), or ulcer repair (44.40, 44.41, 44.42) performed within the first 24 hours after admission from a state that collected data on race/ethnicity. These patients were identified in the Nationwide Inpatient Sample (NIS) between 2000 and 2008. Patients with more than one procedure of interest recorded were categorized under the primary procedure. Race/ethnicity was categorized as Caucasian, African American, Hispanic, and all other racial/ethnic categories. Race/ethnicity data were not reliably collected by Iowa, Kentucky, or Maine for the entire period of interest; patients from these states were dropped from the analysis. We also excluded all patients at hospitals with no African American EGS patients. The outcome of interest was in-hospital death during the primary admission.

Multivariable logistic regression was used to answer the question of whether or not there were racial/ethnic differences in death after EGS on average. Models were adjusted for age, sex, Charlson comorbidity index (a validated measure of comorbidity based on ICD-codes),^{20–22} insurance status, cancer diagnosis (based on ICD-9 diagnosis codes), procedure type, and multiple procedures of interest. Robust standard errors and hospital-level clustering were used to account for correlation of patients treated at the same hospital.

Patients were then stratified into quartiles based on percentage of African American patients undergoing EGS at each hospital. Multivariable logistic regression adjusting for the same patient-level factors as above was used to estimate the odds ratio for death comparing all patients at

hospitals with higher percentage of African Americans undergoing EGS with all patients at hospitals with the lowest percentage of African Americans undergoing EGS.

Multivariable logistic regression was also then used to estimate the adjusted odds ratio for African American versus Caucasian EGS patients within each quartile of hospital percentage of African American patients undergoing EGS.

Hierarchical modeling was then used to quantify the effect of hospital-level factors on the overall racial/ethnic disparity. Hierarchical (mixed-effect) models take into account hospital-level clustering (the fact that patients at the same hospital will have outcomes more like each other than patients at different hospitals) and allow for adjustment and quantification of the effect of hospital-level factors. This hierarchical model allowed each hospital to have a variation in baseline odds of death, allowed each hospital to have a variation in odds of death based on race/ethnicity (a random-slope for African American at the hospital-level), and included the same patient-level adjustment variables as the multivariable logistic regression above was used (age, sex, Charlson comorbidity index, insurance status, cancer diagnosis, procedure type, and multiple procedures of interest). If hospital-level factors account for the disparity seen on average, we would expect the disparity to “disappear” in this adjusted model.

Additional hierarchical models were used to test if hospital-level characteristics were associated with either higher baseline odds of death after EGS or increased racial/ethnic disparity in death after EGS. We explored percentage of African American patients undergoing EGS, average yearly EGS volume, bed size (as defined by NIS), region, location (urban versus rural), and teaching status for both these effects. After identifying those hospital-level characteristics that were individually associated with either hospital-level odds of death or racial/ethnic disparity in death after EGS, we included all of the significant hospital-level characteristics together into a final hierarchical model to estimate the independent effects of each characteristic.

Results

Study population

We identified 93,954 patients with information on race/ethnicity who underwent at least one of our EGS procedures of interest (colectomy [$n = 58,224$], small bowel resection [$n = 28,857$], ulcer repair [$n = 10,236$]) within the first 24 hours after nonroutine admission from the NIS between 2000 and 2008. About 12,916 (13.7%) of the patients were African American. The percentages of patients who died were similar between races/ethnicities (6.6 to 8.6%) with Caucasian patients having the highest percentage. African American patients had a younger age distribution than Caucasian patients (18.0% under 30 years of age versus 6.0%, $P < .001$), were more likely to be male

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