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# Socioeconomic factors and mortality in emergency general surgery: trends over a 20-year period

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## ABSTRACT

**Background:** Socioeconomic factors such as race, insurance, and income quartiles have been identified as independent risk factors in emergency general surgery (EGS), but this impact has not been studied over time. We sought to identify trends in disparities in EGS-related operative mortality over a 20-y period.

**Methods:** The National Inpatient Sample was used to identify patient encounters coded for EGS in 1993, 2003, and 2013. Logistic regression models were used to examine the adjusted relationship between race, primary payer status, and median income quartiles and in-hospital mortality after adjusting for patients' age, gender, Elixhauser comorbidity score, and hospital region, size, and location-cum-teaching status.

**Results:** We identified 391,040 patient encounters. In 1993, Black race was associated with higher odds of in-hospital mortality (odds ratio [95% confidence interval]: 1.35 [1.20-1.53]) than White race, although this difference dissipated in subsequent years. Medicare, Medicaid, and underinsured patients had a higher odds of mortality than those with private insurance for the entire 20-y period; only the disparity in the underinsured decreased over time (1993, 1.63 [1.35-1.98]; 2013, 1.41 [1.20-1.67]). In 2003 (1.23 [1.10-1.38]) and 2013 (1.23 [1.11-1.37]), patients from the lowest income quartile were more likely to die after EGS than patients from the highest income quartile.

**Conclusions:** Socioeconomic disparities in EGS-related operative mortality followed inconsistent trends. Over time, while gaps in in-hospital mortality among Blacks and Whites have narrowed, disparities among patients belonging to lowest income quartile have worsened. Medicare and Medicaid beneficiaries continued to experience higher odds of in-hospital mortality relative to those with private insurance.

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## Introduction

Race and socioeconomic status have been identified as independent predictors of operative mortality.<sup>1</sup> The identification of these disparities has led to a growing body of research across multiple surgical specialties in attempts to better

understand the causes of these associations and improve healthcare outcomes.<sup>2–4</sup> It has been shown that racial and/or ethnic minorities have less access to preventative care and surgery, resulting in delayed diagnoses and more advanced disease at presentation.<sup>5,6</sup> A steady increase in the volume of emergency general surgery (EGS) procedures performed, and a

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resultant increase in the burden of EGS on overall healthcare costs has prompted considerable interest in recent years to determine healthcare quality indicators for improving EGS outcomes.<sup>7–9</sup> Although there is still no consensus, recent efforts to define what EGS encompasses have enhanced the ability to study surgical outcomes in EGS patients in a more consistent and reproducible manner.<sup>8,10,11</sup>

Previous studies assessing disparities in EGS-related operative outcomes have either been procedure specific, have focused on a limited number of procedures, or have examined specific patient populations.<sup>11–14</sup> This limited scope does not provide an adequate basis for the identification of overall trends in disparities pertaining to EGS-related operative outcomes. It is necessary not only to identify these disparities in a comprehensive and systematic way but also to assess whether these outcomes are improving or worsening over time. This information is critical for the appropriate targeting of resource allocation and quality improvement efforts. The objective of this study was to identify trends in the association between socioeconomic factors and in-hospital operative mortality after EGS over a 20-y period using a nationally representative sample.

## Materials and methods

### Data source

The data for this observational study were sourced from the National (Nationwide) Inpatient Sample (NIS) database of the Healthcare Cost and Utilization Project (HCUP). The NIS is the largest national-level all-payer inpatient database, which annually captures data from roughly one-fifth of discharges from nonfederal US hospitals applying a stratified sampling

design.<sup>15</sup> The data elements available in the NIS database include de-identified data on admission-related, patient-related, and hospital-related characteristics, diagnosis and procedure codes, discharge disposition, and resource utilization variables such as length of stay and hospital charges. For this study, we used data for the years 1993, 2003, and 2013. This study was approved by the Rutgers University Institutional Review Board as an exempt study.

### Study population

The study population was comprised of adult patients who underwent EGS. A schematic of inclusion and exclusion criteria can be found in [Figure](#). Using International Classification of Disease, Ninth Revision, and Clinical Manifestation (ICD-9-CM) primary and secondary procedure codes, we first identified patients who underwent selected general surgery procedures. The EGS procedures were selected by including all abdominal surgical procedures from the comprehensive list published by Gale *et al* which had been compiled to include all procedure codes that could apply to the comprehensive list of EGS-defining ICD-9-CM diagnoses recently compiled by the American Association for the Surgery of Trauma (AAST).<sup>7,16</sup> After a thorough review of all other ICD-9-CM abdominal surgery codes, additional procedure codes were then added as felt to be pertinent by the study team (e.g., several laparoscopic procedure codes which were not included in the list published by Gale *et al*). [Appendix A](#) provides the final list of ICD-9-CM procedure codes used to identify EGS procedures for inclusion in this analysis.

We used the “admission type” and “elective” variables as a proxy to capture EGS encounters by excluding all discharges in which the reported type of admission was not either “emergency/urgent” or “nonelective.” To restrict the study to adult

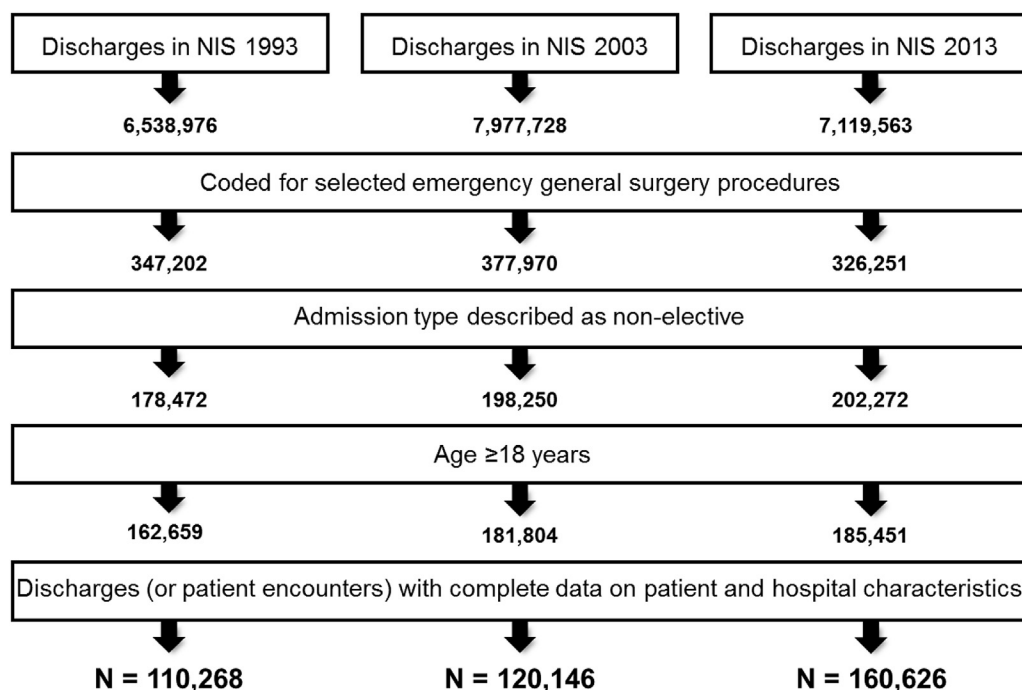


Fig – A schematic of the inclusion and exclusion criteria of the study.

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