Cross-sectional Study

Race and insurance status outcome disparities following splenectomy in trauma patients are reduced in larger hospitals. A cross-sectional study

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ABSTRACT

Background: Splenectomy, still a commonly performed treatment for splenic injury in trauma patients, has been shown to have a high rate of complications. The purpose of this study was to identify predictors, including race and insurance status, associated with adverse outcomes post-splenectomy in trauma patients. We discuss possible explanations and methods for reducing these disparities.

Methods: The American College of Surgeons – Trauma Quality Improvement Program (ACS-TQIP) participant user database was queried from 2010 to 2015 and patients who underwent total splenectomy were identified. All mechanisms of injury, including both blunt and penetrating trauma, were included. Patients with advanced directives limiting care or aged under 18 were excluded. Propensity score matching was used to control for age, preexisting medical conditions, and the severity of the traumatic injury. A chi-squared test was used to find significant associations between available predictors and outcomes for this cross-sectional study.

Results: The post-splenectomy mortality rate was 9.2% (n = 1047), 8.0% (n = 918) of patients had three or more complications, and 20.3% (n = 2315) had major complications. A primary race of white (OR 0.7, 95% Confidence Interval (CI) 0.6–0.9, p < 0.01) and private insurance (OR 0.5, 95%CI 0.4–0.6, p < 0.01) were associated with lower risks of mortality A primary race of neither Black nor white (OR 1.3, 95%CI 1.03–1.7, p = 0.03) and a lack of health insurance (“self-pay”) (OR 1.6, 95%CI 1.3–1.9, p < 0.01) were both correlated with mortality.

Conclusion: The post-splenectomy mortality rate after trauma remains high. In U.S. trauma centers, a primary race of Black and payment status of “self-pay” are associated with adverse outcomes after splenectomy following a traumatic injury. These disparities are reduced when limiting analysis to larger hospitals. Efforts to reduce disparities in outcomes among trauma patients requiring a splenectomy should focus on improving resource availability and quality in smaller hospitals.

1. Introduction

Total splenectomy is still commonly performed as the treatment for splenic injury, even as nonoperative management (NOM) has become the first choice for hemodynamically stable patients at many trauma centers. NOM greatly reduces rates of nontherapeutic laparotomies and thus rates of complications, length of stay, and overall cost [1]. NOM generally consists of close observation of patients, with packed red blood cell transfusion and angioembolization to control bleeding if necessary [2]. This consensus around the benefits of NOM was first reached for the management of blunt splenic trauma, although it has been shown that this paradigm is also useful for managing patients with splenic injuries from penetrating trauma [3]. Navsaria et al. [3] successfully used NOM in patients with abdominal gunshot wounds at Groote Schuur Hospital in Cape Town, South Africa, with less than 5% requiring delayed surgical management [3]. The rate of unnecessary laparotomies in trauma centers when performed on all patients with penetrating trauma is as high as 37% [4]. While NOM can be used to successfully lower rates of unnecessary laparotomies in trauma patients, there will ultimately still be patients who require a laparotomy and splenectomy for successful treatment of their injuries with the technology that is currently available.

Post-splenectomy patients are at high risk for complications, especially infection and sepsis in the long term [5]. The spleen plays an important role in the immune system, and it is well known that patients with asplenia have a much greater risk of infection, especially from...
Patients under the age of 18 or those who had advance directives were identified by checking all available procedure codes, including a total splenectomy (Research Registry Unique Identifying Number 7562). Registered with ResearchRegistry.com (https://www.researchregistry.com). In accordance with the Declaration of Helsinki, the research was approved by the Institutional Review Board of the Icahn School of Medicine at Mount Sinai in New York, NY (IRB-20-03069), including a waiver of patient consent. Retrospective cohort study used the American College of Surgeons (ACS) Trauma Quality Improvement Program (TQIP) participant user database from 2010 to 2015. In accordance with the Declaration of Helsinki, the research was registered with ResearchRegistry.com (https://www.researchregistry.com), Registry Research Identifier Number 7562).

We performed a query for patients who underwent a total splenectomy at a participating verified trauma center. Patients who underwent a total splenectomy were identified by checking all available procedure codes for International Classification of Disease (ICD-9), code 41.5. Patients under the age of 18 or those who had advance directives were excluded. Patients who underwent a partial splenectomy or splenorraphy were not included. Both blunt and penetrating mechanisms of injury were included, and no exclusions were made based on trauma center level.

Available demographic data in the ACS-TQIP database included gender, race, ethnicity, payment status, and region. Race was grouped into Black, white, or other, which was consistent with previously published studies using the TQIP dataset [13]. The geographical region refers to the location within the United States of the trauma center where the patient received treatment. All available comorbidities were collected, as well as clinical data points including Injury Severity Score (ISS) and initial systolic blood pressure (SBP). ISS was calculated using the available Abbreviated Injury Scale (AIS) scores.

### 2. Methods

This study was reviewed by the Institutional Review Board of the Icahn School of Medicine at Mount Sinai in New York, NY (IRB-20-03069), including a waiver of patient consent. Retrospective cohort study used the American College of Surgeons (ACS) Trauma Quality Improvement Program (TQIP) participant user database from 2010 to 2015. In accordance with the Declaration of Helsinki, the research was registered with ResearchRegistry.com (https://www.researchregistry.com), Registry Research Identifier Number 7562).

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### 2.1. Outcomes

The primary objective was to determine if any of the available demographic factors were associated with our primary or secondary end points after a splenectomy in trauma patients. The primary end point was mortality, and the secondary end points were three or more complications or any major complication. Complications that would likely be classified as grade IV or greater in the classification system proposed by Dindo et al. [14] were considered to be major complications and included: acute kidney injury, acute respiratory distress syndrome, cardiac arrest with Cardiopulmonary Resuscitation (CPR), myocardial infarction, pulmonary embolism, stroke/cerebrovascular accident (CVA), unplanned intubation, unplanned return to ICU, and severe sepsis. This cross-sectional study only considered end points that occurred prior to initial discharge.
process was repeated for each of the secondary end points. Standardized mean differences for all variables used in our propensity matching, using a maximum of 0.1 as a strong threshold [16]. The above propensity score matching was matched with two controls. A comparison of demographics and other factors was balanced. A comparison of demographics and other factors not the risk factor being studied [15]. We chose to use all available data or demographics, leaving 11,419 valid patient records for review.

### 2.2. Data Analysis

A total of 11,753 patients were identified who underwent a total splenectomy at a participating trauma center between January 2010 and December 2015. Of these, 334 records were missing necessary clinical data or demographics, leaving 11,419 valid patient records for review. Previous studies using similar propensity score matching methods had shown that a strong propensity score model can be created by selecting variables that are likely related to the outcome but not the risk factor being studied [15]. We chose to use all available comorbidities, as well as Injury Severity Score (ISS) and initial SBP in our propensity score model. The final propensity score model included: age, ISS, initial SBP, alcohol use disorder, ascites in the prior 30 days, bleeding disorder, chemotherapy, congenital defects, congestive heart failure, CHF, current smoker, dialysis, cerebrovascular accident with deficit, diabetic, disseminated cancer, esophageal varices, functionally dependent, angina in the prior six months, peripheral vascular disease, hypertension, impaired sensorium, premature birth, obesity, respiratory disease, steroid use, cirrhosis, dementia, major psychiatric disorder, prehospital arrest with CPR, and attention deficit disorder.

Matching was then performed based on propensity scores using a greedy algorithm with a 1:2 ratio. For example, one patient who died was matched with two controls. The above propensity score matching process was repeated for each of the secondary end points.

Previous studies using similar propensity score matching methods have used the standardized mean difference to assess for balance after matching, using a maximum of 0.1 as a strong threshold [16]. The standardized mean differences for all variables used in our propensity score matching model were below this threshold, suggesting that groups were balanced. A comparison of demographics and other factors between the two groups in each of the matched cohorts was performed using a chi-squared test. We then repeated the identical propensity matching and analysis process while limiting our dataset to the 5931 patients treated at high-volume hospitals, which we defined as hospitals with more than 600 adult beds.

All statistical methods were performed on Statistical Analysis Software version 9.4 (SASv9.4, SAS Institute, Cary, NC). A value of $p < 0.05$ was considered to be significant. This work has been reported in line with the STROCSS criteria [17].

## 3. Results

The post-splenectomy mortality rate was 9.2% ($n = 1047$), 8.0% ($n = 918$) had three or more complications, and 20.3% ($n = 2315$) had major complications. After propensity score matching, 1042 patients who died prior to discharge were matched with 2072 controls, 914 patients who experienced three or more complications were matched with 1805 controls, and 2172 patients who experienced major complications were matched with 4336 controls. A summary of characteristics before and after matching can be found in Tables 1 and 2.

White patients were less likely to die than nonwhite patients (OR 0.7, 95%CI 0.6–0.9, $p < 0.01$) following splenectomy. Patients whose primary race was neither Black nor white were more likely to die (OR 1.3, 95%CI 1.3–1.9, $p < 0.01$), while patients with private insurance (OR 0.5, 95%CI 0.4–0.6, $p < 0.01$) or Medicaid (OR 0.6, 95%CI 0.5–0.8, $p < 0.01$) were less likely to die. Patients who were treated at an ACS-verified trauma center were also less likely to die (OR 0.4, 95%CI 0.3–0.7, $p < 0.01$). Geographical region was not associated with mortality.

Patients who were white were less likely to have three or more...
There were no significant associations between race and mortality in patients treated at hospitals with over 600 beds following splenectomy. The present study demonstrates that disparities in outcomes exist between patients of different races, payment status, and geographical regions who underwent a splenectomy at a trauma center. Hospital volume has been shown to correlate with higher quality outcomes [11]. Accordingly, limiting our analysis to hospitals with over 600 beds led to less likely to experience a major complication (OR 0.76, 95%CI 0.6–0.98, p = 0.037). Neither private insurance nor self-pay were correlated with complications. Patients with Medicaid were more likely to experience three or more complications (OR 1.4, 95%CI 1.02–1.8, p = 0.008) or a major complication (OR 1.5, 95%CI 1.3–1.7, p < 0.0001). Patients treated in the Midwest were less likely to experience three or more complications (OR 0.7, 95%CI 0.5–0.9, p = 0.0001). A summary of these results may be found in Figs. 1 and 2.

4. Discussion

The present study demonstrates that disparities in outcomes exist between patients of different races, payment status, and geographical regions who underwent a splenectomy at a trauma center. Hospital volume has been shown to correlate with higher quality outcomes [11]. Accordingly, limiting our analysis to hospitals with over 600 beds led to reduced racial- and insurance-related disparities in outcomes. Again, race itself is not a risk factor but is associated with many other social, economic, and clinical factors that affect medical outcomes [12].

### Table 3

| Variables | Pre-Matching | Post-Matching | SMD |
|-----------|--------------|---------------|-----|
| Age, y    | 49.06 [20.91]| 40.82 [16.90] | 0.3008 |
| Gender, male | 377 (68.67) | 3613 (72.13) | 0.2769 |
| Injury Severity Score | 36.54 [18.80] | 30.97 [18.27] | 0.4336 |
| Systolic Blood Pressure | 104.45 [44.29] | 114.99 [30.60] | 0.0758 |
| Attention Deficit Disorder | 30 (4.01) | 65 (1.30) | 0.0285 |
| Ascites | 4 (0.73) | 16 (0.32) | 0.0203 |
| Bleeding Disorder | 35 (6.38) | 178 (3.55) | 0.0632 |
| Chemotherapy | 1 (0.18) | 14 (0.28) | 0.1180 |
| Congestive Heart Failure | 17 (3.10) | 68 (1.36) | 0.4767 |
| Cirrhosis | 22 (4.01) | 65 (1.30) | 0.0285 |
| Congenital Defect | 0 (0.00) | 10 (0.20) | 0.1066 |
| Diabetic | 56 (10.20) | 346 (6.91) | 0.0600 |
| Dialysis | 5 (0.91) | 33 (0.66) | 0.0645 |
| Disseminated Cancer | 5 (0.91) | 15 (0.30) | 0.0150 |
| Drug Use | 12 (2.19) | 502 (10.02) | 0.0419 |
| Esophageal Varices | 1 (0.18) | 12 (0.24) | 0.0200 |
| Hypertension | 109 (19.85) | 912 (18.21) | 0.0296 |
| Major Psychiatric Disorder | 12 (2.19) | 366 (7.31) | 0.0201 |
| Myocardial Infarction | 12 (2.19) | 67 (1.34) | 0.0341 |
| Obesity | 21 (5.65) | 318 (6.05) | 0.1691 |
| Pre-Hospital Arrest | 9 (1.64) | 14 (0.28) | 0.0694 |
| Premature | 0 (0.00) | 1 (0.02) | 0.2425 |
| Peripheral Vascular Disease | 2 (0.36) | 14 (0.28) | 0.3317 |
| Respiratory Disease | 36 (6.56) | 304 (6.07) | 0.1397 |
| Steroid Use | 1 (0.18) | 18 (0.36) | 0.0825 |

Data are presented as number (percentage) or mean [standard deviation]. SMD, standardized mean difference, CVA, Cerebrovascular Accident.
associations between race and mortality. A primary race of Black was associated only with multiple complications, and a primary race other than Black or white was associated only with a higher risk of a major complication. This supports similar findings by Breslin et al. [18], who showed that mortality rates were not associated with race within hospitals with large minority populations, and that hospital factors account for racial disparities in mortality rates in black and colon cancer patients. Multiple other studies have shown that controlling for the quality of individual hospitals can help to remove disparities in outcome, and that there are often associations between demographics and the hospital at which a patient is treated [19,20]. Our findings suggest that hospital factors can account for racial disparities in trauma patients who require a splenectomy as well, and further research could investigate whether this can be generalized to all trauma patients.

### 4.2. Payment status

Mortality was less frequent in patients with private insurance and more frequent in patients without insurance. Medicaid patients had a lower frequency of mortality but a higher frequency of multiple complications. Of note, payment information was unavailable for 2622 of the 11,419 patients (23.0%), including patients who were not billed for any reason, received workers’ compensation, or were involved in no-fault automobile accidents. Haines et al. [21] produced comparable findings showing that uninsured patients were more likely to die, while Medicaid was not associated with mortality. Haines et al. [21] did not consider complications as an end point but did find that Medicaid was associated with a longer hospital stay.

We found that associations between payment status and outcome were diminished when limited to high-volume hospitals but not eliminated. Self-pay was still significantly associated mortality risk, but the association was stronger when all hospitals were included. Self-pay and private insurance were no longer associated with multiple complications or major complications, but Medicaid still had a significant association with multiple complications.

### 4.3. Geographical regions

While the geographical location of a trauma center was not associated with mortality, we did find geographical associations with multiple or major complications in our dataset. Multiple complications and major complications were more frequent in patients treated at trauma centers in the South of the U.S., while multiple complications were less frequent in patients treated in the West. Major complications were less frequent in patients treated in the Midwest. Limiting our analysis to larger hospitals had a relatively small effect on geographical associations with outcome and in some cases resulted in associations that were not present beforehand. Brown et al. [22] showed that the geographic distribution of trauma centers is correlated with mortality, and states with dispersed trauma centers (many of which are in the South) have longer transport times and higher mortality rates than states with clustered trauma centers. Lastly, we did find that mortality was less frequent in patients treated at an ACS-verified trauma center. Of note, only 3.4% (n = 105) of the patients in this propensity-score-matched cohort were treated at non-ACS-verified trauma centers.

### 4.4. Limitations

There are multiple limitations to our analysis that must be noted. Comorbidity data in the TQIP dataset is only available in a binary form, and it is not possible to account for differences in the severity of pre-existing comorbidities. For example, we found that obesity and

### Table 4

Baseline characteristics before and after matching patients with major complications following splenectomy – hospitals with >600 beds.

| Variables                        | Pre-Matching | Post-Matching |
|----------------------------------|--------------|--------------|
|                                  | Expired (n = 1268) | Controls (n = 4290) | SMD | Expired (n = 1189) | Controls (n = 2368) | SMD |
| Age, y                           | 46.04 [18.54] | 40.33 [16.98] | 0.3214 | 44.91 [18.34] | 44.27 [17.66] | 0.0354 |
| Gender, male                     | 941 (74.21) | 3049 (71.07) | 0.0794 | 882 (74.18) | 1739 (73.44) | 0.0169 |
| Injury Severity Score            | 35.69 [17.75] | 30.29 [18.41] | 0.2989 | 36.18 [17.51] | 35.99 [17.29] | 0.0110 |
| Systolic Blood Pressure          | 110.41 [36.44] | 115.00 [30.98] | 0.1357 | 110.23 [36.72] | 110.69 [32.27] | 0.0134 |
| ADD                              | 147 (11.59) | 374 (8.72) | 0.0953 | 143 (12.03) | 277 (11.70) | 0.0102 |
| Alcohol Use Disorder             | 11 (0.87) | 9 (0.21) | 0.0899 | 10 (0.84) | 9 (0.38) | 0.0592 |
| Angina                           | 85 (6.70) | 128 (2.98) | 0.1739 | 70 (5.89) | 105 (4.31) | 0.0057 |
| Ascites                          | 5 (0.39) | 10 (0.23) | 0.0288 | 4 (0.34) | 7 (0.30) | 0.0073 |
| Bleeding Disorder                | 5 (0.39) | 5 (0.12) | 0.0550 | 4 (0.34) | 5 (0.21) | 0.0240 |
| Chemotherapy                     | 41 (3.23) | 44 (1.03) | 0.1533 | 35 (2.94) | 41 (1.73) | 0.0803 |
| CHF                              | 253 (19.95) | 1013 (23.61) | 0.0887 | 237 (19.93) | 472 (20.93) | 0.0090 |
| Cirrhosis                        | 10 (0.79) | 28 (0.65) | 0.0161 | 9 (0.76) | 14 (0.59) | 0.0202 |
| Congenital Defect                | 27 (2.13) | 36 (0.84) | 0.1068 | 20 (1.68) | 33 (1.39) | 0.0234 |
| Smoker                           | 156 (12.30) | 246 (5.73) | 0.2308 | 139 (11.69) | 220 (9.29) | 0.0784 |
| CVA/Stroke                       | 7 (0.55) | 13 (0.30) | 0.0382 | 6 (0.50) | 7 (0.30) | 0.0331 |
| Dementia                         | 5 (0.39) | 8 (0.19) | 0.0386 | 5 (0.42) | 8 (0.34) | 0.0134 |
| Functionally Dependent           | 12 (0.95) | 28 (0.65) | 0.0330 | 11 (0.93) | 21 (0.89) | 0.0040 |
| Diabetic                         | 4 (0.32) | 5 (0.12) | 0.0428 | 2 (0.17) | 4 (0.17) | 0.0002 |
| Dialysis                         | 79 (6.23) | 23 (0.64) | 0.3644 | 0 (0.00) | 0 (0.00) | 0 (0.00) |
| Disseminated Cancer              | 7 (0.55) | 9 (0.21) | 0.0556 | 4 (0.34) | 8 (0.34) | 0.0002 |
| Drug Use                         | 312 (24.61) | 799 (16.53) | 0.2088 | 264 (22.20) | 497 (20.99) | 0.0295 |
| Esophageal Varices               | 0 (0.00) | 1 (0.02) | 0.0000 | 0 (0.00) | 0 (0.00) | 0 (0.00) |
| Hypertension                     | 123 (9.70) | 226 (5.27) | 0.1690 | 112 (9.42) | 187 (7.90) | 0.0541 |
| Major Psychiatric Dis.           | 99 (7.81) | 241 (5.62) | 0.0876 | 81 (6.81) | 144 (6.08) | 0.0298 |
| Myocardial Infarction            | 5 (0.39) | 14 (0.33) | 0.0113 | 4 (0.34) | 10 (0.42) | 0.0140 |
| Obesity                          | 33 (2.60) | 54 (1.26) | 0.0977 | 30 (2.52) | 48 (2.03) | 0.0223 |
| Pre-Hospital Arrest              | 8 (0.63) | 15 (0.35) | 0.0403 | 7 (0.59) | 11 (0.46) | 0.0172 |
| Premature                        | 95 (7.49) | 283 (6.60) | 0.0350 | 86 (7.23) | 169 (7.14) | 0.0037 |
| PVD                              | 91 (7.18) | 432 (9.86) | 0.0962 | 88 (7.40) | 167 (7.05) | 0.0135 |
| Respiratory Disease              | 10 (0.79) | 13 (0.30) | 0.0659 | 10 (0.84) | 13 (0.55) | 0.0351 |
| Steroid Use                      | 3 (0.24) | 14 (0.33) | 0.0169 | 3 (0.25) | 8 (0.34) | 0.0158 |

Data are presented as number (percentage) or mean [standard deviation].

SMD, standardized mean difference; ADD, Attention Deficit Disorder, CHF, Congestive Heart Failure, CVA, Cerebrovascular Accident, PVD, Peripheral Vascular Disease.
hypertension were associated with outcomes, but we were only able to match patients based on either the presence or absence of these comorbidities and not the severity. It has also been shown that there are geographical differences in the presence of comorbidities, such as obesity, throughout the United States [23]. Previous studies have shown that many of these demographics, especially race and payment status, are related and cannot be analyzed as completely independent variables [24]. It has also been shown that inclusion of nonsurvivable injuries in the TQIP database might account for differences in outcomes between trauma centers, which could be one factor in the differences in outcomes between the different regions, though our propensity-matching process did account for injury severity score [25]. Additionally, hospital bed count is not a direct measurement of the volume of trauma patients treated, and there are some very high-volume trauma centers in hospitals with fewer than 600 beds.

4.5. Social determinants of health

As early as 1977, when Bronfenbrenner et al. [26] proposed a research model that considers the changing environment in which a human develops, it has been recognized that there are a multitude of factors affecting the health of an individual. The National Institute on Minority Health and Health Disparities Research Framework proposed by Alvidrez et al. [27] serves as a model for ensuring that research addresses the complexity of health disparities and the determinants that affect them. The framework proposes four levels of influence: individual, interpersonal, community, and societal. The data available in the TQIP database allows us to examine only some of the factors on the individual level of influence, namely race and insurance status. We were not able to examine the other three levels beyond individual, which include factors ranging from family functioning, patient-clinician relationship, and availability of health services in a community to sanitation, immunization, societal norms, and quality of care. Additionally, insurance status is an incomplete marker of socioeconomic status, and this is a significant limitation. There is a need for continued analysis with a more specific data collection that can provide a more complete picture of the social determinants of health.

Even though we are limited by the available data points, our findings do suggest that racial- and insurance-related disparities in outcomes can be reduced by controlling for certain hospital characteristics, such as, in this case, size. Providing necessary quality improvements to hospitals that treat a larger number of minority patients, which has previously been proposed by Osborne et al. [28], is likely to reduce the disparities in outcomes. This is not a complete solution, and ultimately many other

| Variable          | OR (95% CI)         | P     |
|-------------------|---------------------|-------|
| Male              | 0.98 (0.84-1.15)    | 0.81  |
|                   | 1.03 (0.84-1.3)     | 0.69  |
| White             | 0.73 (0.62-0.86)    | 0.0002|
|                   | 0.81 (0.65-1.05)    | 0.064 |
| Black             | 1.17 (0.95-1.46)    | 0.15  |
|                   | 1.09 (0.83-1.43)    | 0.55  |
| Other Race        | 1.52 (1.20-1.94)    | 0.001 |
|                   | 1.22 (0.96-1.74)    | 0.25  |
| Hispanic          | 1.17 (0.91-1.49)    | 0.22  |
|                   | 0.93 (0.64-1.35)    | 0.7   |
| Self Pay          | 1.65 (1.38-1.99)    | <.0001|
|                   | 1.46 (1.14-1.88)    | 0.0031|
| Private Insurance | 0.51 (0.43-0.61)    | <.0001|
|                   | 0.53 (0.42-0.68)    | <.0001|
| Medicaid          | 0.67 (0.52-0.88)    | 0.0034|
|                   | 0.56 (0.39-0.8)     | 0.0013|
| ACS Verified TC   | 0.41 (0.27-0.61)    | <.0001|
|                   | 0.36 (0.23-0.57)    | <.0001|
| South Region      | 1.15 (0.99-1.34)    | 0.061 |
|                   | 1.17 (0.95-1.44)    | 0.15  |
| West Region       | 0.9 (0.74-1.09)     | 0.28  |
|                   | 0.87 (0.63-1.21)    | 0.42  |
| Midwest Region    | 0.9 (0.75-1.09)     | 0.29  |
|                   | 0.89 (0.68-1.18)    | 0.42  |
| Northeast Region  | 0.97 (0.77-1.22)    | 0.78  |
|                   | 0.95 (0.67-1.28)    | 0.64  |

Fig. 1. Mortality Risk Ratios – Odds ratios with 95% confidence intervals and p-values visualized both before and after limiting analysis to hospitals with greater than 600 beds for each variable’s effect on mortality.
social determinants of health must be addressed to eliminate disparities in outcomes. It is also important to note that the term “lower-quality hospital” does not imply fault among those who staff those facilities but indicates a multitude of factors including a lack of resources and less access to specialized care. Bach et al. [29] found that physicians primarily treating Black patients had significantly less access to high-quality imaging and subspecialists, and that those physicians were less likely to be board certified.

5. Conclusion

After controlling for preexisting medical conditions and injury severity in a cohort of 11,419 patients who underwent a splenectomy in a U.S. trauma center from 2010 to 2015, race and payment status independently predicted mortality and in-hospital complications. A primary race of Black predicted multiple complications and major complications, while a primary race of white was associated with lower risks of mortality and a lesser percentage with multiple complications. A lack of health insurance predicted mortality while private insurance was associated with a lower risk of both mortality and major complications. These disparities are reduced among high-volume hospitals. A major implication of this study is that improving the quality of lower-volume hospitals and those that treat a larger proportion of minority patients can reduce disparities in outcomes.

Authorship

HJK and IML conceived of the study concept and design. HJK contributed to data acquisition and analysis. HJK wrote the original manuscript draft and IML provided critical revision.

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None to declare.

Ethical approval

This study was reviewed by the Institutional Review Board of the Icahn School of Medicine at Mount Sinai in New York, NY (IRB-20-03069) including a waiver of patient consent.

Consent

N/A.
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