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Penetrating Colon Trauma Outcomes in Black and White Males

Steven J. Skube, MD¹, Bruce Lindgren, MS², Yunhua Fan, MPH³, Stephanie Jarosek, PhD⁴, Genevieve B. Melton, MD, PhD^{1,5}, Michael D. McGonigal, MD⁶, Mary R. Kwaan, MD, MPH⁷

¹Department of Surgery, University of Minnesota, Minneapolis, Minnesota

²Biostatistics Core, Masonic Cancer Center, University of Minnesota, Minneapolis, Minnesota

³Department of Urology, University of Minnesota, Minneapolis, Minnesota

⁴School of Public Health, University of Minnesota, Minneapolis, Minnesota

⁵Institute for Health Informatics, University of Minnesota, Minneapolis, Minnesota

⁶Department of Surgery, Regions Hospital, St. Paul, Minnesota

⁷Department of Surgery, University of California, Los Angeles, California

Abstract

Introduction: Racial disparities have been both published and disputed in trauma patient mortality, outcomes, and rehabilitation. In this study, the objective was to assess racial disparities in patients with penetrating colon trauma.

Methods: The National Trauma Data Bank was searched for males aged 14 years from 2010 through 2014 who underwent operative intervention for penetrating colon trauma. The primary outcomes for this study were stoma formation and transfer to rehabilitation; secondary outcomes were postoperative morbidity and mortality. Analyses were performed in 2016–2018.

Results: There were 7,324 patients identified (4,916 black, 2,408 white). Black and white patients underwent fecal diversion with stoma formation at a similar rate (19.6% vs 18.5%, $p=0.28$). Black patients were more likely than white patients to be uninsured (self-pay; 37.1% vs 29.9%) and more likely to be injured by firearms (88.3% vs 70.2%, $p<0.001$), but had a lower overall postoperative morbidity rate (52.6% vs 55.3%, $p=0.04$). The odds of stoma formation (OR=0.92, 95% CI=0.78, 1.09, $p=0.35$) and the odds of transfer to rehabilitation (OR=1.03, 95% CI=0.82, 1.30, $p=0.78$) were similar for black versus white patients.

Conclusions: Black patients experienced similar rates of stoma formation and transfer to rehabilitation as white patients with penetrating colon trauma. Multivariate analysis confirmed expected findings that trauma severity increased the odds of receiving an ostomy and rehabilitation

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Address correspondence to: Steven J. Skube, MD, Department of Surgery, University of Minnesota, 420 Delaware Street SE, Mayo Mail Code 195, Minneapolis MN 55455. skub0013@umn.edu.

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SUPPLEMENTAL MATERIAL

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placement. The protocol-based management approach to emergency trauma care potentially decreases the risk for the racial biases that could lead to healthcare disparities.

INTRODUCTION

Healthcare disparities, particularly racial disparities in health care, are of importance in understanding how to improve the quality of health for all patients. Racial disparities have been demonstrated in cancer care^{1,2} and surgical outcomes.^{3–6} Racial disparities after treatment for traumatic injury have been demonstrated as well, but also contradicted. One such study found a higher mortality rate in minority trauma patients.⁷ However, a study using the National Trauma Data Bank (NTDB) found no racial disparities in mortality when accounting for shock⁸ and another study using the National Inpatient Sample found no difference in trauma mortality between races in risk-adjusted models.⁹ Disparate outcomes have been demonstrated in pediatric black brain-injured patients¹⁰; formal rehabilitation has been shown to occur less often among brain-injured minority patients than among white patients.^{11–13} Socioeconomic factors and insurance status likely factor into these disparities.^{14–16}

The Centers for Disease Control and Prevention ranks trauma as the leading cause of death in males from age 1 to 34 years.¹⁷ The colon is the second most commonly injured organ in penetrating abdominal trauma.¹⁸ Still, colorectal injuries from trauma are uncommon, accounting for about 1% of both blunt and penetrating injuries.^{18,19}

Historically, when repairing or resecting the colon after traumatic injury, fecal diversion was common. In 1943, a letter from the Office of the Surgeon General issued a mandate that all colon injuries receive an ostomy.^{20,21} Stoma formation for fecal diversion is fraught with adverse issues, such as patient dissatisfaction, decreased quality of life, and often the need for a subsequent reversal operation. Stoma cares are burdensome and appliances can be costly.²² Today, for most colon injuries in civilians, primary repair has become standard—thanks to the advent of more detailed colon injury classification,^{23–26} improved critical care, more rapid operative intervention, and prospective, multicenter studies.²⁷ Whether fecal diversion is performed depends heavily on the extent of colon tissue destruction, and management with a stoma is often still performed in more severe traumatic injuries.²⁸ Various factors, such as injury by firearms, affect the extent of colon tissue destruction. Blunt colon trauma is more often managed nonoperatively than penetrating trauma, yet the extent of colon tissue destruction is often more severe when an operation is required.^{18,24}

One of the primary goals of this study is to assess the rate of stoma formation. Previous studies in rectal cancer and Crohn's disease have demonstrated a higher rate of fecal diversion in black patients compared with white patients.^{3,29–31} Although these diseases are different from penetrating traumatic injury to the colon, findings in the above studies, which are adjusted for disease severity, suggest further hypotheses that black patients may be treated by surgeons who are not as capable of performing a quality anastomosis, resulting in the easier and more expeditious maneuver of a stoma, or that a surgeon is unwilling to take added risk and time during a procedure to attempt a high-quality anastomosis in blacks. Stoma formation in the current study is used as a surrogate of quality of surgical care, and

the hypothesis is that fecal diversion will occur more commonly in black men. The second goal of this study is to assess the rate of transfer to rehabilitation. Transfer to rehabilitation has been shown to be of importance for racial disparities in previous studies on traumatic brain injury^{11,12,32} and general trauma care.³³ The hypothesis for this outcome is that black men are less likely to transfer to rehabilitation.

Previous literature demonstrating disparate racial outcomes in elective colorectal surgery has been published,^{3,29-31} and it is well known that penetrating trauma disproportionately affects more black men.³⁴⁻³⁷ Racial disparities among colon trauma have yet to be studied. The objective of this study is to assess racial disparities in surgical care between black and white patients with operatively managed penetrating colon trauma.

METHODS

Study Sample

For this retrospective review, the NTDB, the world's largest repository of trauma registry data, was accessed. It includes deidentified data from trauma centers ($n=747$, as of 2016³⁸) in the U.S. and contains >7 million records.

Measures

The records of males aged 14 years³⁹ were searched in the NTDB from 2010 through 2014 to isolate those who underwent operative intervention for penetrating colon trauma. The cohort was limited to non-Hispanic black and non-Hispanic white patients. Those transferred to another facility were excluded.

To limit the database search to patients with a colon injury diagnosis, diagnosis codes from ICD-9-CM were used. Patients with rectal injury were excluded. To define the mechanism of injury, the NTDB database category "INJTYPE" was used to include only patients with penetrating colon injury.

The two racial groups were compared and analyzed: black men and white men. To adjust for confounders, data on race, age, insurance status, injury mechanism, admission Glasgow Coma Scale (GCS) score, admission Injury Severity Score (ISS),⁴⁰ admission Abbreviated Injury Scale score, time to operation, comorbidities (which is also inclusive of smoking, alcohol use, and drug use), hospital region, trauma level, hospital setting, and number of trauma surgeons were used in each regression model.

Hospital-associated data were also obtained: geographic region, trauma-level status, teaching status, and number of trauma surgeons. A comparison of outcomes for a subpopulation, using only the South region of the U.S. as defined by the NTDB, was performed to examine potential regional differences in trauma care. This region constitutes the 16 states in the South U.S. Census region and also includes the most hospitals, incidents, and percentage of firearm injuries compared with the other regions of the NTDB.

Patients with missing data were omitted from calculations for those individual categories. Missing values ranged from 0.01% for ostomy creation to 13.6% for trauma center level.

The other missing variables with >0.01% data missing included transfer to rehabilitation (13.3%), time to surgery >6 hours (12.4%), hypotension on admission (8.5%), comorbidities (7.2%), postoperative complications (3.5%), and GCS score (2.3%). Sensitivity analysis was performed using imputation methods to determine whether missing values skewed results.

Primary outcome measures were stoma formation and transfer to rehabilitation. Secondary outcome measures were postoperative morbidity and mortality, presence of surgical site infection, number of hospital days, and number of intensive care unit days. ICD-9-CM procedure codes for diversion were used to determine ostomy status, which included creation of an ileostomy or a colostomy. Transfer to rehabilitation was defined as transfer to an inpatient rehabilitation facility, long-term care hospital, skilled nursing facility, intermediate-care facility, or other rehabilitation facility within the “HOSPDIS” category. “Overall morbidity” was created from the NTDB hospital complications category and included “any medical complication that occurred during the patient’s stay at [the] hospital.” This included 20 specific complications as well as an “other” option.

Statistical Analysis

Summary statistics are presented as frequencies and percentages for qualitative items and medians and interquartile ranges (IQR) for ordered and quantitative variables. Statistical analyses were performed in 2016–2018 using SAS, version 9.3. Chi-square or Fisher’s exact tests for categorical variables and the nonparametric two-sample Wilcoxon rank-sum test for age, GCS score, number of hospital days, and number of intensive care unit days were used for data analysis. Multiple logistic regression for both stoma formation and transfer to rehabilitation was performed. Results for race and other potential covariates are reported as ORs with their 95% CIs. To account for the missing values for some of the covariates used in the logistic regression, a sensitivity analysis was conducted using multiple imputation with the Markov chain Monte Carlo method.⁴¹ A *p*-value <0.05 was considered statistically significant for all analyses.

RESULTS

The final cohort in this study included 7,324 patients (4,916 black, 2,408 white) with penetrating colon trauma who underwent operative intervention. More than 67% of the cohort consisted of black patients, compared with only 33% white males, demonstrating the disproportionate incidence of penetrating abdominal trauma in the black population. Using the general male population to infer expected incidence, \cong 12% of the patients would be expected to be black and 88% white.^{17,42} In the study cohort, black patients and white patients underwent fecal diversion with stoma formation at similar rates (19.6% vs 18.5%, *p*=0.28).

Patient-level data are summarized in Table 1. Black patients were younger (median age, 27 years, IQR, 21–35 years) than white patients (median age, 35 years, IQR, 25–49 years). In addition, black patients were more likely to be uninsured (self-pay; 37.1% vs 29.9%), less likely to have private insurance (15.2% vs 25.7%), and more likely to be injured by firearms (88.3% vs 70.2%, *p*<0.001). Black patients had an ISS >15 more frequently than white patients (51.3% vs 44.9%, *p*<0.001). Per univariate analysis, black patients were less likely

to transfer to rehabilitation after their hospital admission (10.5% vs 14.1%, $p<0.001$). Subcategories of the “transfer to rehabilitation” variable were also analyzed, with black men less likely to transfer to most of the facilities (Appendix Table 1, available online). Mortality was similar between the two groups, but black patients had a lower overall morbidity (52.6% vs 55.3%, $p=0.04$).

Hospital-level data were relatively consistent for the two groups (Table 2), although black patients were more often treated at a Level I trauma center and university hospital settings.

A subset analysis of the South region of the NTDB was performed. This subpopulation included 3,297 patients (2,198 black, 1,099 white). There were no obvious differences in study outcomes in the South region, as compared with the entire U.S. Stoma formation was again similar for black and white patients (20.2% vs 19.3%, $p=0.6$). Median hospital days were the same for black men and white men (9.0, IQR, 6–17 vs 9.0, IQR, 5–19, $p=0.7$) and median intensive care unit days were fewer for black men (4.0, IQR, 2–10 vs 5.0, IQR, 3–12, $p=0.001$). The South region again demonstrated a lower rate of transfer to rehabilitation (9.1% vs 12.8%, $p=0.002$) and lower overall morbidity (56.6% vs 60.7%, $p=0.04$) in black patients.

Per multivariable analysis of the records of patients who underwent stoma formation, the odds of stoma formation were similar for black versus white patients (Table 3). Firearm-generated penetrating trauma, higher ISS at presentation, increased time to operation, Northeast region compared with the South region, and a high number of trauma surgeons correlated with increased odds of receiving a stoma. Self-pay patients (no insurance) had decreased odds of receiving an ostomy compared with those with private or government-based health insurance.

Although univariate analysis demonstrated that fewer black patients were transferred from the hospital to rehabilitation, multivariable analysis did not demonstrate a significant difference between races (Table 4). Transfer to rehabilitation following penetrating colon trauma and operative intervention was associated with higher age, higher ISS, higher Abbreviated Injury Scale abdomen score, firearm injury, treatment in the Northeast region compared with the South, and the presence of private or government insurance compared with self-pay. Transfer to rehabilitation was negatively associated with a higher GCS at presentation.

Because of the missingness of data for certain variables (0.01%–13.6%), a sensitivity analysis was performed to test the consistency of the analyses. Using imputation, the OR for black race was similar to the original data for stoma formation (0.90, $p=0.14$ vs 0.92, $p=0.35$) and for transfer to rehab (0.95, $p=0.50$ vs 1.03, $p=0.78$). This provides evidence that the original analyses are generalizable even with some incomplete variables.

DISCUSSION

This study did not demonstrate a difference in stoma formation or in transfer to rehabilitation among black versus white patients experiencing penetrating colon trauma. As

expected, trauma severity (including injury by firearms and a higher ISS) increased the odds of stoma formation and transfer to rehabilitation.

Interestingly, patients with self-pay insurance had lower odds of stoma formation. This association is likely due to uncontrolled factors. It is possible that a biased decision was made by the surgeon to attempt to prevent additional expensive procedures and hospitalizations. Further work is needed to assess the relationship of insurance status in stoma formation.

Mortality was similar among black and white patients. However, white patients had a higher rate of overall postoperative morbidity. Unfortunately, these data further confirm findings from other studies^{34–37,43} that blacks suffer disproportionately from penetrating abdominal trauma, with a preponderance of fireman injury. In this study, blacks comprised 67% of males with penetrating colonic trauma who survived injury and reached the operating room, whereas extrapolation from Census data would predict only 12% of patients would be black if no disparities in injuries occurred.⁴² For comparison, only 7% of motor vehicle crash patients were black in a recent trauma study using the NTDB.⁸

Trauma care, unlike other specialties in medicine, involves a multidisciplinary, systematic approach to patients, beginning in the prehospital setting, through the designation of trauma centers and the use of the Advanced Trauma Life Support algorithms.⁴⁴ To be designated as a trauma center, specific criteria must be met; quality measurement on a national level helps ensure that hospitals are compliant with standards of care and follow management approaches consistent with current evidence-based literature.⁴⁴ Standardized systems often dictate trauma care, given the acute, emergency nature of injuries.^{45–47} In addition, multiple healthcare professionals, including multiple surgeons, are often caring for an individual patient, which may also play a role in reducing potential racial or other biases in trauma care.⁸ It is possible that rigorous trauma systems and adoption of the evidence-based guideline recommending primary repair of penetrating colon injuries have minimized racial disparities, potentially through decreasing the need for subjective decision making by the surgeon or healthcare team. Nonetheless, in some areas of trauma care, racial disparities persist, as evidenced by multiple studies^{7,10,12,48–53} and by a recent systematic review and meta-analysis.⁴⁹ Haider et al.^{51,52,54} argued, in a series of articles, that perhaps unconscious racial bias contributes to some racial disparities in health care.

Many studies of racial disparities in trauma care have addressed rehabilitation of patients with brain injury.^{10–12} Other studies of racial disparities in trauma care have not focused on a specific area of injury and simply evaluated overall morbidity and mortality,^{7,48–50,53} although some have looked at hospital-level factors.^{48,50} By contrast, this study concentrated on a specific injury: penetrating colon trauma that required operative intervention. This is the first study on racial disparities in patients with penetrating colon trauma. One prior single-institution study on socioeconomic and insurance status disparities in patients with bowel injuries was found during literature review.⁵⁵

In civilians, the principles of managing penetrating colon trauma have changed significantly over the past 50 years, favoring primary repair.^{23,24,57,58} In 2000, Demetriades and

colleagues²⁷ advocated considering, in all patients with penetrating colon trauma, primary anastomosis without diversion. In patients who did undergo primary anastomosis without diversion (versus those who had stoma formation), a meta-analysis of six RCTs demonstrated a similar mortality rate and a potentially decreased complication rate.^{58,59} Recently, racial and socioeconomic disparities have been demonstrated in ostomy reversal.^{60,61} Studies of rectal cancer patients using national databases have demonstrated a higher rate of stoma formation in black (versus white) rectal cancer patients,^{29,30} though the disease factors attributing to such differences may be distinct from those in the trauma population.

Results of this study did not support the hypothesis that, in black patients, stoma formation rates would be higher and postoperative outcomes worse. Instead, no meaningful difference was found between the two racial groups.

Limitations

By using the NTDB, it is possible to capture a large cohort of patients with penetrating colon injury throughout the U.S. Although the NTDB has been criticized in the past for missing and inaccurate data, those concerns have lessened after the most recent updates of the data dictionary in 2007.⁵⁶ One limitation of this database includes the absence of prehospital data, particularly transportation time, which, if prolonged, may cause tissue devitalization and fecal contamination, spoiling conditions for a primary repair and increasing the chance of stoma formation. Another concern is its potential bias of trauma data, because it includes records from mainly Level I and Level II trauma centers. In the past, the NTDB was able to link ZIP code data to income as an additional marker of SES; however, such linkage is no longer available. Furthermore, the NTDB does not offer data on cost of care, which could be useful for further analysis of disparities. The NTDB does not allow for adjustment for important confounders of estimated blood loss and the need for blood transfusions because such data were unavailable. Lastly, outcomes are limited to morbidity and mortality associated with the admission trauma, length of stay, and discharge disposition. Subsequent hospitalizations and procedures outside of the initial trauma admission, including rates and timing of ostomy reversal, cannot be captured within this database.

CONCLUSIONS

This study did not demonstrate a difference in stoma formation or in transfer to rehabilitation or rehabilitation among black versus white patients with penetrating colon trauma that required operative intervention. Trauma severity increased the odds of both of those outcomes. The acute, emergent nature of penetrating injuries and the systematic approach to trauma care may help protect against disparate outcomes between races, but further research is needed. The factors that influence racial disparities are complex, perhaps occurring in only certain aspects of trauma care and likely involving unconscious biases or even specific patient, hospital, and caregiver attributes. A protocol-based management approach to emergency trauma care could decrease the risk of racial disparities. Identifying areas that lack obvious racial disparities is as important as identifying areas where disparities are at play, so that future research can elucidate the mechanisms behind racial disparities in trauma care.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1.

Patient-level Characteristics (n=7,324 Patients: 4,916 Black, 2,408 White)

Characteristics	White	Black	p-value
Age, years, median (IQR)	35.0 (25–49)	27.0 (21–35)	<0.001
Insurance status, n (%)			<0.001
Private insurance	619 (25.7)	748 (15.2)	
Government pay	791 (32.9)	1,684 (34.3)	
Self-pay	719 (29.9)	1,823 (37.1)	
Other/unknown	279 (11.6)	661 (13.5)	
Admission			
GCS score, median (IQR)	15.0 (14.5–15)	15.0 (15–15)	0.6
Head injury documented, n (%)	84 (3.5)	189 (3.8)	0.5
AIS head >3	33 (39.3)	87 (46.0)	0.4
Hypotension (SBP <90 mmHg), n (%)	238 (10.5)	448 (10.1)	0.6
Time to procedure >6 hours, n (%)	118 (5.6)	186 (4.3)	0.03
ISS >15, n (%)	1,038 (44.9)	2,358 (51.3)	<0.001
AIS abdomen >3	349 (14.5)	793 (16.2)	0.07
Type of penetrating injury, n (%)			<0.001
Cut/pierce	717 (29.8)	573 (11.7)	
Firearms	1,689 (70.2)	4,343 (88.3)	
Selected comorbidities, n (%)			
Bleeding disorder	54 (2.4)	49 (1.1)	<0.001
Cirrhosis	19 (0.8)	4 (0.1)	<0.001
Congestive heart failure	22 (1.0)	13 (0.3)	<0.001
Current smoker	555 (24.5)	1,017 (22.5)	0.07
COPD	100 (4.4)	276 (6.1)	0.004
Diabetes mellitus	110 (4.9)	109 (2.4)	<0.001
Disseminated cancer	11 (0.5)	6 (0.1)	0.009
Hypertension	355 (15.7)	351 (7.8)	<0.001
Myocardial infarction	19 (0.8)	8 (0.2)	<0.001
Morbid obesity (BMI >40)	171 (7.5)	261 (5.8)	0.005

Characteristics	White	Black	p-value
At least one NTDB comorbidity	1,592 (70.2)	2,586 (57.1)	< 0.001
Outcomes			
Stoma formation, <i>n</i> (%)	446 (18.5)	963 (19.6)	0.3
Loop ostomy	30 (1.3)	138 (2.8)	< 0.001
End ostomy	418 (17.4)	842 (17.1)	0.8
Hospital days, median (IQR)	9.0 (5–17)	9.0 (6–17)	0.1
ICU days, median (IQR)	5.0 (2–11)	4.0 (2–9)	0.01
Complications, <i>n</i> (%)			
Bleeding	22 (1.0)	36 (0.8)	0.4
Superficial SSI	89 (3.9)	164 (3.4)	0.4
Deep SSI	74 (3.2)	170 (3.6)	0.5
Organ space SSI	123 (5.4)	254 (5.3)	1.0
Overall morbidity	1,272 (55.3)	2,508 (52.6)	0.04
Mortality	230 (9.6)	452 (9.2)	0.6
Transfer to rehabilitation, <i>n</i> (%)	298 (14.1)	446 (10.5)	< 0.001

Note: Boldface indicates statistical significance ($p < 0.05$).

AIS, Abbreviated Injury Scale; COPD, chronic obstructive pulmonary disorder; GCS, Glasgow Coma Scale; ICU, intensive care unit; IQR, interquartile range; ISS, Injury Severity Score; SBP, systolic blood pressure; NTDB, National Trauma Data Bank; SSI, surgical site infection.

Table 2.

Hospital-level Characteristics (N=7,324 Patients: 4,916 Black, 2,408 White)

Characteristics	White	Black	p-value
Region, <i>n</i> (%)			<0.001
Midwest	483 (20.1)	1,227 (25.0)	
Northeast	328 (13.6)	988 (20.1)	
South	1,099 (45.6)	2,198 (44.7)	
West	498 (20.7)	501 (10.2)	
Trauma center level, <i>n</i> (%)			<0.001
Level I	1,429 (68.4)	3,388 (79.9)	
Level II, III, IV	661 (31.6)	853 (20.1)	
Hospital type, <i>n</i> (%)			<0.001
Community	753 (31.3)	1,152 (23.4)	
Nonteaching	249 (10.3)	298 (6.1)	
University	1,406 (58.4)	3,466 (70.5)	
Number of trauma surgeons, <i>n</i> (%)			0.008
0–3	93 (3.9)	194 (4.0)	
4–8	1,755 (72.9)	3,416 (69.5)	
>8	560 (23.3)	1,306 (26.6)	

Note: Boldface indicates statistical significance ($p < 0.05$).

Table 3.

Odds of Stoma Formation, per Logistic Regression

Characteristics	OR (95% CI)	p-value
Race (black)	0.92 (0.78, 1.09)	0.4
Payment		
Private insurance	1.17 (0.95, 1.43)	0.1
Government	1.16 (0.97, 1.38)	0.1
Other/unknown	1.28 (1.02, 1.61)	0.03
Self-pay (ref)	–	–
Injury by firearm	3.74 (2.86, 4.90)	<0.001
Age (5-year increments)	1.02 (0.99, 1.05)	0.1
GCS total score 8	0.91 (0.73, 1.14)	0.4
ISS score >15	1.59 (1.36, 1.85)	<0.001
AIS abdomen >3	1.07 (0.88, 1.30)	0.5
Time to procedure >6 hours	1.40 (1.02, 1.91)	0.04
At least one comorbidity	1.00 (0.86, 1.17)	1.0
Obesity (BMI 40)	1.12 (0.85, 1.48)	0.4
Region		
Midwest	0.85 (0.69, 1.04)	0.1
Northeast	1.23 (1.02, 1.47)	0.03
West	0.86 (0.65, 1.13)	0.3
South (ref)	–	–
Trauma center level I	0.84 (0.66, 1.06)	0.1
Teaching hospital	1.16 (0.94, 1.43)	0.2
Trauma surgeons >8	1.30 (1.12, 1.52)	0.001

Note: Boldface indicates statistical significance ($p < 0.05$).

AIS, Abbreviated Injury Scale; GCS, Glasgow Coma Scale; ISS, Injury Severity Score.

Table 4.

Odds of Transfer to Rehabilitation, per Logistic Regression

Characteristics	OR (95% CI)	p-value
Race (black)	1.03 (0.82, 1.30)	0.8
Payment		
Private insurance	2.54 (1.89, 3.40)	<0.001
Government	2.09 (1.60, 2.73)	<0.001
Other	1.38 (0.96, 2.00)	0.08
Self-pay (ref)	–	–
Injury by firearm	1.64 (1.21, 2.21)	0.001
Age (5-year increase)	1.24 (1.19, 1.28)	<0.001
GCS total score 8	0.60 (0.44, 0.83)	0.002
ISS score >15	2.77 (2.21, 3.46)	<0.001
AIS abdomen >3	1.33 (1.03, 1.73)	0.03
Time to procedure >6 hours	1.44 (0.97, 2.14)	0.07
At least one comorbidity	0.97 (0.78, 1.20)	0.8
Obesity (BMI 40)	1.39 (0.97, 1.99)	0.07
Region		
Midwest	1.30 (0.99, 1.72)	0.061
Northeast	1.82 (1.42, 2.32)	<0.001
West	0.95 (0.65, 1.38)	0.8
South (ref)	–	–
Trauma center I	0.84 (0.60, 1.17)	0.3
Teaching hospital	1.15 (0.86, 1.55)	0.3
Trauma surgeons >8	1.08 (0.87, 1.34)	0.5

Note: Boldface indicates statistical significance ($p < 0.05$).

AIS, Abbreviated Injury Scale; GCS, Glasgow Coma Scale; ISS, Injury Severity Score.