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African–American and Caucasian mortalities are the same after traumatic injury: pair matched analysis from a national data

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ABSTRACT

Background African–Americans have worse outcomes than Caucasians in many clinical conditions studied, including trauma. We sought to analyze if mortality is different in these groups through analysis of a national data set.

Methods Recent data from the national Trauma Quality Improvement Program were assessed with analysis, including all African–American or Caucasian patients who were brought to level I or level II trauma centers for care. Propensity scores were calculated for each African–American patient using age, sex, InjurySeverity Score (ISS), GlasgowComa Scale (GCS), injury type, insurance information and American College of Surgeons trauma level. The primary outcome of this study was in-hospital mortality, and the secondary outcomes were hospital length of stay and discharge disposition.

Results A total of 82 150 (13.65%) out of 601 768 patients who qualified for the inclusion in the study were African–American. The remaining 519 618 (86.35%) were Caucasian. The median age (IQR) of the patients was 54 (33 to 72) years old, and approximately two-thirds of the patients were male. The median ISS and GCS score were 12 (9 to 17) and 15 (15 to 15), respectively. More than 90% of patients sustained blunt injuries. Overall, there was no significant difference found in overall in-hospital mortality between Caucasians and African–American patients (3% vs. 2.9%, p=0.2); however, the median (95% CI) hospital length of stay was 1 day longer in African–American patients compared with Caucasian patients (5 (5.5) vs. 4 (4.4), p<0.001). When the discharged destinations between the two groups were compared, a higher proportion of Caucasians were discharged to home without services (66% vs. 33%).

Conclusion Our study showed that trauma mortalites among African–American and Caucasians are the same. Efforts to mitigate the ethnic and racial biases in the delivery of healthcare should continue, and these results (no differences in mortality) should be validated in other clinical settings.

Level of evidence Level II.

INTRODUCTION

The disparity in healthcare delivery and outcomes among ethnic minorities in the USA is not a new topic of discussion. Efforts have been implemented to mitigate ethnic and racial bias, including education and training, improvement of equity in access to care, enhancement of regulatory vigilance, monitoring of managed care and improvement of data systems to monitor the quality of medical care.[1] These efforts have met with variable success, and recently, an analysis of hospital data accountability found that the algorithm used for the assigned risk score for the patients resulted in less access to specialized care for African–American patients.[2] Disparities continue to exist.

Many studies have evaluated the impact of race on clinical outcomes. African–American race represents a significant risk factor for adverse outcome in many clinical diseases.[3–7] When insurance coverage is taken into account, disparities in outcome between races remain.[8] Acute trauma care represents a unique situation where delivery of healthcare is expected to be provided immediately without the patient's race, ethnicity or insurance coverage. Compared with Caucasian patients, a recent study showed that there is increased mortality among African–American trauma patients.[9] However, another recent population-based study found no significant difference in mortality between Caucasian and African–American patients after a traumatic injury.[10]

The reasons behind the variability in mortality in different studies are not well understood. One explanation is that it may be the existence of implicit bias at the point of care towards certain races that affect outcome[11] or the use of different variables and methodologies in the NTDB (National Trauma Data Bank) adopted in these studies to draw conclusions.[12] This study was designed to answer the same question, whether African–American race has adversely impacted outcomes when compared with Caucasian counterparts after an injury using recent data from national Trauma Quality Improvement Program (TQIP) data set, and exact matching methodology was adopted to balance the characteristics.

METHODS

Data sources and data extraction

The adult TQIP database from 2011 to 2016 was accessed for the study. The TQIP is considered a quality improvement program by the American College of Surgeons (ACS). More than 825 trauma centers all across the USA currently participate in the TQIP program (https://www.facs.org/quality-programs/trauma/tqp/center-programs/tqip; accessed date December 3, 2019). The TQIP also provides feedback two times a year to participating institutions on certain quality indicators. All African–Americans and Caucasians who sustained injury and were treated at level I and level II trauma centers were included in the study. Other patient

Table 1 Characteristics of patients before matching

		Unmatched analysis			Exact matched analysis		
Variable	Values	Not African–American (n=519 618)	African–American (n=82 150)	P values	Not African–American (n=56 161)	African–American (n=56 161)	P value
Age	Median (Q1 to Q3)	57 (37 to 74)	37 (25 to 55)	<0.001	42 (27 to 59)	42(27 to 59)	1
Sex	Female	197 616 (38)	20 014 (24.4)	<0.001	14 808 (26.4)	14 808 (26.4)	1
	Male	322 002 (62)	62 136 (75.6)		41 353 (73.6)	41 353 (73.6)	
Hypotension	0	503 073 (96.8)	77 937 (94.9)	<0.001	55 546 (98.9)	55 546 (98.9)	1
	1	16 545 (3.2)	4213 (5.1)		615 (1.1)	615 (1.1)	
ISS	Median (Q1 to Q3)	12 (9 to 17)	12 (9 to 18)	<0.001	10 (9 to 17)	10 (9 to 17)	1
GCS score	Median (Q1 to Q3)	15 (15 to 15)	15 (14 to 15)	<0.001	15 (15 to 15)	15 (15 to 15)	1
Injury type	Blunt	495 856 (95.4)	56 859 (69.2)	<0.001	46 300 (82.4)	46 300 (82.4)	1
	Penetrating	23 762 (4.6)	25 291 (30.8)		9861 (17.6)	9861 (17.6)	
Insurance	Blue Cross/Blue Shield	23 915 (4.6)	2181 (2.7)	<0.001	1433 (2.6)	1433 (2.6)	1
	Medicaid	49 081 (9.4)	19 469 (23.7)		11 558 (20.6)	11 558 (20.6)	
	Medicare	175 971 (33.9)	13 101 (15.9)		11 175 (19.9)	11 175 (19.9)	
	No fault automobile	25 867 (5)	2937 (3.6)		2086 (3.7)	2086 (3.7)	
	Not billed (for any reason)	1245 (0.2)	492 (0.6)		126 (0.2)	126 (0.2)	
	Other	15 181 (2.9)	2721 (3.3)		1420 (2.5)	1420 (2.5)	
	Other government	11 893 (2.3)	2573 (3.1)		1422 (2.5)	1422 (2.5)	
	Private/commercial insurance	152 989 (29.4)	18 005 (21.9)		14 039 (25)	14 039 (25)	
	Self-pay	54 497 (10.5)	19 887 (24.2)		12 353 (22)	12 353 (22)	
	Workers' compensation	8979 (1.7)	784 (1)		549 (1)	549 (1)	
ACS trauma level				<0.001			1
	I	349 881 (67.3)	64 041 (78)		44 347 (79)	44 347 (79)	
	II	169 737 (32.7)	18 109 (22)		11 814 (21)	11 814 (21)	

Hypotension denotes a systolic blood pressure of <90 mm Hg.
ACS, American College of Surgeons; GCS, Glasgow Coma Scale; ISS, Injury Severity Score.

characteristics included age (between 16 and 89 years), sex, InjurySeverity Score (ISS), injury type, Abbreviated Injury Scale (AIS) of different body regions, Glasgow Coma Scale (GCS), initial vital signs (heart rate and initial systolic blood pressure (iSBP), presence of hypotension on initial presentation (defined as iSBP <90 mm Hg) and whether insurance coverage was present. Patients aged <16 years old and identified as members of other races (eg, Hispanic or Asian) were excluded from the study. Patients who presented with no signs of life were also excluded from the study (please see table 1).

Outcomes

The primary outcome of this study was in-hospital mortality and the secondary outcomes were hospital length of stay and discharge disposition.

Statistical methods

Univariate analysis

The patient's demography, injury, insurance information and outcomes were compared between the African–American and Caucasian groups. Data were summarized using summary statistics (median with IQR (first quartile to third quartile) for continuous variables, and frequency and percentage for categorical variables) as described previously.[13] The two groups were compared using the Wilcoxon rank-sum test for the continuous variables and the χ^2 test for the categorical variables.[13] Since there were significant differences identified in univariate analysis on baseline patient characteristics, therefore matching methodology was used to balance the two groups.

Exact matching and pair matched analysis

The first step in performing the exact matching was to calculate the estimated propensity score for each African–American patient using age, sex, ISS, GCS score, injury type, insurance

Table 2 AbbreviatedInjury Scale score of ≥2 different body regions

Variable	Values	All (N=601 768)	Not African–American (n=519 618)	African–American (n=82 150)
Abdomen	0	531 137 (88.3)	463 287 (89.2)	67 850 (82.6)
	1	70 631 (11.7)	56 331 (10.8)	14 300 (17.4)
Brain	0	386 823 (64.3)	329 046 (63.3)	57 777 (70.3)
	1	214 945 (35.7)	190 572 (36.7)	24 373 (29.7)
Face	0	550 195 (91.4)	475 352 (91.5)	74 843 (91.1)
	1	51 573 (8.6)	44 266 (8.5)	7307 (8.9)
Neck	0	593 602 (98.6)	513 082 (98.7)	80 520 (98)
	1	8166 (1.4)	6536 (1.3)	1630 (2)
Pelvis	0	571 990 (95.1)	494 321 (95.1)	77 669 (94.5)
	1	29 778 (4.9)	25 297 (4.9)	4481 (5.5)
Spine	0	586 322 (97.4)	507 136 (97.6)	79 186 (96.4)
	1	15 446 (2.6)	12 482 (2.4)	2964 (3.6)
Thorax	0	410 006 (68.1)	355 054 (68.3)	54 952 (66.9)
	1	191 762 (31.9)	164 564 (31.7)	27 198 (33.1)
Extremities	0	385 543 (64.1)	332 477 (64)	53 066 (64.6)
	1	216 225 (35.9)	187 141 (36)	29 084 (35.4)

Table 3 AbbreviatedInjury Scale score >2 of different body regions

Variable	Values	All (N=112 322)	Not African–American (n=56 161)	African–American (n=56 161)
Abdomen	0	98 339 (87.6)	49 157 (87.5)	49 182 (87.6)
	1	13 983 (12.4)	7004 (12.5)	6979 (12.4)
Brain	0	78 805 (70.2)	39 422 (70.2)	39 383 (70.1)
	1	33 517 (29.8)	16 739 (29.8)	16 778 (29.9)
Face	0	103 794 (92.4)	52 133 (92.8)	51 661 (92)
	1	8528 (7.6)	4028 (7.2)	4500 (8)
Neck	0	110 753 (98.6)	55 339 (98.5)	55 414 (98.7)
	1	1569 (1.4)	822 (1.5)	747 (1.3)
Pelvis	0	106 940 (95.2)	53 737 (95.7)	53 203 (94.7)
	1	5382 (4.8)	2424 (4.3)	2958 (5.3)
Spine	0	109 326 (97.3)	54 882 (97.7)	54 444 (96.9)
	1	2996 (2.7)	1279 (2.3)	1717 (3.1)
Thorax	0	78 062 (69.5)	38 545 (68.6)	39 517 (70.4)
	1	34 260 (30.5)	17 616 (31.4)	16 644 (29.6)
Extremities	0	71 937 (64)	36 952 (65.8)	34 985 (62.3)
	1	40 385 (36)	19 209 (34.2)	21 176 (37.7)

information and ACS trauma level. Then, the one-to-one exact matching was performed using the R package 'MatchIt'.[14] Again, the data were summarized using summary statistics as described previously. The pair matched analyses were performed using the Wilcoxon signed-rank test to compare the groups on the continuous variables and McNemar's test for categorical variables. If there was more than two categories, the Stuart-Maxwell test was performed as described previously.[13] The Kaplan-Meier procedure was used to estimate the median time, and the SE was estimated using Greenwood's formula.[15] Kaplan-Meier curves were generated. The log-rank test was used to compare the time (Kaplan-Meier curves) between groups as described previously.[13] All p values were two sided and values of <0.05 were considered statistically significant. All statistical analyses were performed using the R language.[16]

RESULTS

A total of 82 150 (13.65%) out of 601 768 patients who qualified for the inclusion in the study were African–American. The remaining 519 618 (86.35%) were Caucasian. The median age of the patients was 54 (IQR 33 to 72) years old, and approximately two-thirds of the patients were male. The median ISS and GCS score were 12 (IQR 9 to 17) and 15 (IQR 15 to 15), respectively. More than 90% of patients sustained blunt injuries. Head injury and extremity injuries were the two most common organ-specific injuries sustained by these patients (please see tables 1 and 2).

Unmatched (univariate) analysis

There were significant differences found between the Caucasians and African–American groups with respect to age (57 (37 to 74) vs. 37 (25 to 55)), male gender (62% vs. 75.6%), ISS (12 (9 to 17) vs. 12 (9 to 18)), penetrating trauma (4.6% vs. 30.8%) and insurance coverage, respectively. All p values were <0.001 (please see table 1). When the two groups were compared on AIS score of ≥2 on different body regions, the African–Americans sustained more torso injuries, whereas the Caucasians suffered from more head injury (please see table 2 for detailed information).

Exact matching and pair matched analysis

After one-to-one exact matching, each group contained 56 161 patients. No difference existed on the baseline patient's characteristics after matching (please see table 1). The median age, ISS and GCS score in both groups were 42 (27 to 59) years, 10 (9 to 17) and 15 (15 to 15). However, after matching, the proportion of most of the body region injuries between the groups was balanced except extremity injury. A higher proportion of African–American patients sustained extremity injury compared with their Caucasians counterpart (37.7% vs. 34.2%; see table 3).

Outcomes

There were no significant difference in overall in-hospital mortality between Caucasians and African–American patients (3% vs. 2.9%, $p=0.2$); however, the median (95% CI) hospital length of stay was 1 day longer in African–American patients compared with Caucasians (5 (5.5) vs. 4 (4.4), $p<0.001$) (please see table 4). When the discharged destinations between the two groups were compared, a higher proportion of Caucasians were discharged to home without services (66% vs. 33%; please see table 5).

DISCUSSION

Our study analyzed the recent TQIP data set and found no significant difference in overall in-hospital mortality between African–American and Caucasians trauma victims. However, African–American patients stayed longer in the hospital and required more additional services at the time of hospital discharge.

Most prior studies reported higher mortality among ethnic minority patients after trauma.[8] Haider and colleagues examined the NTDB data set almost 10 years ago and included only those patients aged 18–64 years who had an ISS of ≥9 and compared

Table 4 Outcomes

Variable	Before matching	All (N=601 768)	Not African–American (n=519 618)	African–American (n=82 150)	P value	OR (95% CI)	Absolute risk difference (95% CI)
Total death	0	569 649 (94.7)	491 872 (94.7)	77 777 (94.7)	0.852	0.997 (0.964 to 1.030)	−0.00017 (−0.0018 to 0.0015)
	1	32 119 (5.3)	27 746 (5.3)	4373 (5.3)			
	Exact matched	**All (N=112 322)**	**Not African–American (n=56 161)**	**African–American (n=56 161)**			
Total death	0	109 014 (97.1)	54 477 (97)	54 537 (97.1)	0.2	0.95 (0.87 to 1.03)	−0.001 (−0.003 to 0.001)
	1	3308 (2.9)	1684 (3)	1624 (2.9)			

Table 5 Discharged disposition

Variable	Values	All (N=109 014)	Not African–American (n=54 477)	African–American (n=54 537)	P value
Hospital disposition	Another hospital	3275 (3)	1713 (3.1)	1562 (2.9)	<0.001
	Home: healthcare	7958 (7.3)	3493 (6.4)	4465 (8.2)	
	Home: no services	70 763 (64.9)	36 293 (66.6)	34 470 (63.2)	
	Hospice care	370 (0.3)	207 (0.4)	163 (0.3)	
	Intermediate care	826 (0.8)	325 (0.6)	501 (0.9)	
	Left against medical advice	1298 (1.2)	644 (1.2)	654 (1.2)	
	Long-term care	5640 (5.2)	2664 (4.9)	2976 (5.5)	
	Skilled nursing care	18 884 (17.3)	9138 (16.8)	9746 (17.9)	

African–Americans, Hispanics and Caucasians.[8] They included more than 400 000 patients in their analysis and found higher in-hospital mortality among the African–American and Hispanic populations in unadjusted and adjusted analyses. The uninsured Hispanic patients had the highest odd of mortality followed by African–Americans (2.30, 95% CI 2.13 to 2.49; 1.78, 95% CI 1.65 to 1.90), respectively. The same authors and colleagues later performed a systemic review; 7 out of initially 35 selected studies showed higher odds of mortality among African–American patients compared with Caucasian counterparts (1.19, 95% CI 1.09 to 1.31).[9]

Contrary to previous studies, our study used the ACS–TQIP database data. ACS sends the feedback to all participating trauma centers all across the USA on some of the quality matrix, including in-hospital mortality, using the same database. Our study clearly showed no significant difference in mortality outcome regardless of the patients being African–American or Caucasian. This result may surprise some of the readers, but the important point to note is that we used very recent national quality data. Furthermore, we also used exact matching methodology to balance the two ethnic groups (black and white patients). We matched insurance coverage as well to determine if disparity in race generated the disparity in mortality (no disparity was noted). This may reflect the positive influence of ongoing efforts to limit implicit or explicit biases at the point of care, at least among trauma providers. A recent survey study among clinicians in an acute care setting found no implicit bias in the decision-making process,[17] which may represent more evidence of progress.

Limitation

Although the study was performed using a well-recognized national quality database, the retrospective nature of the study carries inherent limitations. We attempted to include all the available characteristics of the patients that can influence the mortality and did exact matching on one-to-one basis to balance the group; however, exact matching cannot account for unobserved variables.

CONCLUSION

Our study showed that trauma mortalities among African–Americans and Caucasians are the same. Efforts to mitigate the ethnic and racial biases in the delivery of healthcare should continue, and these results (no differences in mortality) should be validated in other clinical settings.

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