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Lower extremity vascular injuries: Increased mortality for minorities and the uninsured?

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Abstract

Background—There is increasing evidence to suggest that racial disparities exist in outcomes for trauma. Minorities and the uninsured have been found to have higher mortality rates for blunt and penetrating trauma. However, mechanisms for these disparities are incompletely understood. Limiting the inquiry to a homogenous group, those with lower extremity vascular injuries (LEVIs), may clarify these disparities.

Methods—The National Trauma Data Bank (NTDB; version 7.0, American College of Surgeons) was used for this study. LEVIs were identified using codes from the International Classification of Diseases, 9th revision. Univariate and multivariate analyses were performed using Stata software (version 11; StataCorp, LP, College Station, TX).

Results—Records were reviewed for 4,928 LEVI patients. The mechanism of injury was blunt in 2,452 (49.8%), penetrating in 2,452 (49.8%), and unknown in 24 cases (0.5%). Mortality was similar by mechanism (7.6% overall). Regression analysis using mechanism as a covariate revealed a significantly worse mortality for people of color (POC; odds ratio [OR], 1.45; 95% confidence interval [CI], 1.03-2.02; $P = .03$) and the uninsured (UN; OR, 1.62; 95% CI, 1.15-2.23; $P = .006$). However, when separate analyses were performed stratifying by mechanism, no significant mortality disparities were found for blunt trauma (POC OR, 1.28; 95% CI, 0.85-1.96; $P = .23$; UN OR, 1.33; 95% CI, 0.78-2.22; $P = .29$), but disparities remained for penetrating trauma (POC OR, 1.81; 95% CI, 0.93-3.57; $P = .08$; UN OR, 1.85; 95% CI, 1.18-2.94; $P = .009$).

Conclusion—For patients with LEVI, mortality disparities based on race or insurance status were only observed for penetrating trauma. It is possible that injury heterogeneity or patient cohort differences may partly explain mortality disparities that have been observed between racial and socioeconomic groups. (*Surgery* 2011;150:656-64.)

In 1985, the US Department of Health and Human Services reported the results of a landmark study that found that 60,000 excess deaths occur in minority populations each year.¹ “Excess deaths” is defined as the difference between the number of deaths observed

in minority populations and the number of deaths that would be expected if that group had the same age- and sex-specific death rate as the majority population. Both racial and socioeconomic disparities have been revealed for a wide variety of illnesses, not only with respect to outcomes but also for risk factors, disease incidence,² and health care options offered to patients.³⁻⁶

Theoretically, trauma care should be “color-blind” and “insurance-blind,” because trauma systems have evolved to provide care on the basis of need and not ability to pay or ethnicity.⁷ In practice, however, injury mortality has been shown to be higher among the uninsured and specific racial groups, particularly African Americans and Latinos, even when controlling for severity of injury.⁸⁻¹² In fact, disparities exist even for specific mechanisms of injury, such as motorcycle crashes and pedestrians struck by automobiles.^{8,10} What remains unclear are the underlying causes of these observed differences. Trauma care protocols and services do not appear to explain race or socioeconomic status outcome disparities.^{13,14} Some researchers have found genetic differences between races for particular disease states, such as diabetes¹⁵⁻¹⁷ and hypertension.^{18,19} Still other investigators have found that outcome disparities for the uninsured, Medicaid patients, and people of color are at least partially attributable to differences in baseline health characteristics and hospital performance.^{20,21}

Interestingly, not all populations have exhibited these differences. For example, disparities have been found among vascular surgery patients and for cardiovascular disease,²²⁻²⁴ but in a large, Veterans Administration (VA) study of vascular procedures, race was not found to be an important predictor of outcome.²⁵ The authors hypothesized that the VA system may benefit from equality of access and more standardized pre- and postsurgical health care. However, the VA is a unique health care system with a narrowly defined group of surgical procedures. Among trauma patients, heterogeneity of injury, imprecision of injury measurements, and/or a lack of standardized pre- or postinjury care may be contributing to observed disparities. The hypothesis of the study was that mortality rate disparities by race and socioeconomic status may be partly explained by injury heterogeneity. Therefore, limiting the analysis to a homogenous group of injured patients, those with lower extremity vascular injuries (LEVIs), disparities would be diminished or eliminated.

METHODS

Population

This is a retrospective cohort study using data derived from the National Trauma Data Bank (NTDB).²⁶ The NTDB is a multistate database of hospitalizations for trauma in the United States. It is the most complete national trauma database currently available, containing approximately 4 million records from 682 trauma centers in the United States and Canada. All data provided by the NTDB are deidentified. Permission was granted from the American College of Surgeons to query the data, and an institutional review board exemption was obtained from the Northwestern University Feinberg School of Medicine.

Patients with LEVIs were identified using the International Classification Diseases, 9th revision codes 904.0–904.8. All patients with LEVIs were studied, including patients with concomitant injuries, because isolated LEVIs were very rare. Uninsured patients were defined only as patients who were listed as “self-pay,” while patients with all other types of funding, including Medicaid and Medicare, were classified as insured. A person of color (POC) was defined as someone who was Latino, African American, Asian American, or Native American. Bivariate statistics were calculated for each racial group, but regression analyses were performed on the combined variable, POC, to improve statistical power. Mechanism of injury was categorized as blunt or penetrating, and the primary outcome of

interest was mortality during the index hospitalization, because these data are deidentified and taken at the incident level.

Statistical analysis

Univariate and multivariate analyses were performed using Stata11 software (StataCorp, LP, College Station, TX). The distribution of demographic and clinical characteristics is presented. Chi-square tests were used to compare the proportion of participants who died across demographic groups and by mechanism of injury. Multivariable logistic regression analysis was used to calculate odds ratios (ORs) and 95% confidence intervals (CIs) comparing mortality by demographic characteristic and mechanism. Logistic regression analyses controlled for age, gender, race, insurance status, Injury Severity Score (ISS), and initial systolic blood pressure (SBP). A regression model that included mechanism as a dichotomous covariate was compared with regression models stratified by mechanism. This was performed because of the a priori assumption that mechanism might be a confounder relating to both mortality and sociodemographics. Missing data were common for each of the covariates, comprising 5–10% of each set of values. To determine the effect of the missing data and increase the effective study sample size, imputed logistic regression models were also tested. These models yielded identical results as the nonimputed models.

Because the ISS is an imperfect measure of injury, particularly for penetrating trauma, a second set of models using the revised trauma score instead of the ISS and SBP were constructed and compared with the first set of regression results.²⁷ To evaluate whether the mechanism of injury (ie, blunt versus penetrating) modified the association of sociodemographic characteristics (eg, race or insurance status) with mortality, multiplicative interaction terms were entered into logistic regression models that also included lower order terms and other covariates (eg, age, SBP, and ISS). Goodness of fit tests were performed for all models.

RESULTS

Unadjusted mortality

Injuries were evenly split in the cohort between blunt and penetrating mechanisms (2,452 in each group). Gunshot wounds predominated among penetrating trauma victims ($n = 1,936$; 81%). Patients who suffered penetrating injuries were much more likely to be male (91.4% vs 75.4%; $P < .001$) compared with patients who suffered blunt injuries. They were also younger (mean age, 28.7 ± 12.2 years vs 37.9 ± 17.8 years; $P < .001$) and more likely to be a POC (76.6% vs 28.7%; $P < .001$). African Americans comprised 51.1% of penetrating LEVI patients, and Latinos comprised 19%, but only 12.1% and 10.5% of blunt injuries, respectively. Patients suffering penetrating trauma were also more likely to be uninsured (31% vs 12%; $P < .001$). Mean SBP was lower (110.3 ± 38.3 mm Hg vs 125.1 ± 33.6 mm Hg; $P < .001$), and the ISS was lower (12.5 ± 8.7 vs 15.8 ± 12.0 ; $P < .001$; Table I).

Those who died were older (mean age 39.6 ± 18.8 years vs 32.8 ± 15.6 years; $P < .001$), more likely to be a POC (58.9% vs 52.5%; $P = .019$), and more likely to be uninsured (31.7% vs 20.5%; $P < .001$; Table II).

When unadjusted mortality rates by mechanism were compared, mortality was higher for the uninsured who suffered both blunt and penetrating trauma. However, the mortality rates were similar for whites and POC with blunt trauma. The highest mortality rates were experienced by nonwhite, uninsured individuals who had penetrating LEVIs (Table III).

Adjusted mortality

Logistic regression analyses were performed comparing several different models of LEVI to determine independent predictors of mortality if mechanism was included as a covariate for an overall model or if stratified analyses were performed by mechanism. Regression diagnostics to determine covariate variance inflation factors (VIFs) yielded VIFs of 4-8, suggesting the collinearity of mechanism, race, and insurance status. The Prob > χ^2 for each model was <.001.

Table IV reports the association of demographic and clinical characteristics with mortality. An ISS >16 and a SBP <90 mm Hg were strongly and significantly associated with mortality (OR = 8 for both variables and all models). Being >55 years of age approximately doubled the risk of mortality in all models (all $P < .05$); but, gender, but gender was not associated with a mortality difference. When mechanism of injury was included as a covariate, excess mortality for the uninsured (OR, 1.61; 95% CI, 1.15–2.23; $P = .006$) and for nonwhites (OR, 1.45; 95% CI, 1.05–2.02; $P = .03$) was apparent. Mechanism alone was not significantly associated with mortality. Interaction effects were tested between mechanism and race, race and insurance, and mechanism, race, and insurance. No significant interaction effects were found.

However, when separate models were stratified by mechanism, conflicting results were found. For patients with blunt LEVIs, neither race (OR, 1.28; 95% CI, 0.85–1.93; $P = .24$) nor lack of insurance (OR, 1.33; 95% CI, 0.79–2.25; $P = .29$) predicted mortality. For individuals with penetrating LEVIs, lack of insurance remained significant (OR, 1.85; 95% CI, 1.16–2.94; $P = .009$), and there was a higher mortality among POC, although it failed to reach statistical significance (OR, 1.82; 95% CI, 0.93–3.6; $P = .08$). A final model for penetrating trauma mortality included mechanism of stab wound versus gunshot wound as a covariate. The results were not significant (OR, 1.91; 95% CI, 0.83–4.43; $P = .13$). Models using the revised trauma score did not change the direction or magnitude of the significance for any variable.

DISCUSSION

A large body of literature has emerged in the past several years noting that outcomes after trauma are not “color-blind” or “insurance-blind.” However, the mechanisms underlying these disparities are poorly defined. The hypothesis of this study was that injury heterogeneity may explain some of the mortality differences seen by race and insurance status. To test this, a relatively homogeneous injury type was selected, LEVI, and mortality statistics were compared. It was readily apparent that the demographic characteristics of patients injured by blunt and penetrating LEVI were very different, particularly with respect to race. POC clearly suffered a far higher incidence of penetrating LEVI.

This study found that by limiting comparisons to patients with a specific injury, some previously observed disparities in mortality lose significance. Mortality for blunt LEVI was not significantly affected by race or insurance status on either unadjusted or adjusted analysis. However, both race and insurance status continued to predict mortality after penetrating LEVIs, and the magnitude of this association was quite large. These results begin to provide an explanation for mortality differences after trauma. It suggests that mechanism is partly driving mortality disparities, although the underlying reasons for this are still unclear; genetic differences in the host response to penetrating injuries, provider bias in caring for those injured by violence, or poor performance of injury measurements for penetrating injuries may all contribute to observed differences. It is known that the ISS and other injury scores that are weighted toward a composite score of anatomic regions of injury simply do not adequately describe the severity of penetrating injury.²⁷⁻³⁰ A single blood

pressure reading in the emergency department is often all that can be used to help control for physiologic derangements in many large administrative data sets, which may also inadequately describe severity of illness. It suggests that improved methods of data collection and injury scoring for patients with penetrating injuries (such as the Penetrating Abdominal Trauma Index) may be helpful.²⁷

This study is not without limitations. First, it uses an administrative database, with the inherent limitations therein. The NTDB is a voluntary reporting database; therefore, distributions by race, mechanism, and other variables are not random within the sample and true population estimates cannot be calculated. Details such as estimated blood loss, which could help further ascertain injury severity, and comorbidities are not available in the NTDB. Because >80% of the sample was under 55 years of age and the mean ages for all groups were under 40, controlling for comorbidities may be less important than for nontraumatic surgical diseases, but it is still an important limitation. In addition, because the data set contains incident-level data, no late deaths after the index hospitalization were included. However, sound analyses of this and other administrative data sets have provided rich information on a variety of trauma topics, such as trauma transfers and outcomes disparities.^{8,31-35}

Second, it would also be interesting to compare disparities in mortality for specific injuries, such as femoral artery lacerations requiring repair, but the numbers were too small to allow for meaningful analysis at this time. This was particularly true when samples were limited to patients without concomitant injuries to other body areas. The data set was also of insufficient size to allow meaningful comparisons between races other than simply “white” versus “person of color.” In addition, these data are relatively old, and there have been marked advancements in both vascular and orthopedic surgical management of extremity wounds in the past decade. However, the data set is both comprehensive and inclusive, which allows for improved measures of association, and there is no reason to think that any of the independent variables or aspects of care of patients with LEVIs would have systematically changed by race or insurance status in the ensuing years. Nonetheless, as further data become available, validation of these and other findings will be important. It is also possible, as the sample sizes were <3000 in each arm, that stratified analysis was underpowered to detect the effects of race and insurance status in each arm separately. Finally, the findings of collinearity, the unadjusted mortality results by race and mechanism, and the marked differences in regression results after stratification are seemingly at odds with the lack of significance of interaction terms by mechanism in the regression models. It is possible that penetrating mechanism is so unevenly distributed within the sample that it is a symbol of some other, underlying disparity or that these results are simply related to chance, but this is unlikely given the entirety of the results.

In conclusion, this study has shown that mechanism of injury is an important consideration in the assessment of racial and insurance-based mortality disparities in trauma. This study suggests that the mechanism of injury may be an important confounder in the relationships between race, insurance status, and mortality, and it further emphasizes the gaps in data collection and injury severity assessment for penetrating trauma. It highlights the need for improved measures of injury severity in penetrating trauma and ongoing research to further qualify the ultimate sources of these mortality differences.

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DISCUSSION

Dr Mary-Margaret Brandt (Ann Arbor, MI): Using the National Trauma Data Bank to answer this ongoing question of where the disparities are in care, where they come from, and how we fix them is a really difficult problem. And I applaud you for this very complex and interesting effort.

Using the single diagnosis of lower extremity vascular injuries, I think, was an interesting tack, although I do have a few observations and some questions. Is your mechanism actually really a surrogate for socioeconomic status, penetrating? Injuries were much more common in the uninsured and also in people of color. Why did you pick 55 years of age as your age cutoff, if 65 is retired and over 40 is an old burn patient? Would you want to do quartiles or break that down a little more differently into different groups? And were there actually older, meaning octogenarians, who had blunt injuries? I think are first blush, lower extremity vascular injury seems very clean. But then when you get beyond---to blunt versus penetrating---we know blunt is fairly well scored with the injury severity score and penetrating is horribly done. And then you go from penetrating---is it a gunshot wound, is it a shotgun wound, is it a knife wound? That makes it even more difficult to tease out the variables. I think, again, mechanism may be a surrogate for socioeconomic status. It also may be a variable for the status of the population in which the patients actually live. And I look forward to further research. I think you did an excellent job.

Dr Marie Crandall (Chicago, IL): Thank you, Dr Brandt, for those comments and questions. Mechanism, I absolutely think, is both a surrogate for socioeconomic status and for race. There is a high degree of colinearity in both. For those of us who do trauma every day, we know that people of color and the uninsured are hugely disproportionately affected by the burden of penetrating trauma in the United States. Unfortunately, our best statistical methods to risk stratify are logistic regression, which I think is imperfect. And I think that this study has shown that it is imperfect to show that people are coming into this black box of what happens in the hospital. They are coming in from different places and with different injuries and potentially with different preexisting comorbidities from the social determinants of health that we think about from a population health perspective. So I think you are probably right in identifying the fact that these disparities still exist and that the mechanism is different based on socioeconomic strata and insurance, I think, is important. How to fix that and how to risk stratify that---especially with a trauma registry that is really incident- and not patient-based---is a challenge. The second question, "Why use 55 years of age as a cutoff?" It was because otherwise I would have had to really run 2 separate logistic regressions because the penetrating and blunt injured patients were so radically different and it lowered my degrees of freedom quite a bit. I still could have had significant *P* values, but it would not have been as valid a model. So, I chose over 55 years of age. And under 55 years of age is definitely the patient population grossly affected by trauma.

Then finally, lower extremity, vascular injury, heterogeneity---absolutely. That is an absolute challenge to this assessment.

Dr Nora Hansen (Chicago, IL): I had several questions. One of the observations you made was that the lack of insurance led to increased mortality. Do you think that now---with the health care reform and everyone wanting to get insurance, or they want everyone to get insurance---will that change things? I suspect not. But if not, what factors would you need to modify to improve the mortality rates in this subset of patients? And then you comment in the paper that it is known that the ISS and other injury scores that are weighted toward a composite score really do not adequately reflect the severity of penetrating injury. What

suggestions do you have to improve the methods of data collection and injury scoring? How would you implement them in your trauma center?

Dr Marie Crandall (Chicago, IL): The first question about health care reform is fascinating. So, of course, I cannot predict the future. I do not know the answer to that. And the disparities that exist before getting injured are really potentially causing huge effects on what happens after the patient is injured. But there are some maybe hopeful signs in the sense that in populations where health care provision has been relatively race and insurance neutral (ie, the VA population), and the military in particular, young military patients, those disparities are much less. And in fact, for young military recruits who have medical problems, their outcomes are equivalent irrespective of race. Of course, insurance is not an issue for either of those groups, but socioeconomic status may be. And those disparities are definitely lessened in a system where there is equal access and potentially reasonably equivalent service provision to all patients. How that will work out in practice for 300 million people, I cannot imagine. In terms of injury scoring, the only penetrating score that is used with any regularity--- and it is not included in the National Trauma Data Bank or the Illinois state trauma registry, with which I am familiar---is the Penetrating Abdominal Trauma Index, created by Moore et al. And that is actually very good, because obviously a nick on your liver that is not bleeding in hemodynamically is hugely different than a retrohepatic caval injury. And the ISS only has a difference of 1 to 6. But in terms of the effects on that, and whether or not you have associated colon and liver injuries and pancreatic injuries, is enormous for the trauma surgeon and for the patient. So, I think that turning attention to scores that we will be able to better quantify the effect of multiorgan system injury caused by penetrating trauma, I think, is very important.

Dr. Donald Reed, Jr (Fort Wayne, IN): I am just fascinated by the data mining of these huge databases. But on the slide that you alluded to, where you saw the difference in the insurance status and the result based on race and penetrating injuries, it seems to me, for those of us who do trauma on a daily basis, that one gunshot wound or penetrating trauma is not necessarily the same as the other. For instance, we get gunshot wounds all the time. If they are insured, it will often be a small caliber or self-inflicted wound. And we got a Gangland shooting 2 nights ago that had multiple gunshot wounds. So, I wonder if there is any way, you alluded to it a moment ago in your answer, to sort of tease that out. For those of us, like Maggie Brandt and I, who have done tours in the sandbox and seen soldiers with horrific injuries, ISS and trauma, the TS just does not seem to tease that stuff out. So, I am wondering if there is another way you can get at the heart of that data. In other words, you may have discovered something, but you have not really explained it. And see if you can work on that in the future.

Dr Marie Crandall (Chicago, IL): I find myself very frustrated with the data that we collect and then attempt to spit back out as answers. One of the ways that we determine the mechanism of injury for penetrating trauma is by E codes, the external cause disease. And let's say a 965 would be gunshot wound. A 966, I think, is a stab wound. But each of those have subpoints and they are based on the ICD-9 coding. But if you look at gunshot wounds, the E coding has nothing that is a high-velocity weapon that is not a hunting rifle. So, our coders, who are urban---really, the workhorse of urban trauma in most places is the 9 millimeter. That is the majority of gunshot wounds, but higher velocity weapons with multiple gunshot wounds are very poorly coded at most institutions because of the limitations of E coding and ICD-9 coding. So, I think that that's another challenge for the people who are moving forward with the trauma quality improvement project, like Shahid Shafi and people who are working on improving data collection and risk assessment, like Avery Nathans.

Dr Wendy Wahl (Ann Arbor, MI): If you look at truly isolated lower extremity trauma patients, so only an extremity vascular injury, and you will you see the same discrepancies with race as do you if you combine with other injuries? ISS is notoriously bad for head injury trauma, for chest and abdominal injuries, because you can have multiple organ injuries and get the same score. But you would expect the difference in your outcomes to be worse if you have an abdominal vascular injury with the lower extremity vascular injury than just the isolated lower extremity injury.

And you should be able to tease that out because an ISS score of greater than 16 suggests probably that you have more than 1 organ injury. And certainly, if you go over 25, you definitely have more than 1 organ injury. And did you look at it by stratifying by those different ISS groups?

Dr Marie Crandall (Chicago, IL): That is an excellent point. We did not exclude patients who had more than 1 organ system injury. And the reason that we did that was because we wanted to have as large and inclusive of a data set as possible and make the real-world sort of trauma situation. But that does induce limitations, which is that the patient who is bluntly injured by being run over by a truck is somebody who is very different than who was running away from an assailant and was shot in the leg.

Dr Melina Kibbe (Chicago, IL): One of the things that comes to my mind when you present this data---and I think this is also an area that you are very interested in---is the time that it takes to get the patient from the field to the hospital. And that seems to me like one of the most logical areas that you are probably going to be focusing on, because somebody who is in a worse socioeconomic area, is it just simply taking them longer to get to the hospital versus if they are in the Gold Coast in Chicago? And is that something you are going to be addressing? How do you address it? And then, once you figure out if that's the problem, knowing you, you are going to fix that, or at least try?

Dr Marie Crandall (Chicago, IL): Dr Kibbe, that's a really, really interesting and very huge topic. It has been the subject of many studies. So, we know that globally, rural patients who have similar injuries do worse than urban patients, because their time to presentation at a trauma center is longer. When those same studies have been attempted to be performed on urban trauma patients, there have been very mixed results. In fact, we have 2 papers that are currently under consideration for publication about this very topic. One looks at patients with penetrating thoracic injuries in an urban setting, and another looks at blunt abdominal trauma. And we looked at race- and insurance-based disparities and mortality for those patients. Another that is under submission right now looks at patients who have suffered gunshot wounds in an urban area and are looking at transport times in particular as well as geography. Not all systems are like ours. The city of Chicago has 7 level I trauma centers distributed around the city. But some of the greatest concentration areas of gunshot wounds are in the south side, where the nearest trauma center is nearly 5 miles away. So, there are higher transport times for those patients and patients in the south side. And what we have found---I am going to give preliminary results.

What we have found is if we excluded patients who had no vital signs on arrival, who never regained vital signs in the emergency department, if we excluded those patients, because there's no question that if you live close to a trauma center, if you live across the street from a trauma center and you are shot and you are dead, you will get transported the half a block. But if you are 20 miles away, you will just be pronounced dead at the scene. So, we excluded those patients. For those patients, there is no question that the higher transport times increased mortality for penetrating trauma.

Dr Melina Kibbe (Chicago, IL): So, have you been able to relate the higher transport times to certain zip codes that are poorer socioeconomically?

Dr Marie Crandall (Chicago, IL): Yes. The trauma deserts are the exact urban deserts of grocery stores and libraries and educational attainment.

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Table 1

Lower extremity vascular injury demographics by mechanism

	<i>Mechanism</i>		<i>P value</i>
	<i>Blunt, N = 2,452 (50%)</i>	<i>Penetrating N = 2,452 (50%)</i>	
Gender			<.001
Female	603 (24.6%)	211 (8.6%)	
Male	1,847 (75.4%)	2,237 (91.4%)	
Age, y	Average, 37.9 ± 17.8	Average, 28.7 ± 12.2	<.001
0–55	1,997 (83.9%)	2,276 (96.4%)	
56–89	383 (16.1%)	85 (3.6%)	
Race			<.001
Asian or Pacific Islander	34 (1.5%)	40 (1.7%)	
Black	273 (12.1%)	1,188 (51.1%)	
Hispanic	238 (10.5%)	441 (19.0%)	
Native American	18 (0.8%)	11 (0.5%)	
Other	85 (3.8%)	102 (4.4%)	
White, not Hispanic	1,613 (71.3%)	544 (23.4%)	
Race			<.001
Person of color	648 (28.7%)	1,748 (76.6%)	
White	1,613 (71.3%)	544 (23.4%)	
Insured			<.001
Uninsured	270 (12.0%)	707 (30.6%)	
Insured	1,985 (88.0%)	1,607 (69.5%)	
ISS	Average, 15.8 ± 12.0	Average, 12.5 ± 8.7	<.001
0–16	1,581 (65.1%)	1,948 (80.0%)	
17–100	848 (34.9%)	487 (20.0%)	
SBP (mm Hg)	Average, 125.1 ± 33.6	Average, 110.3 ± 38.3	<.001
0–90	86 (3.7%)	194 (8.4%)	
91–300	2,227 (96.3%)	2,112 (91.6%)	

ISS, Injury severity score; SBP, systolic blood pressure.

Table II

Lower extremity vascular injury demographics and mortality

	Mortality			P value
	Alive, N = 4,552 (92.4%)	Dead, N = 376 (7.6%)		
Gender				.931
Female	756 (16.6%)	63 (16.8%)		
Male	3,791 (83.4%)	312 (83.2%)		
Age, y	Average, 32.8 ± 15.6	Average, 39.6 ± 18.8		<.001
0–55	3,994 (90.8%)	291 (82.4%)		
56–89	405 (9.2%)	62 (17.6%)		
Race				
Asian or Pacific Islander	70 (1.7%)	5 (1.4%)		.119
Black	1,333 (31.4%)	135 (38.2%)		
Hispanic	627 (14.8%)	54 (15.3%)		
Native American	28 (0.7%)	1 (0.3%)		
Other	172 (4.1%)	13 (3.7%)		
White, not Hispanic	2,021 (47.5%)	145 (41.1%)		
Race				.019
Person of color	2,230 (52.5%)	208 (58.9%)		
White	2,021 (47.5%)	145 (41.1%)		
Insured				<.001
Uninsured	875 (20.5%)	108 (31.7%)		
Insured	3,384 (79.5%)	232 (68.2%)		
ISS	Average, 13.0 ± 9.1	Average, 28.6 ± 15.6		<.001
0–16	3,453 (76.4%)	98 (26.1%)		
17–100	1,064 (23.6%)	277 (73.9%)		
SBP (mm Hg)	Average, 121.2 ± 32.5	Average, 74.9 ± 54.9		<.001
0–90	160 (3.7%)	115 (34.4%)		
91–300	4,142 (96.3%)	219 (65.6%)		

ISS, Injury severity score; SBP, systolic blood pressure.

Table III

Unadjusted mortality rates by race and insurance status

	<i>Blunt</i>		<i>Penetrating</i>	
	<i>Insured</i>	<i>Uninsured</i>	<i>Insured</i>	<i>Uninsured</i>
White	6.9%	10%	4.0%	7.1%
Person of color	7.0%	9.9%	6.8%	12.2%

Table IV

Independent predictors of mortality

<i>Model 1: Mechanism as</i>		
<i>covariate</i>	<i>OR (95% CI)</i>	<i>P value</i>
Age >55 y	2.11 (1.4–3.17)	<.001
Male gender	0.99 (0.68–1.45)	.96
Lack of insurance	1.61 (1.15–2.23)	.006
Person of color	1.45 (1.05–2.02)	.03
SBP <90 mm Hg	12.5 (8.2–17.54)	<.001
ISS >16	9.16 (6.75–12.44)	<.001
Mechanism	0.8 (0.57–1.13)	.21
<i>Model 2: Mechanism stratified: blunt LEVI</i>		
Age >55 y	1.99 (1.28–3.1)	.002
Male gender	0.95 (0.63–1.41)	.79
Lack of insurance	1.33 (0.79–2.25)	.29
Person of color	1.28 (0.85–1.93)	.24
SBP <90 mm Hg	9.0 (3.23–11.23)	<.001
ISS >16	8.8 (5.66–13.7)	<.001
<i>Model 3: Mechanism stratified: penetrating LEVI</i>		
Age >55 y	2.64 (1.16–6.04)	.02
Male gender	1.12 (0.45–2.76)	.81
Lack of insurance	1.85 (1.16–2.94)	.009
Person of color	1.82 (0.93–3.6)	.08
SBP <90 mm Hg	20 (10.87–29.41)	<.001
ISS >16	9.81 (6.39–15.09)	<.001

CI, Confidence interval; *ISS*, injury severity score; *LEVI*, lower extremity vascular injury; *OR*, odds ratio; *SBP*, systolic blood pressure.