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A Population-Based Analysis of Neighborhood Socioeconomic Status and Injury Admission Rates and In-Hospital Mortality

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Abstract

Background—Research indicates that neighborhood socioeconomic status (N-SES) is inversely related to injury and injury related mortality. We hypothesized that injury related hospitalization rates would vary by N-SES and that N-SES would be related to in-hospital mortality.

Study Design—Adults (age 18 – 84 years) living in Shelby County Tennessee were eligible for the study. Addresses of adults admitted to the only Level I trauma center in the county from 1996 – 2005 were geocoded and matched to one of 214 census tract groups. Census tract groups were divided into quintiles based on percent of the population living below the poverty level (Lowest to Highest Income N-SES). Crude injury admission rate ratios (CIRR) and 95% confidence intervals (CI) were calculated. Multivariable logistic regression was used to determine if N-SES was associated with in-hospital mortality.

Results—Compared to the Highest N-SES, those in the Lowest N-SES suffered significantly higher rates of blunt (CIRR 5.74 95%CI 5.35, 6.15) and penetrating injuries (CIRR 20.98 95%CI 18.03, 24.42). On multivariable logistic regression analysis, compared to the Highest N-SES, decreasing N-SES was not associated with in-hospital mortality for blunt [High-Middle (0.90 95%CI 0.57,1.44) Middle (1.22 95%CI 0.78,1.87) Low-Middle (0.89 95%CI 0.58,1.39) Lowest (0.67, 95%CI 0.42,1.08)] or penetrating injury [High-Middle (1.35 95%CI 0.48,3.81) Middle (2.77 95%CI 0.99,7.25) Low-Middle (1.44 95%CI 0.55,3.74) Lowest (1.03, 95%CI 0.39,2.73)].

Conclusions—N-SES was inversely related to crude injury rates for all mechanisms. However, in-hospital mortality was not associated with N-SES level.

INTRODUCTION

For many years, researchers have realized that there are geographical variations in health and advances in geographic information systems have pushed this line of research forward. Numerous reports indicate that there is an association between living in a socioeconomically disadvantaged neighborhood and poor health outcomes (1-8). The association of neighborhood socioeconomic status (N-SES) and individual health outcomes appears to be

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independent of individual level SES (9-12). Mortality following injury has also been found to be inversely associated with N-SES (13-20). However, the reason for this association remains unclear.

The purpose of this study is two-fold. First, we intended to determine if living in a relatively poor neighborhood was associated injury related admission rates, injury mechanism and injury severity in Shelby County, Tennessee. Second, we wished to determine if, once admitted secondary to an injury, there was an association between N-SES strata and in-hospital mortality in Shelby County, Tennessee. We hypothesized that living in the lowest N-SES stratum would be associated with significantly higher injury related admission rates and higher injury severity compared to living in higher SES strata. Further, we hypothesized that N-SES would be independently related to in-hospital mortality following injury.

METHODS

Study Setting

The Presley Memorial Trauma Center (PMTC) is the single designated adult Level I trauma center in Shelby County Tennessee. Explicit triage guidelines direct persons to the PMTC that either have signs of moderate to severe injury or have the possibility of moderate to severe injury based on mechanism of injury. Additionally, most other significantly injured persons who require hospitalization are transferred from the other hospitals in Shelby County to the PMTC for definitive care. Thus, it is possible to estimate population based injury hospital admission rates in Shelby County Tennessee by using the trauma registry at the PMTC as the source of numerator information.

Description of the Trauma Registry at the PMTC

All persons admitted after injury are included in the PMTC trauma registry. For the purposes of this study, we further limited the population to patients admitted between 1996 and 2005 who were between 18 and 84 years old. Patients were excluded if they were greater than twenty-four hours from the time of injury at the time of admission to the trauma center. We excluded patients who were more than twenty-four hours from the time of injury from the study in an effort to exclude patients who were re-admitted to the hospital after being discharged following treatment for an injury. Also, patients who were burned, victims of drowning, bites/stings, overexertion, poisoning and suffocation were also excluded. Since we were attempting to determine population based injury admission rates, if patients were not residents of Shelby County Tennessee (the same county as the Level I Trauma Center) then the patients were excluded. The trauma registry of the PMTC also contains detailed demographic, physiologic, and injury severity information of injured patients as well as their disposition at discharge. Additionally, injury mechanisms within the trauma registry are classified according to a framework recommended by the Centers for Disease Control and Prevention for presenting injury related data (21).

Every year the trauma registry at the PMTC undergoes a geocoding process performed by Mapping Analytics (Rochester, NY). The geocoding process uses the addresses of the patients in the trauma registry and specialized software (Centrus Desktop Software) to determine the latitude and longitude of each address in the database. Once the latitude and longitude are determined, the United States Census Tract Group corresponding to the address can be identified. This allows our group to merge data in the trauma registry to detailed information downloaded from the United States Census Bureau at the Census Tract Group level. On average, each census tract contains 4000 individuals in a homogenous neighborhood (10).

Determination of Neighborhood Level Socioeconomic Status Indicator

Using techniques developed by Krieger and others in the Public Health Disparities Geocoding Project at Harvard University (10), we developed a N-SES indicator based on the percent of the population in a Census Tract Group living below the poverty level at the time of the 2000 census. The federal poverty level varies by size and age composition of individual households. As a reference, in 1999 the average threshold for a family of four was $17,029 (10-12). Census Tract Groups within Shelby County (n = 214) were divided into quintiles based on cutpoints derived from the percent of the population within each Census Tract Group living below the poverty level at the time of the 2000 Census. The five N-SES categories were Lowest (>34.8% of the population living below the poverty line), Low-Middle (20.9 – 34.8% of the population living below the poverty line), Middle (10.0 – 20.8% of the population living below the poverty line), High-Middle (4.4 – 9.9% of the population living below the poverty line) and Highest (≤ 4.3% of the population living below the poverty line). The division of Census Tract Groups in this manner resulted in 43 census tract groups in each N-SES category with the exception of the Lowest N-SES category, which had 42. Once the Census Tract Groups were divided into N-SES categories, these data were merged with the geocoded trauma registry.

Injury Admission Rate Determination

Using techniques described by Krieger and others (10-12), we generated injury admission rates stratified by N-SES category for adults aged 18 to 84 years of age in Shelby County Tennessee. The numerator for each crude injury admission rate calculation was the number of injury related admissions of persons 18 – 84 from each N-SES category to the PMTC from 1996 – 2005. Denominator data were determined from 2000 Census data for Shelby County, Tennessee. The denominator was the number of person-years at risk for injury (for persons aged 18 – 84) in each N-SES category in Shelby County, Tennessee from 1996 – 2005. For example, there were 2722 persons 18 – 84 admitted with a blunt injury to the PMTC from 1996 – 2005 from the Lowest N-SES category. Based on 2000 Census data, there were 63,456 people aged 18 – 84 living in the 42 census tract groups that make up the Lowest N-SES category used in this study. To determine the person-years at risk we multiplied the 63,456 people by the total time of the study (10 years) to obtain the 630,456 person-years in the denominator of the crude rate calculations. The result of this (2722 / 630,456) is 0.0043. The final step in the crude rate calculation was to multiply this result by 10,000 in order to come up with the crude injury admission rate per 10,000 adults (aged 18 – 84) per year, 43 per 10,000 in this example.

Crude injury admission rate ratios were also calculated for blunt and penetrating mechanisms of injury. For each crude rate ratio calculation, the crude injury admission rate for the Highest N-SES level was used as a referent. The results from these calculations are reported as the point estimate and the 95% confidence interval.

Logistic Regression Analysis

To explore the association between N-SES and in-hospital mortality we used logistic regression analysis. We developed logistic regression models for in-hospital mortality for both blunt and penetrating injury. Patient physiologic and injury related factors as well as N-SES level were determined from the PMTC trauma registry. Categorical variables considered for inclusion in logistic regression analysis for the in-hospital mortality outcome for blunt and penetrating injury included gender and the motor score on the Glasgow Coma Scale. Continuous variables considered for inclusion in the models were age at admission, injury severity score, and admission systolic blood pressure. Variables that met $p<0.10$ on bivariate analysis were included in the final model. The N-SES categorical variable was forced into each model to determine the relation between N-SES and in-hospital mortality.

All odds ratios are reported as the point estimate and the 95% confidence interval. Categorical variables are reported as percentages of the N-SES category from which they were derived. Continuous variables are reported as the mean ± standard deviation. SAS software (Version 9.2, Cary, North Carolina) was used for all statistical calculations. All of the procedures in this study were conducted after approval from the University of Tennessee Health Science Center Institutional Review Board.

RESULTS

Description of Injured Patients Admitted to the Presley Memorial Trauma Center

From January 1, 1996 to December 31, 2005 39,564 patients 18 – 84 years of age were admitted to the PMTC. Of those, 21,048 were residents of Shelby County. One hundred sixty-one of the 21,048 met the mechanism of injury exclusion criteria. Of the remaining, 3,225 patients were transferred to the trauma center greater than 24 hours from the time of injury leaving and the census tract group could not be determined for 4 patients. This left 17,658 patients 18 – 84 who were admitted after injury. Overall, 74.0% of the patients were male and the mean age of the population was 37.2±14.7. The mean admission systolic blood pressure was 132.1±35.2mmHg. The mean Injury Severity Score (ISS) was 10.6±9.8 and the mean motor score on the Glasgow Coma Scale was 5.6±1.2. The overall in-hospital mortality was 5.8%.

Table 1 illustrates the characteristics of the study population stratified by N-SES level. When comparing the Highest N-SES category to the other N-SES categories persons living in the Middle and Low-Middle N-SES neighborhoods were significantly younger. Compared to those living in the Highest N-SES neighborhoods, persons living in the Lowest and Low-Middle N-SES neighborhoods had significantly lower ISS. There were no statistical differences in admission systolic blood pressure. Persons from the Highest N-SES neighborhoods were significantly more likely to be female, white, have commercial insurance and have lower motor scores on the Glasgow Coma Scale compared to those from the Lowest N-SES category (Table 1).

Comparison of Crude Injury Admission Rates by N-SES Category

Crude injury admission rate ratios were calculated by N-SES category in Shelby County from 1996 – 2005 for blunt and penetrating injuries with the Highest N-SES category as the referent (Table 2). Crude blunt injury rates steadily and significantly increased across N-SES categories to the point that persons living in the Lowest N-SES category had nearly 6 times the crude blunt injury admission rate as those from the Highest N-SES category. The results for injury admission rate ratios for penetrating injury were similar. Persons living in the Lowest N-SES category in Shelby County had almost 21 times the rate of penetrating injury admission compared to those living in the Highest N-SES category in Shelby County.

Comparison of Crude Injury Admission Rates by Mechanism and Injury Severity Within N-SES Categories

Compared to the Highest N-SES category, injury admission rates were significantly higher in the other N-SES categories for all blunt injury mechanisms except motorcycle crash. For motorcycle crash, only the Low-Middle and High-Middle N-SES categories had significantly higher admission rates compared to the Highest N-SES category. Injuries to motor vehicle crash occupants accounted for nearly 50% of the blunt crude injury rate in each N-SES category except in the Lowest N-SES category. In the Lowest N-SES category, assaults made up the majority of blunt injury admissions with a crude injury admission rate of 13.7 (Table 3).

For the penetrating mechanisms compared to the Highest N-SES category, those in the other N-SES categories had significantly higher injury admission rates. Within each N-SES category, firearm related injury admissions made up the majority of penetrating injury admission rates. Compared to the Highest N-SES category, injury admissions rates were significantly higher for the other N-SES categories when injuries were stratified by injury severity. Within each N-SES category, mild injuries (ISS 1 – 15) made up the vast majority of injury admission rates (Table 3).

Relationship Between N-SES Category and In-Hospital Mortality

Logistic regression analysis was performed separately for blunt and penetrating injuries to determine if N-SES category was related to in-hospital mortality after controlling for demographic, physiologic and injury related factors. The final multivariable model for both blunt and penetrating injuries included N-SES category (which was forced into both models), age at admission, admission systolic blood pressure, ISS, and the admission motor score on the Glasgow Coma Scale. The resulting models for in-hospital mortality had good fit with an area under the curve of 0.956 for blunt injuries and an area under the curve of 0.984 for penetrating injuries. For persons who suffered either blunt or penetrating injuries, in multivariable logistic regression analysis patient and injury related factors, but not N-SES level, were associated with in-hospital mortality. Increasing age and higher injury severity scores were associated with in-hospital mortality following both blunt and penetrating injury. Lower admission systolic blood pressure and lower motor score on the Glasgow Coma Scale were also related to in-hospital mortality following blunt and penetrating injury. However, N-SES level was not significantly associated with in-hospital mortality after controlling for patient and injury related variables (Table 4).

DISCUSSION

Previous research indicates that there is a clear association between living in a poor neighborhood and suffering from high rates of injury of various types (13-20). The purpose of this study was to address outstanding questions regarding the relationship between the relative SES of the neighborhood in which a person lives and injury. First we explored if living in a relatively poor neighborhood confers increased risk of suffering an injury on the neighborhood inhabitants. We next examined potential disparities in injury mechanism and severity based on N-SES. Finally, we explored the association between N-SES category and in-hospital mortality after injury.

To investigate population based injury rates on a neighborhood level, we estimated population injury rates using our trauma registry and linked persons in the trauma registry to data from the 2000 Census. We found that persons from the lowest income neighborhoods suffered the highest rates of injury. Our results were similar to findings from other ecological studies in the literature. As early as 1985 in a study by Rivera et al carried out in Memphis, Tennessee (the largest city within Shelby County Tennessee), found that pedestrian injuries, for persons under 14 years of age, were more likely in low SES census tracts compared to higher SES census tracts (20). More recent studies in adults, indicate that persons living in neighborhoods with the highest percent of the population in poverty have significantly higher rates of homicide, motor vehicle crashes and other external causes of injury (13-15).

The next question addressed was whether disparities in injury severity or mechanism exist for persons from socioeconomically disadvantaged neighborhoods. For injury severity, the data showed that mild injuries (ISS ≤ 15) accounted for the majority of admissions following injuries from all N-SES levels. However, there are some differences in crude injury rates for various mechanisms across N-SES levels on a population base. Our results

are similar to those of Cubbin et al. In their study, they found that persons living in poor neighborhoods had a two-fold increase in the rates of homicide, motor vehicle crashes and other external causes of injury compared to persons in the highest income neighborhoods (13). Similarly, the magnitude of change in blunt injury rates in our study for persons living in the lowest income neighborhoods was nearly six times higher than the rate among those living in the highest income neighborhoods. We also found that population based penetrating injury rates were over twenty times higher for persons living in the lowest income neighborhoods compared to those living in the highest income neighborhoods. It is possible that since ISS tends to underestimate injury severity in penetrating injury, that this might explain why we observed a lower mean ISS in the lowest income N-SES level.

The final question we addressed in this study, and one that is most important to persons who care for injured patients, was whether N-SES level was independently related to mortality after admission to a Level I trauma center. The results of the logistic regression analysis did not support our original hypothesis that N-SES is related to in-hospital mortality. Rather, we found that injury severity and patient physiologic criteria play the main role in determining the risk of death following admission to a trauma center after injury.

One potential explanation for why N-SES was not related to in-hospital mortality for patients following injury may be because access to care in a mature emergency management system with clear protocols is driven by anatomic and physiologic evidence of moderate or severe injury or the potential for moderate or severe injury based on injury mechanism. The fact that we did not find an association between N-SES level and mortality after adjusting for patient physiologic factors and injury severity may indicate that differences in pre-injury health status that may exist are outweighed by the physiologic burden of injury. However, the results of this study do not allow for a definitive answer to this question. Like many trauma registries, the registry used for this study did not contain co-morbidity data for many of the most severely injured patients. Because of the missing data we were unable to determine if pre-injury co-morbidities might have been a factor in in-hospital mortality differences.

There are several other limitations associated with this study and the results need to be considered with these limitations in mind. Any study that uses geographic location to group persons assigns these group level characteristics to all people in that group without regard to individual level data. The trauma registry used for this study had no individual level SES data available. It is possible that individual SES level may play a greater role in determining in-hospital outcome after injury than does N-SES level.

We also have no way of knowing how long a patient lived at the address prior to the injury, thus, we do not have a clear indication of the length of exposure to the neighborhoods of interest. Further, there was a slight increase in the population of Shelby County during the study period. Over the 10 years of the study, the total population of Shelby County, Tennessee changed approximately 3% based on estimates from the Census Bureau. In 1996, the population of Shelby County was estimated at 877,907 and grew to 897,472 in the 2000 Census and was at 905,399 by the end of the study period. Even thought the change in population was modest, the rate calculations used in this study could have been influenced.

Another limitation of geocoding is that if an address of a prison or university is overrepresented in a database, it is possible that the study results could be influenced. Upon examination of the raw data we found that two addresses, corresponding to two Shelby County correctional facilities, were overrepresented relative to other addresses in the database. Persons from these addresses represented less than 2% of the study population. Interestingly, one of the addresses in question was in the Lowest N-SES level and the other

was in the Highest N-SES level. Because the numbers were so low and because persons were almost evenly distributed between the two addresses, there were no differences in the analysis when persons from these address were excluded.

It is possible that some patients with mild injury were not included in the trauma registry, either because the emergency medical services/trauma system was not utilized or because the patient was not admitted to our trauma center. However, when we excluded mildly injured patients, we found the same relationship between N-SES and injury rates and in-hospital mortality rates as we saw when we considered the entire population. Because we analyzed trauma data from all of Shelby County, a relatively urban location, the validity of our conclusions may be limited in centers that treat a primarily suburban or rural population or in centers where care may differ based on a patient's SES or insurance status.

With these limitations in mind, the results of this study indicate that compared to living in the highest income neighborhood those living in lower income neighborhoods have increased risk of suffering both penetrating and blunt injuries that result in admission to a Level I trauma center. Further, multivariable logistic regression analysis revealed that in-hospital mortality was not associated with N-SES level, which was contrary to our original hypothesis. From a public health perspective, the results from this study imply that interventions to reduce injury rates should be focused within neighborhoods with the lowest socioeconomic status with particular attention to penetrating injury prevention. Additionally, trauma system development should ensure that all persons, regardless of N-SES, have access to the highest level of trauma care available so that in-hospital mortality can be minimized.

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ABBREVIATIONS

N-SES	Neighborhood Socioeconomic Status
SES	Socioeconomic Status
PMTC	Presley Memorial Trauma Center
ISS	Injury Severity Score

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Table 1

Characteristics of Patients Admitted to a Level I Trauma Center in Shelby County, TN, 1996 – 2005 (n=17,658)

Characteristics	Neighborhood Socioeconomic Status Category				
	Lowest n=4500	Low-Middle n=5024	Middle n=4200	High-Middle n=2599	Highest n=1335
Age, y*	36.9±13.9	37.0±14.6	36.9±14.7	37.6±15.3	38.2±16.1
Male, %†	76.5	74.5	73.9	71.1	70.0
Race, %‡					
White non-Hispanic	6.3	14.4	31.4	50.1	70.5
African American non-Hispanic	91.6	79.8	59.8	42.3	24.3
Hispanic	1.6	4.7	7.3	5.6	2.3
Other	0.5	1.1	1.5	2.0	2.9
Payer source, %§					
Commercial	8.2	15.5	21.7	34.5	46.1
Medicare	8.3	7.3	7.5	7.9	8.4
TennCare	31.7	28.5	21.1	15.5	8.8
Other	11.4	6.8	8.7	9.5	15.1
None	40.4	41.9	41.0	32.6	21.6
Injury Severity Score‖	9.2±8.7	10.2±9.2	11.4±10.4	12.0±10.6	12.2±10.4
Admission systolic blood pressure (mmHg)¶	132.1±34.2	133.1±34.1	129.7±39.2	132.9±33.3	132.6±32.1
Admission GCS motor response, %#					
6	90.6	89.8	86.1	88.5	88.0
4 – 5	4.4	4.9	6.1	5.6	5.8
2 – 3	0.8	0.9	0.8	1.1	1.0
1	4.2	4.4	7.0	4.8	5.2

*Age is reported as mean ± standard deviation; n missing = 1; $p < 0.05$ for Low-Middle and Middle N-SES categories compared to Highest N-SES category.

†Male is reported as the percent of N-SES category that was male; n missing = 2; χ^2 $p < 0.0001$

‡Race is reported as the percent of each race group within each N-SES Category; Other includes Asian, American Indian, Pacific Islander; n missing = 0; χ^2 $p < 0.0001$

[§] Payer source is reported as the percent of each payer source group within each N-SES Category; TennCare includes TennCare Standard and TennCare Medicaid; Other category includes sources of payment that did not fit into one of the other payer source categories (i.e. auto insurance, military insurance, hurricane evacuation insurance, workers compensation, homeowners insurance); n missing = 234; χ^2 $p < 0.0001$

[//] Injury Severity Score is reported as mean±standard deviation; n missing = 527. $p < 0.05$ for Low-Middle and Lowest N-SES categories compared to Highest N-SES category.

[¶] Admission Systolic Blood Pressure is reported as mean ± standard deviation in mmHg; n missing = 299.

[#] Glasgow Coma Scale (GCS); Admission GCS Motor Response is reported as the percent of each motor response group within each N-SES Category; n missing = 285. χ^2 $p < 0.0001$.

Table 2

Crude Injury Admission Rate Ratios by Neighborhood Socioeconomic Status Categories in Shelby County, TN, 1996 – 2005 for Blunt and Penetrating Injuries

Injury	Neighborhood Socioeconomic Status Category									
	Lowest n = 634,560 person-years		Low-Middle n = 1,237,690 person-years		Middle n = 1,385,260 person-years		High-Middle n = 1,579,740 person-years		Highest n = 1,500,930 person-years	
	No. of admissions	CIRR* (95% CI)	No. of admissions	CIRR (95% CI)	No. of admissions	CIRR (95% CI)	No. of admissions	CIRR (95% CI)	No. of admissions	CIRR
Blunt mechanism*	2,722	5.74 (5.35, 6.15)	3,286	3.55 (3.32, 3.80)	3,017	2.91 (2.72, 3.12)	2,010	1.70 (1.58, 1.83)	1,122	Referent
Penetrating mechanism*	1,650	20.98 (18.03, 24.42)	1,614	10.52 (9.04, 12.25)	1,083	6.31 (5.40, 7.37)	529	2.70 (2.29, 3.19)	186	Referent

Crude injury admission rate ratios were calculated in the following manner. First crude injury rates were calculated. The numerator for each rate calculation was the number of injury related admissions from each neighborhood socioeconomic status category to the Presley Memorial Trauma Center from 1996 – 2005. The denominator was the total number of person-years at risk for injury in each neighborhood socioeconomic status category in Shelby County, Tennessee from 1996 – 2005. For crude rate ratio calculations the crude injury rate for the Highest Neighborhood Socioeconomic Status Category was used as the referent.

CIRR, Crude injury admission rate ratio.

* Mechanism of injury was determined from ICD-9 E-codes recorded during hospital admission. Categories for mechanism of injury are reported so that they are consistent with the Centers for Disease Control Injury Intentionality Matrix as published in the MMWR 1997;46:1-30.; 439 persons had missing mechanism of injury information and were excluded from rate calculations.

Table 3

Crude Injury Admission Rates per 10,000 Adults per year from Different Neighborhood Socioeconomic Status Categories in Shelby County, TN, 1996 – 2005 by Mechanism and Injury Severity

Injury	Neighborhood socioeconomic status category				
	Lowest n = 634,560 person-years	**Low-Middle n = 1,237,690 person-years**	**Middle n = 1,385,260 person-years**	**High-Middle n = 1,579,740 person-years**	**Highest n = 1,500,930 person-years**
Blunt mechanism*†	42.9§	26.5§	21.8§	12.7§	7.5
Motor vehicle crash – occupant*†	12.1§	11.4§	10.8§	7.2§	4.2
Motor vehicle crash – other*†	1.1§	0.8§	0.9§	0.5§	0.2
Motor cycle crash*†	0.7	0.9§	0.8	0.9§	0.7
Pedestrian struck*†	4.3§	2.2§	1.8§	0.7§	0.4
Fall*†	10.3§	5.1§	3.8§	2.0§	1.3
Assault*†	13.7§	5.7§	3.1§	1.2§	0.6
Other blunt*†‡	0.7§	0.4§	0.6§	0.2§	0.1
Penetrating Mechanism*†	26.0§	13.0§	7.8§	3.3§	1.2
Firearm*†	15.6§	8.1§	5.3§	2.3§	0.8
Cut/Pierce*†	10.4§	4.9§	2.5§	1.0§	0.4
Injury Severity					
Mild injury (ISS 1 – 15)*	56.6§	31.2§	22.0§	11.6§	6.2
Moderate injury (ISS 16-24)*	7.0§	4.6§	3.8§	2.2§	1.3
Severe injury (ISS ≥ 25)*	5.3§	3.7§	3.8§	2.2§	1.2

*Results are reported as crude injury hospitalization rates per 10,000 adult person years. The numerator for each rate calculation was the number of injury related admissions from each neighborhood socioeconomic status category to the Presley Memorial Trauma Center from 1996 – 2005. The denominator was the total number of person-years at risk for injury in each neighborhood socioeconomic status category in Shelby County, Tennessee from 1996 – 2005. The result from the division of the numerator by the denominator was multiplied by 10,000 to arrive at the crude injury rate reported. For a more detailed description of how rates were calculated see the Methods section.

†Mechanism of injury was determined from ICD-9 E-codes recorded during hospital admission. Categories for mechanism of injury are reported so that they are consistent with the Centers for Disease Control Injury Intentionality Matrix as published in the MMWR 1997;46:1-30; 439 persons had missing mechanism of injury information and were excluded from rate calculations.

‡The Other Blunt category includes pedal cyclist, machinery and other transport (such as injuries as a result of an aircraft crash) injury categories.

§ $p<0.05$ versus Highest N-SES Category.

Table 4

Logistic Regression Analysis of In-Hospital Mortality after Blunt and Penetrating Injury in Shelby County, TN, 1996 – 2005

Variable	Blunt Injury (n = 12,605), Odds Ratio (95% CI)	Penetrating Injury (n = 5,053), Odds Ratio (95% CI)
N-SES Category*		
Highest	Referent	Referent
High-middle	0.90 (0.57, 1.44)	1.35 (0.48, 3.81)
Middle	1.22 (0.78, 1.87)	2.77 (0.99, 7.25)
Low-middle	0.89 (0.58, 1.39)	1.44 (0.55, 3.74)
Lowest	0.67 (0.42, 1.08)	1.03 (0.39, 2.73)
Age, y†	1.05 (1.05, 1.06)	1.02 (1.00, 1.04)
Admission systolic blood pressure (mmHg)‡	0.98 (0.97, 0.98)	0.98 (0.98, 0.99)
Injury Severity Score§	1.07 (1.06, 1.08)	1.11 (1.09, 1.13)
Admission GCS motor response‖		
6	Referent	Referent
4 – 5	7.07 (5.11, 9.76)	8.50 (5.06, 14.29)
2 – 3	11.20 (6.33, 19.82)	47.74 (23.07, 98.78)
1	36.56 (26.42, 50.60)	82.91 (51.52, 133.42)

*N-SES, Neighborhood Socioeconomic Status; n missing from blunt injury = 0; n missing from penetrating injury = 0.

†n Missing from blunt injury = 1; n missing from penetrating injury = 0.

‡n Missing from blunt injury = 205; n missing from penetrating injury = 94.

§n Missing from blunt injury = 519; n missing from penetrating injury = 8.

‖GCS, Galsgow Coma Scale; n missing in blunt injury = 205; n missing in penetrating injury = 80.