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Associations between race, socioeconomic status and non-fatal injuries in Atlanta between 2001-2004

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2012

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Abstract:

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Author: Erin Hulland

Injuries are a leading cause of morbidity and mortality both worldwide and in the United States, with over 16,000 deaths daily and many more disabilities attributable to injuries. [1] With such a resounding impact, research on the risk factors is of great importance. This study examined the relationship between socioeconomic factors and race on three types of injury – falls, assault, and suicide – and on all injuries overall in the metro Atlanta area between 2001 and 2004. It was hypothesized that older age and winter months of the year would be the strongest predictors of falls; that races other than white and low socioeconomic status would be the strongest predictors of assault; that white race, high socioeconomic status and male gender would be the strongest predictors of suicide; and that young age, male gender, white race and high socioeconomic status would be the strongest predictors of any injury overall. Univariate and multivariate logistic regression were performed to determine the odds of having visited the emergency department of a local hospital for one of the specific injuries (versus another type of injury) and the odds of having visited the emergency department for any injury at all versus another type of visit. It was found that younger age was associated with higher odds of falls, that month of the year was not a significant predictor of falls versus other injuries, and that non-Hispanic black race had the lowest odds and a protective effect for falls while Hispanic ethnicity had the highest odds of falls. When looking at the variables associated with assault, Hispanic ethnicity and black race had protective effects against assault while other race and non-Hispanic white race had the highest odds for assault. Lower socioeconomic status, as indicated by percent of population without a high school diploma, was protective against assault. White and other race were associated with higher odds of suicide, and that higher socioeconomic status was related to higher odds of suicide. Finally, younger age, male gender, white and other race and higher socioeconomic status were all related to higher odds of any injury, overall.

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Chapter 1: Introduction

Introduction

Injuries are a leading cause of morbidity and mortality both worldwide and in the United States. Globally, over 16,000 people die daily due to injuries, and many more are harmed.[1] In the United State alone, 180,811 people (58.56 per 100,000 persons) died due to injury in 2010, putting accidental injuries at the 5th leading cause of death in the United States. [2, 3] An additional 31,575,978 people (10,329.98 per 100,000 people) experienced non-fatal injuries in that same year. Injuries are costly in not only life-years lost and in decreased quality of life, but also in monetary losses. The estimated cost of all fatal and non-fatal injuries in the United States in 2000 was over $406 billion dollars, most of which was attributed to motor vehicle accidents and falls.[4] With such high numbers of injuries and exceedingly large costs, public health professionals have been interested for the past 30 years in finding a way to reduce these numbers nationally and internationally. From this research, it has been demonstrated that injuries are not encountered equally, and that certain types of injuries, such as homicide or self-harm, have very different rates by race and by socioeconomic status, both at the individual level and at the census block group or neighborhood level. [3-22]

Although research has been conducted for various causes of injuries over the last few decades, most of it has been focused on fatal injuries using mortality statistics rather than on non-fatal injuries. While this is an important area to study, there is a much greater number of non-fatal injuries than fatal injuries in the United States. Since the epidemiology of non-fatal injuries is innately different than that of fatal injuries, previous results from fatal injuries cannot be applied to non-fatal injuries, thereby creating a need

for research on non-fatal injuries.[9] Additionally, a large emphasis has been put on childhood injuries rather than injuries in adults due to the fact that injuries are the leading cause of death in children under 15 years of age, further justifying the necessity for research of non-fatal injuries in adults.[1, 16, 17] Although there is a minimal number of studies on non-fatal injuries in adults to begin with, very little has been published on the socioeconomic and race disparities by neighborhood or census block group in non-fatal injuries in adults. Of those that have been published, most have focused on motor accidents or falls alone, since they are the biggest cost-inducing injuries, or on non-urban areas.[5, 10, 23- 25] There is therefore a need for research on how socioeconomic disparities and racial differences at the neighborhood level relate to non-fatal injuries in urban-residing adults.

Study Specific Hypotheses

For this study, it was hypothesized that older age and month of the year would be positively associated with the incidence of falls, since the elderly are more at risk for falls and precipitation, particularly frozen precipitation, often makes conditions more suitable for a fall.[10] It was hypothesized that races other than white and poorer socioeconomic status would be positively associated with incidence of assault, an association that has been seen in previous studies.[6-9] It was hypothesized that white race, male gender and higher socioeconomic status would be positively associated with incidence of suicide, another relationship seen in previous studies.[6] Finally, it was hypothesized that higher socioeconomic status and white race would be positively associated with any injury in general, since people of higher socioeconomic status are more likely to own motor vehicles or bicycles and less likely to face chronic or communicable illnesses.[26, 27]

Additionally, it was hypothesized that younger males would be particularly at risk for emergency department visits related to injuries. [28]

Problem Statement

The health disparities in non-fatal injuries are still quite severe, despite many attempts at implementing injury prevention interventions. There is a need for more in-depth research to determine the mechanisms that create these socioeconomic and racial inequalities in non-fatal injuries. In large metropolitan cities, including Atlanta, there is a wide distribution of socioeconomic statuses and races, which vary by census block groups and neighborhoods, and thus such places are ideal for studying the epidemiology of disparities associated with non-fatal injuries. With such a large number of non-fatal injuries still occurring, there is therefore a great desire and urgency to determine how and why people from different socioeconomic backgrounds and races exhibit different patterns of non-fatal injuries.

Purpose Statement

The aim of this research is to determine which groups of people in the metro-Atlanta area bear the burden of certain non-fatal injuries, based on racial and socioeconomic factors at the census block group level. Researching the distributions of non-fatal injuries can determine details regarding the epidemiology of non-fatal injuries allowing development of specific interventions and prevention policies to target specific proper racial and socioeconomic groups and help reduce the disparities in injuries, as well as the associated morbidity and mortality nation-wide.

Significance Statement

This research can provide greater evidence that non-fatal injuries are not experienced equally among people within neighborhoods of varying socioeconomic status and race, and that an increased burden of most injury types falls on those who are non-white and have lower socioeconomic statuses.

Chapter 2: Literature Review

Introduction

The various journal articles and books below demonstrate the wide range of studies on injury rates, both fatal and non-fatal. Both international and domestic studies were reviewed to get a sense of the incidence of injury rates both nationwide and all over the world. After reviewing the articles, they were categorized by country of origin, whether or not they were studies of adults or children, and whether or not they studied fatal injuries, non-fatal injuries, or both. Additional interest was placed on those articles that used geographic information systems, since geocoding and graphical displays were of interest in the current study.

International Studies

Injuries are a leading cause of death worldwide, and there is great interest in determining both the cause and effects of injuries internationally. While the mechanisms behind fatal and non-fatal injuries will vary greatly by country, looking at trends internationally, particularly in high-income, developed countries, will aid in understanding where the United States falls in injury rates, and what factors are universal versus national. After researching articles, it was found that most international studies of injuries were either broad studies conducted by the World Health Organization (WHO) on global death rates and injury rates, and the factors causing them, or were studies from localized regions in Europe researching the relationship between socioeconomic status, race and other mechanisms on injury rates (both fatal and non-fatal) in infants, children and teens.

Two articles fell into the first of the two aforementioned categories, and both were published by the World Health Organization. The first was an article published in 1999 that presented the 15 leading causes of death and burden of disease by geographic region and income level, and provided estimates of injury death and disability worldwide, while analyzing the role of injury morbidity and mortality globally. [1] It was found that in high-income countries, road-traffic injuries were the leading cause of death for people aged 5-14 and 15-44 years old, with 6 other types of injuries falling within the top 15 causes of death in these two age groups. Additionally, road-traffic injuries were the leading cause of burden of disease in 5-14 year olds and the 3rd leading cause in 15-44 year olds. As with the mortality findings, 4 other types of injuries were in the top 15 causes of burden of disease in these two age groups. The second article was published in 2009 and was a lengthy review of recent study findings internationally (with a focus on the European region) on how socioeconomic status relates to injury risks, and possible proposed counter measures. [15] Approximately 300 studies were reviewed, and among mortality studies, it was demonstrated evidentially that people from low socioeconomic areas tended to have higher risks of mortality than those from more fortunate areas. The studies related to non-fatal injuries and morbidity tended to have less consistent findings than mortality studies, but many still demonstrated marked differences in injury risk between socioeconomic groups.

Five articles fell into the second category mentioned above, with four of the articles hailing from the United Kingdom and one from Sweden. The first article, published in 1997 in Scotland, used surveys taken by 11, 13 and 15 year olds in school to determine if and how injury rates were related to individual socioeconomic factors. [29] The

overall finding was that neither father's occupation nor family affluence was significantly related to overall the incidence of medically attended injuries. The second study published in 2001 was from Sweden and examined the relationship between parental socioeconomic status and non-fatal road traffic injuries in children and adolescents. [12] It was found that the risks of pedestrian and bicycle injuries were greater among children of manual labor workers (versus high or intermediate salaried employees) and that the disparities in socioeconomic status were most pronounced in injuries involving motor vehicles. The third study, published from England in 2001, considered whether sociodemographic factors were significant predictors of unintentional injury risk in toddlers.[26] Overall, it was found that living in a less fortunate neighborhood ("depraved ward"), male sex, and lack of access to a car were associated with at least one medically attended injury, and were each independently associated with number of medically attended injuries. The fourth study reviewed was published in England in 2002 and examined once again the relationship between injury morbidity and neighborhood-level socioeconomic deprivation via the Townsend score, a measure that encompasses overcrowding, lack of home-ownership, not owning a car, and employment, for a number of different types of injuries for infants and children.[13] The main finding was that both number of hospital injury admissions and the severity of injuries increased with decreasing socioeconomic status, and that the gradient was steeper for children under the age of 5 than between 5 and 14. The fifth article reviewed was published in England in 2005 and considered the relationship between family and neighborhood characteristics and the risk of fatal and non-fatal injuries.[14] Overall, it was found that there was not any neighborhood effect on Accident and Emergency (A & E) Department attendance rate

that wasn't explained by family level variables, such as age of mother at birth and family income, among others.

Domestic Studies

It was important to review the findings of multiple studies in the United States on injury morbidity and mortality with relation to socioeconomic status and race to determine the precedent for the proposed study of interest. When reviewing the articles, there appeared to be a clear division not only in studies of fatal versus non-fatal injuries, but also in studies of children versus adults. The studies reviewed below have been first broken up by age group (adults versus children) and then subsequently by fatal versus non-fatal injury studies, although there were a small number of studies that examined both types of injury. One study of interest was not a study of injury rates in children or adults, but was instead more of a commentary and study on the impact of race and socioeconomic status on health outcomes in general. This study, published in 1999, considered how race, ethnicity, and socioeconomic status affect various important health outcomes, including injury mortality, on a national scale. [22] It was found that there was a difference in overall mortality rate by race and ethnicity, with blacks having a much higher overall death rate than whites, but with death rates varying by cause for all races and ethnicities. Additionally, it was found that socioeconomic variations within a race group were far more significant and more predictive of variations in mortality rates than race alone.

Studies of Children or Adolescents

The majority of the articles reviewed were studies of fatal and non-fatal injuries in children. Although the current study does not focus on injuries in children, it is

important to examine the rates in children as well as adults so that there is a full picture of injury morbidity and mortality in the United States. These studies of injuries in children are further divided below by fatal injuries and non-fatal injuries.

Fatal injury articles:

There were a large number of studies on fatal injuries in children, using mortality statistics and death certificates. One national study examined sociodemographic risk factors on injury mortality in infants using data from the National Center for Health Statistics linked with Death Certificates. [20] Overall, it was found that infants born to mothers under the age of 20, mothers that had more than 2 other children, mothers who had less than a high school education and mothers who were unmarried (all factors that are indicative of lower socioeconomic and sociodemographic status) had an increased risk of injury mortality 10 times that of the infants born to the lowest risk group. Another study of both fatal and non-fatal injuries in children published in Washington State in 1990 examined home and neighborhood socioeconomic factors and how they related to pedestrian-motor vehicle accident injury rates.[25] It was found that children living in multi-family dwellings (an indicator for low familial socioeconomic status) had a significantly higher risk of injury than those in single family dwellings, and children living in census tracts with median incomes lower than $20,000 were also at significantly greater risk for injury than those in census tracts with median incomes greater than $30,000. This demonstrates that both family level socioeconomic status variables and census tract level variables can be predictive of injury risk. Two studies examined the relationship between census tract level socioeconomic status and severe injuries (both fatal and non-fatal) in children. One study examined this relationship in Northern

Manhattan, an economically disadvantaged section of New York City, and used hospital data of injuries to determine which causes of injury were the most prevalent in these areas. [8] It was found that falls, motor-vehicle injuries, ingestions, burns and blunt traumas were the leading causes of injury, but that the rate of assault was much higher in this region than the national average, indicating a potential relationship between low socioeconomic status and high risk of assault. The second article examined the risk of severe injuries, as recorded from hospital admission data in Hamilton County, Ohio, in relation to socioeconomic status, as well as geographic representation of injuries, which will be further discussed below.[17] It was found that census tracts that had higher rates of injuries tended to have multiple indicators of low socioeconomic status (low median income, high unemployment, etc.)

Non-fatal injury articles:

There was a multitude of studies reviewed that examined the risks and rates of non-fatal injuries in children, some which considered specific causes of injury, while others examined all injuries in general. There were three studies (outlined above) that considered both non-fatal and fatal injuries that are not reiterated here. One article examined the relationship between population level race and socioeconomic factors and pedestrian-motor vehicle injuries in children in Hartford, Connecticut, with an emphasis on the geographical distribution of injuries.[5] In this study it was found that census tracts that had a higher frequency of accidents had a higher proportion of children and non-white residents, and were also characterized by a high number of households headed by females and households below the poverty line.

Two articles looked at fatal and non-fatal injuries in children in disadvantaged urban areas, and the relationship to socioeconomic status and race. The first study examined hospital medical records and death records in Northern Manhattan and considered how census-tract level socioeconomic status and race influenced injury morbidity and mortality. [9] The main finding of the study was that although it was hard to disentangle race and socioeconomic status in the disadvantaged neighborhoods, low socioeconomic status factors, particularly low median income, were significantly associated with higher rates of both accidental and intentional injuries. The second study looked at the influence of individual-level, and more importantly neighborhood-level, socioeconomic factors on injury rates in young children in Baltimore, Maryland as recorded by an adult in a survey.[16] Although all three regions researched in this study were socioeconomically disadvantaged, there was a great variation in injury rates and causes. Nonetheless it was found that younger age of the child and more housing violations (poor construction or maintenance of housing) were indicative of higher injury rates.

Another article examined the relationship between socioeconomic and psychosocial factors and the prevalence and risk of unintentional injuries in high-risk infants in North Carolina. [11] The main findings of this study were that family conflict, followed by maternal unemployment and fewer than two siblings in the home, were significant predictors of unintentional injury in infants while high stress and the use of social support were predictive of fewer unintentional injuries in infants. Another article reviewed examined the relationship between socioeconomic status, race and gender and childhood burn injuries, as well as tips for preventing certain types of burns in young

children. [30] Overall, it was found that children aged 0-4, Native American and black children, poor children and children living in South and Southeast America were at greater risks for burn injuries than older children, white children, richer children and children living in the North and Northwest. The final article reviewed was a national study that discussed the challenges of examining non-fatal injuries in children in the absence of a relevant national survey, but the researchers added a supplement to the National Health Interview Survey of 1988 which asked parents to recall whether their children had experienced a non-fatal injury in the past 12 months. [19] Overall, the study reported that adolescents and males had the highest injury rates. Contrary to most other studies, it was found that higher levels of mothers' education, health care and mothers' income were associated with higher injury rates, although none of these associations were significant after adjusting for recall bias.

Studies of Adults

The focus of the current paper is to determine how socioeconomic status and race relate to non-fatal injuries in urban-residing adults, and studies published of injury rates in adults summarize previously studied relationships and the current knowledge of the field. While the majority of studies on injuries in the United States involve childhood injury rates and risks, there were a small number of articles reviewed that considered injury rates in adults. Those studies that research adult injury rates and risks, however, frequently address individual specific causes of injuries rather than multiple types of injuries, and are also more frequently on a national rather than a city level.

Fatal injury articles:

Studies of fatal injuries are much more prevalent than studies of non-fatal injuries, and this is especially true in studies of injuries in adults. Three studies of fatal injuries were reviewed; one was a study of fatal motor vehicle injuries nation-wide and the other two were studies of national injury mortality.

The first, published in 1987, was a study of fatal motor vehicle injuries in adults by county across the nation in relation to census-level socioeconomic data, which used geographic information systems and mapping to show the population density distributions as well as the distribution of motor-vehicle injuires.[23] Although there were great variations from one county to the next, overall it appeared that counties with higher rates of motor-vehicle injuries were associated with those that were less densely populated and those that had lower incomes. The other two articles reviewed were by the same authors (Cubbin, LeClere and Smith), and used National Health Interview Survey injury rates. One publication examined the relationship between individual level socioeconomic status indicators and race in fatal and non-fatal injuries.[6] The main findings relating to fatal injuries documented tremendous variation in injury mortality rates by cause and by socioeconomic status indicator. The other publication by Cubbin, LaClere and Smith examined how both individual and neighborhood level socioeconomic status indicators affected injury mortality.[7] The authors find that both individual and neighborhood level socioeconomic indicators effected fatal injury rates, but that neighborhood level indicators had independent associations with mortality rates without the individual level effects, and that trends seen at the individual level remained robust despite the inclusion of neighborhood level effects.

Non-fatal injury articles:

Two articles examined non-fatal injuries and are most similar to the proposed study.

The first study by Cubbin, LeClere and Smith published in 2000, as summarized above, examined individual level socioeconomic factors and their association to non-fatal and fatal injuries. [6] The study found working in a blue-collar job increased the odds of a non-fatal injury overall, that African Americans were at an increased risk for homicide, and that African Americans and Hispanics were at a decreased risk for suicide and other non-fatal injuries after controlling for socioeconomic status. The second article discussed race, and to a more minimal extent, socioeconomic status, and associations with falls in elderly adults residing in community homes.[10] The main finding of interest in this study was that African American elderly adults were less likely to have a fall at all, but that race was not a significant predictor of multiple falls. Additional factors that influenced higher risks of falls in elders were increased age, increased education, diabetes, arthritis and history of broken bones.

Geocoding

Four of the articles reviewed used geographic information systems and geocoding to visually display data. Two of the four studies demonstrated the geographic prevalence of injuries (motor vehicle and overall) in localized regions,[5, 17] the third focused on nationwide motor-vehicle injury deaths,[23] while the fourth wasn't focused on injuries but instead considered breast and colorectal cancer mortality rates in the Bronx.[24] All of the studies used the maps to demonstrate the location and pattern of high concentrations of injuries or deaths, particularly in relation to census tract information or population

density. These studies were of particular interest to the current study since the current study will be examining how non-fatal injuries in adults are distributed in the Atlanta area, specifically in relation to hospital location and known sociodemographic characteristics.

Chapter 3: Methods

Introduction

The data for this study was collected from two different sources: emergency department data from metro-Atlanta hospitals and 2000 census data from the U.S. Census Bureau.[31] Patients' addresses collected from the emergency departments were geocoded using ArcGIS for Windows by Ritam Chowdhury in 2011 to the to the census block group. [32] The geocoding success rate was approximately 80.78% (from a total of 3.85 million records to 3.11 million geocoded records). Missing geocodes were primarily due to P.O. Boxes or address matches with less than 50% match probability. The data were restricted to the years 2001 – 2004 and to the 10 hospitals of interest[a] that reported complete data, using SAS software, Version 9.3 of the SAS system for Windows.[33] Restricting the years reduced the number of observations from 3.11 million to 2.46 million, and restricting the data to the 10 specified hospitals resulted in 2.23 million observations. Next, any improbable addresses were removed (i.e. no longitude or latitude), and the number of observations dropped to 1.89 million. Since the interest was in looking at non-fatal injuries in adults only, the data were then restricted to those aged 18 and older, yielding almost 1.31 million observations. The census data were then merged with the Census 2000 data at the block group level.

Injuries were coded using ICD-9 E codes, ranging from 800 to 999, and were split into 15 different categories: falls, traffic injuries, struck by objects, overexertion, assault, drug reaction, surgery, bites, foreign body, venom, bicycle injuries, burns, suicide,

[a] The hospitals of interest were Cobb Wellstar, Crawford Long, Douglas Wellstar, Emory University, Grady – SMS, Gwinnett, Henry, Kennestone Wellstar, Paulding Wellstar and Southwest

accidental drug overdose, and other injuries. Only the first ICD-9 E code for each participant was used, reflecting only those injuries as the primary cause of emergency department visit. The three largest categories were other injuries (65.2%), falls (9.8%) and suicide (8.4%). Race at the census block group level was recorded in as a categorical variable that provided frequencies and counts for how many and which races were present in a census block group. The races analyzed at the census block group level were the proportions of non-Hispanic whites, non-Hispanic blacks, Hispanics, and a group of "other races" which consisted of Asian and Pacific Islanders, American Indian or Alaskan Natives or those who reported "other" or "none" as their race or ethnicity. Those census block groups that reported none of the listed race groups (including the "other races") were listed as missing racial information, and are considered a separate category. The missingness of the data severely impacts results and are thus not interpreted in the analyses, but are presented in the results tables.

Analyses of Interest

The main interest of this paper was to determine whether the probability of non-fatal injuries differs by race and socioeconomic status. All analyses were performed using SAS software, Version 9.3 of the SAS System for Windows.[33] The relationship between race / ethnicity and non-fatal injuries was examined at both the individual level and the census block group level, while the socioeconomic status variables were examined only at the census block group level. Those socioeconomic status variables of interest were median household income, percent of population below poverty level, and percent with less than high school education. Since previous research has indicated that the probability of assault and suicide vary by race, and falls are one of the largest injury categories, these

three variables were the outcomes of interest in the study. To determine the odds ratio associated with individual-level and block group-level covariates for each of these injuries, each specific injury was treated as a case, and the cases were compared to controls defined as all other injuries. The use of all other injuries as the referent group implies that our analysis addresses whether race/ethnicity and sociodemographic factors impact falls differently than they do other injury types. Additionally, the relationship between socioeconomic and race on all injuries was examined in comparison to all non-injury related emergency department visits. For this analysis, all injuries were treated as cases, and the controls were defined as all emergency department visits. Multivariate and univariate logistic regression were used to determine the odds of each injury group versus the odds of all other injuries, or all injuries in general in comparison to the odds of all emergency department visits for race/ethnicity and socioeconomic status, controlling for age, gender, and month of the year.

Geographic Information Systems

The local risk of each type of injury was estimated for each ZIP code by taking the counts of each type of injury and dividing them by the total population of the ZIP code. Each percent was then multiplied by 100,000 persons to obtain a crude incidence. These incidences were then mapped using ArcGIS by ZIP code in relation to the distribution of the hospitals of interest within the Atlanta area. This analysis was performed for each injury group of interest (assault, suicide, and falls) and all injuries overall to determine whether certain types of injuries were clustered more closely around specific hospitals or areas. The ZIP code level was used rather than the census block group to aid with confidentiality due to low counts, and to observe broader trends. The

ZIP code level greater Atlanta GIS data was taken from ESRI.[32] Greater Atlanta area ZIP codes are defined as those that range from 30000 through 30399.

Chapter 4: Results

Descriptive Statistics

This analysis included nearly 1.31 million observations from 10 different hospitals within the metro-Atlanta area. Individual level, injury and census level descriptive statistics are displayed in Table 1. Approximately 25% of all emergency department visits to the 10 hospitals of interest between 2001 and 2004 were for injuries, with the majority (65.2%) of these being other, uncategorized injuries. The next three largest categories of injury emergency department visits were falls (9.8%), suicide (8.4%), and motor vehicle accidents (3.9%). The remaining 10 injury categories accounted for less than 13% of all injury-related emergency department visits combined. The average emergency department visitor in general was approximately 44 years of age, female, and white, while the average emergency department visitor for an injury was approximately 40 years of age, male, and black. Most of the census block groups observed had all four race groups. The average median household income was $49,200 and on average 12% of households were below the poverty level per census block group. Additionally, on average, 20% of individuals had less than a high school diploma per census block group.

Geographic Information Systems Mapping

The results from using ArcGIS to map the rate of the specific injuries by ZIP code, in relation to the area's hospitals are displayed in Figures 1 through 9. Figure 1 shows the rate of falls versus all emergency department visits by ZIP code in the greater Atlanta area. It is visible that those ZIP codes with more falls tended to be in the northern region, particularly to the northeast. Since falls occur most frequently in or around the

home, it is understandable that there was no visible pattern around the hospitals of interest.[34] When looking at Figure 5, the rate of falls versus other injury visits by ZIP code, the pattern visible in Figure 1 became much less distinct, and no other patterns are observed.

When looking at Figure 2, the rate of assault versus all emergency department visits by ZIP code, no distinct pattern is visible, which was surprising. Assault is more common in urban areas, so it was hypothesized that a higher fraction of ED visits would be due to assault within the city limits (or, within the perimeter), and aside from one small section right in the center of the city, this was not observed.[8] However, the fact that the one ZIP code with the highest fraction of ED visits associated with assault was located right in the center of the city does support this hypothesis, although only to a minimal extent. The hypothesis was more supported by Figure 6, the rate of assault versus other ED injury visits, where it is visible that there is a slight pattern of higher incidence of assaults towards the center of the city.

Figure 3 shows the rate of suicide versus all emergency department visits by ZIP code. A visible clustering of suicide cases appears in the southeast region of the greater Atlanta area, as well as two separate smaller clusters: one near Emory University Hospital, Emory Midtown Hospital and Grady Memorial Hospital, and a second near Henry Medical Hospital, which are among the largest hospitals in Georgia. It is unclear why the majority of suicides occurred in these regions, since suicide was associated with higher socioeconomic status, and the majority of the wealth in the greater Atlanta area is in the north. [35] This pattern is also visible in Figure 7, the rate of suicide versus other injury visits by ZIP code, though the clustering around the hospitals is less severe.

Finally, in Figure 4, the rate of all injuries versus emergency department visits around the greater Atlanta area, it was seen that, by-and-large, injuries were concentrated to the north. This supports the hypothesis that the burden of injuries fell more on those of higher socioeconomic status (in comparison to all emergencies), since the majority of wealth in metro-Atlanta is concentrated in the north of the city. [35]

Unadjusted (Univariate) Analyses

Falls

Unadjusted univariate analysis considered the odds of falling by each variable of interest individually, and the results can be seen in Table 2. On an individual level, compared to whites, blacks were 0.509 times as likely to have had a visit to the emergency room related to falls versus any other injury (95% CI: 0.493-0.525; p-value<0.001) while Hispanics were 1.733 times as likely to have had a visit to the emergency room related to falls versus any other injury (95% CI: 1.664-1.805; p-value<0.001); those who reported having an "other" race did not have an odds ratio significantly different to that of whites (OR: 1.045; 95% CI: 0.994-1.098; p-value=0.083). Compared to males, females were 0.364 times as likely to have had a visit to the emergency room related to falls versus any other injury (95%CI: 0.356-0.373; p-value<0.001). For every 10 year increase in age, there was an 18.2% decrease in odds of having visited the emergency department for a fall versus another type of injury (OR: 0.818; 95% CI: 0.812-0.824; p-value<0.001).

In comparison to census block groups with all four race groups (non-Hispanic white, non-Hispanic black, Hispanic and othe), those census block groups with only

other, non-Hispanic white and Hispanic had significantly higher odds of emergency department visits due to falls versus other injuries. The census block groups with non-Hispanic whites and other races only, non-Hispanic whites and Hispanics only, and non-Hispanic whites only were not significantly different than the census block groups with all four race groups. The census block groups with the other combinations of races all had significantly lower odds ratios in regards to emergency department visits than the census block groups with all four race groups.

Finally, when looking at the continuous socioeconomic status indicators, a ten percentage point increase in either percentage of the population without at least a high school diploma or percentage of the population below the poverty level corresponded to a decrease in the odds of having had an emergency department visit related to a fall versus another type of injury (ORs, respectively: 0.999 and 0.998; both p-values <0.001). Alternately, for every 10,000 dollar increase in income, the odds of having had an emergency department visit related to a fall were 1.117 times that of any other injury (95% CI: 1.111-1.122; p-value<0.001).

Assault

Unadjusted univariate analysis next considered the odds of assault by each variable of interest individually, and the results can be seen in Table 3. On an individual level, the odds of blacks were 0.401 times that of whites to have had a visit to the emergency room related to assault versus any other injury (95%CI: 0.367-0.439; p-value<0.001). The odds of Hispanics were 0.524 times that of whites to have had a visit to the emergency room related to assault versus any other injury (95% CI: 0.440-0.623;

p-value<0.001), and the odds of those who reported having an "other" race were 0.709 times that of whites to have had a visit to the emergency room related to assault versus any other injury (95% CI: 0.612-0.822; p-value<0.001). Compared to males, the odds of females were 1.212 times that of males to have had a visit to the emergency room related to assault versus any other injury (95%CI: 1.142-1.287; p-value<0.001). For every 10 year increase in age, there was an 18.6% decrease in odds of having visited the emergency department for assault versus another type of injury (OR: 0.814; 95% CI: 0.798- 0.829; p-value<0.001).

In comparison to census block groups with all four race groups (non-Hispanic white, non-Hispanic black, Hispanic and other), those census block groups with non-Hispanic blacks only, those with non-Hispanic blacks and Hispanics only, those non-Hispanic whites and non-Hispanic blacks only, those with non-Hispanic white, non-Hispanic black and Hispanics only, those with other and non-Hispanic blacks only, those with other, non-Hispanic blacks and Hispanics only, and those with other, non-Hispanic black and non-Hispanic whites only had significantly lower odds of emergency department visits due to assault versus other injuries. The census block groups with non-Hispanic whites only, non-Hispanic whites and Hispanics only, non-Hispanic whites and others only, and non-Hispanic whites, Hispanics and others only did not have significantly different odds of assault than the census block groups with all four races.

Finally, when looking at the continuous socioeconomic status indicators, a ten percentage point increase in percentage of the population without at least a high school diploma or percentage of the population below the poverty level corresponded to a decrease in the odds of having had an emergency department visit related to assault

versus another type of injury (ORs, respectively: 0.998 and 0.998; both p-values <0.001). Alternately, for every 10,000 dollar increase in income, the odds of having had an emergency department visit related to assault were 1.099 times that of any other injury (95% CI: 1.084-1.114; p-value<0.001).

Suicide

Unadjusted univariate analysis considered the odds of suicide by each variable of interest individually, and the results can be seen in Table 4. On an individual level, compared to whites, the odds for blacks were 0.664 times as that for whites to have had a visit to the emergency room related to suicide versus any other injury (95%CI: 0.644-0.685; p-value<0.001) and the odds for Hispanics were 0.756 times as as that for whites (95% CI: 0.710-0.806; p-value<0.001). Alternately, the odds for those who reported having an "other" race were 1.142 times that of whites to have had a visit to the emergency room related to suicide versus any other injury (95% CI 1.085-1.203; p-value<0.001). The odds for females were 0.806 times that of males to have had a visit to the emergency room related to suicide versus any other injury (95%CI: 0.787-0.826; p-value<0.001). For every 10 year increase in age, there was an 8.9% decrease in odds of having visited the emergency department related to suicide versus another type of injury (OR: 0.911; 95% CI: 0.904-0.917; p-value<0.001).

In comparison to census block groups with all four race groups (non-Hispanic white, non-Hispanic black, Hispanic and other), those census block groups with non-Hispanic blacks only, those with non-Hispanic blacks and Hispanics only, those with non-Hispanic blacks and non-Hispanic whites only, those with non-Hispanic whites, non-

Hispanic blacks and Hispanics only, those with non-Hispanics blacks and others only, those with non-Hispanic blacks, Hispanics and others only, and those with non-Hispanic blacks, non-Hispanic whites and others only and other had significantly lower odds of emergency department visits due to suicide. The census block groups with non-Hispanic whites and other races only had significantly higher odds of having had an emergency department visit related to suicide. The census block groups with non-Hispanic whites and Hispanics, those with just non-Hispanic whites, and those with other races, non-Hispanic whites and Hispanics all did not have significant associations with odds of emergency room visits related to suicide.

Finally, when looking at the continuous socioeconomic status indicators, a ten percentage point increase in percentage of the population without at least a high school diploma or percentage of the population below the poverty level corresponded to a decrease in the odds of having had an emergency department visit related to suicide versus another type of injury (ORs, respectively: 0.999 and 0.999; both p-values <0.001). Alternately, for every 10,000 dollar increase in income, the odds of having had an emergency department visit related to suicide were 1.062 times that of any other injury (95% CI: 1.056-1.068; p-value<0.001).

All Injuries

Unadjusted univariate analysis considered the odds of an injury visit to the emergency department compared to all other types of visit by each variable of interest individually, and the results can be seen in Table 5. On an individual level, the odds for blacks were 0.667 times that of whites to have had a visit to the emergency room related

to any injury versus any other type of emergency visit (95% CI: 0.660-0.673; p-value<0.001) while the odds for Hispanics were 1.295 times that of whites (95% CI: 1.272-1.320; p-value<0.001); those who reported having an "other" race did not have an odds ratio significantly different to that of whites (OR: 0.989; 95% CI: 0.970-1.008; p-value=0.268). The odds for females were 0.630 times that of males to have had a visit to the emergency room related to any injury versus any other type of emergency visit (95% CI: 0.625-0.635; p-value<0.001). For every 10 year increase in age, there was a 12.5% decrease in odds of having visited the emergency department for any type of injury versus other types of emergency visit (OR: 0.875; 95% CI: 0.873-0.877; p-value<0.001).

In comparison to census block groups with all four race groups (non-Hispanic white, non-Hispanic black, Hispanic and other), those census block groups with non-Hispanic blacks only, those with non-Hispanic blacks and Hispanics only, those non-Hispanic whites and non-Hispanic blacks only, those with non-Hispanic white, non-Hispanic black and Hispanics only, those with other and non-Hispanic blacks only, those with other, non-Hispanic blacks and Hispanics only, and those with other, non-Hispanic black and non-Hispanic whites only had significantly lower odds of emergency department visits due to any injury versus other types of visits. The census block groups with non-Hispanic whites and other only, and those with non-Hispanic whites, Hispanics and others only had significantly higher odds of having an emergency department visit related to any injury versus another type of visit. Those census block groups with non-Hispanic whites only, and those with non-Hispanic whites and Hispanics only did not have significantly different odds of any injury than the census block groups with all four races.

Finally, when looking at the continuous socioeconomic status indicators, a ten percentage point increase in both percentage of the population without at least a high school diploma and percentage of the population below the poverty level corresponded to a decrease in the odds of having had an emergency department visit related to an injury versus another type of emergency department visit (ORs, respectively: 0.999 and 0.999; both p-values <0.001). Alternately, for every 10,000 dollar increase in income, the odds of having had an emergency department visit relates to an injury were 1.070 times that of any other type of emergency department visit (95% CI: 1.068-1.072; p-value<0.001).

Adjusted (Multivariate) Analyses

Multivariate analysis is used to examine the relationship of a number of variables on one dependent variable, while controlling for the effects of the other variables. The results of the multivariate analyses for falls, assault, suicide and all injuries can be seen in Tables 6-9.

Falls

The results from the multivariate analysis for the odds of emergency department visits related to falls can be seen in Table 6. The odds ratio for age was 0.821 which indicated that, for every 10 year increase, the odds of having visited the emergency department due to a fall was 0.817 times that of having visited due to another type of injury, after controlling for all other variables (95% CI: 0.811-0.823; p-value<0.001). Women were also less likely than men to have visited the emergency department related to a fall versus another type of injury with an odds ratio of 0.595 (95% CI: 0.587 – 0.602;

p-value<0.001). On an individual level, in comparison to whites, being of black race was associated with lower odds of having had an emergency department visit related to a fall versus another injury (OR: 0.583; p-value<0.001), while both Hispanic race and other race were related to higher odds of having had an emergency department visit related to a fall, after controlling for all other variables (ORs, respectively: 1.478, 1.072, both p-values<0.001). At the census block group level, the odds associated with those block groups that had only non-Hispanic whites and non-Hispanic blacks were 0.778 times that of census block groups having all four races to have visited the emergency department related to a fall versus another injury, controlling for all other variables (95% CI: 0.645-0.938; p-value=0.009), while the odds for those block groups that had only non-Hispanic blacks and other races were 1.248 times that of block groups with all four races (95% CI: 1.1013-1.539; p-value=0.038).

When looking at the continuous socioeconomic status indicators, a ten percentage point increase in the percentage of the population without at least a high school diploma corresponded to a decrease in the odds of having had an emergency department visit related to a fall versus another type of injury, after controlling for all other variables (OR: 0.9995; 95% CI: 0.9993-0.9997; p-value <0.001). Alternately, for every 10,000 dollar increase in income, the odds of having had an emergency department visit related to a fall were higher than that of any other injury, after controlling for all other variables (OR: 1.060; 95% CI: 1.050-1.070; p-value <0.001).

Assault

The results from the multivariate analysis for the odds of emergency department visits related to assault can be seen in Table 7. The odds ratio for age was 0.795 which indicated that, for every 10 year increase, the odds of having visited the emergency department due to assault was 0.795 times that for having visited due to another type of injury, after controlling for all other variables (95% CI: 0.779-0.810; p-value<0.001). Women were also more likely than men to have visited the emergency department related to assault versus another type of injury with an odds ratio of 1.109 (95% CI: 1.073 – 1.145; p-value<0.001). On an individual level, in comparison to whites, being of black race or Hispanic race was associated with lower odds of having had an emergency department visit related to assault versus another injury (ORs, respectively: 0.658, 0.721; both p-values<0.001), while those of other races were related to higher odds than whites of having had an emergency department visit related to assault, after controlling for all other variables. (OR: 1.156; p-value=0.016). None of the race indicators at the census block group level were significant.

When looking at the continuous socioeconomic status indicators, a ten percentage point increase in the percentage of the population without at least a high school diploma corresponded to a decrease in the odds of having had an emergency department visit related to a fall versus another type of injury, after controlling for all other variables (OR: 0.9995; 95% CI: 0.9990-0.9999; p-value=0.017). Additionally, those that were injured in February, as compared to December, were 1.134 times as likely to have visited the emergency department for injuries associated with assault (95% CI: 1.024-1.255; p-value=0.015).

Suicide

The results from the multivariate analysis for the odds of emergency department visits related to suicide can be seen in Table 8. The odds ratio for age was 0.904 which indicated that, for every 10 year increase, the odds of having visited the emergency department due to suicide was 0.904 times that of as having visited due to another type of injury, after controlling for all other variables (95% CI: 0.989-0.911; p-value<0.001). Women were also less likely than men to have visited the emergency department related to suicide versus another type of injury with an odds ratio of 0.911 (95% CI: 0.899 – 0.922; p-value<0.001). On an individual level, in comparison to whites, being of black race or Hispanic race was associated with lower odds of having had an emergency department visit related to suicide versus another injury (ORs, respectively: 0.788, 0.810; both p-values<0.001), while those of other races were related to higher odds of having had an emergency department visit related to suicide, after controlling for all other variables. (OR: 1.327; p-value<0.001). At the census block group level, compared to those block groups that have all four race groups, those block groups that had only non-Hispanic blacks and Hispanics, those block groups with other and non-Hispanic blacks only, and those block groups with non-Hispanic blacks, Hispanics and other races only were less likely to have visited the emergency department related to suicide versus another injury, while those block groups that had only non-Hispanic blacks and non-Hispanic whites, those block groups that had only non-Hispanic whites, non-Hispanic blacks and Hispanics, those block groups that had only non-Hispanic whites and other races only, and those block groups that had non-Hispanic whites, non-Hispanic blacks

and other races only had greater odds of having visited the emergency department related to suicide versus another injury, after controlling for all other variables.

When looking at the census block group level continuous indicators of socioeconomic status, a ten percentage point increase of the population that did not have at least a high school diploma corresponded to a decrease in the odds of having had an emergency department visit related to suicide versus another type of injury, after controlling for all other variables (OR: 0.9994; 95% CI: 0.9992-0.9996; p-value <0.001).

All Injuries

Finally, the results from the multivariate analysis for the odds of emergency department visits related to any injury compared to other emergency department visits can be seen in Table 9. The odds ratio for age was 0.874 which indicated that, for every 10 year increase, the odds of having visited the emergency department due to any injury was 0.874 times as likely as having visited due to another type of emergency, after controlling for all other variables (95% CI: 0.872-0.879; p-value<0.001). Women were also less likely than men to have visited the emergency department related to any injury versus another type of emergency department visit with an odds ratio of 0.795 (95% CI: 0.791 – 0.798; p-value<0.001). On an individual level, in comparison to whites, being of black race was associated with lower odds of having had an emergency department visit related to any injury versus another type of emergency department visit (OR: 0.752; p-value<0.001), while both Hispanic race and other race were related to higher odds of having had an emergency department visit related to any injury, after controlling for all other variables (ORs, respectively: 1.199, 1.030; both p-values<0.001). At the census

block group level, compared to those block groups that have all four race groups, those block groups that had only non-Hispanic whites, and those block groups that had only non-Hispanic whites, non-Hispanic blacks and other races were less likely to have visited the emergency department related to any injury versus another type of visit, while those block groups with only non-Hispanic blacks, non-Hispanic whites and Hispanics were more likely have visited the emergency department related to any injury versus another type of visit, after controlling for all other variables.

When looking at the census block group level continuous indicators socioeconomic status, a ten percentage point increase of the population that did not have at least a high school diploma and a ten percentage point increase of the population below the poverty level corresponded to a decrease in the odds of having had an emergency department visit related to any injury versus another type of emergency department visit, after controlling for all other variables (ORs, respectively: 0.9999, 0.9999; both p-values <0.001). Alternately, a 10,000 dollar increase in average median household income corresponded to an increase in the odds of having had an emergency department visit related to any injury versus another type of emergency department visit, after controlling for all other variables (OR: 1.048; p-values<0.001).

Chapter 5: Discussion

Outcomes of Interest

Falls

Contrary to the *a priori* hypothesis, increased age was associated with a decreased risk of falling versus other injuries, which may be due to the fact that those of older ages are not as likely to leave the house or participate in athletic activities, which can increase the incidence of falls.[10, 28] Month of the year, which was used to account for precipitation, was not a significant predictor of the odds of falling, which may be due to the fact that the precipitation in Atlanta is mostly stable from season to season, unlike in other regions where seasonal effects could lead to an increase in falls. At the individual level, blacks were less likely to have gone to the emergency room for a fall (compared to other reasons) than whites were, while both those of Hispanic race and other race were more likely. Interestingly, at the census block group level, using the multivariate model, this relationship was convoluted in that the block groups with just non-Hispanic whites and non-Hispanic blacks were less likely to have visited the emergency department for a fall while those block groups that had only non-Hispanic blacks and other races were more likely to have visited the emergency department related to a fall than for other reasons. This may be an instance of the so-called ecologic fallacy, where different associations are observed at the aggregate census level than at the individual level. It is, however, of interest to look at both the neighborhood effect of race and the individual level effect of race on injury incidence. [21] The individual level conclusions for race were supported by the univariate analysis where, at least, all the census block groups with non-Hispanic blacks were at significantly lower risks for falls than the block groups with all

four races. Overall, it was apparent that non-Hispanic black race is the strongest predictor of lowered individual level risk of falls while the other race group is the strongest predictor of higher individual risk of falls.

In looking at the socioeconomic status indicators, increasing percentages of individuals without a high school diploma were associated with lower odds of having had a fall-related emergency department visit compared to visits for other reasons, while increasing median household income was associated with higher odds of having had a fall emergency department visit. This could be due to the fact that those with a higher median household income have more access to athletic activities and related falls. This is supported by the fact that individuals from less educated census block groups, where socioeconomic status is lower, were less likely to experience a fall-related emergency department visit compared to visits for other reasons. Additionally, higher median income could also be related to bigger houses, which may include staircases, thereby increasing the risk of fall-related visits as well.

Assault

Once again, the results seen for assault injuries were contrary to the *a priori* hypothesis. It was found that those of black and Hispanic race, at the individual level, exhibited a protective effect for emergency department visits due to assault versus other injuries while those of other race groups were the ones that experienced higher odds of visits for assault versus another type of injury. This could be because the individual level indicator of race measures the injury of the victim rather than the assailant. Those of black or Hispanic race have historically had elevated rates of assault, and may therefore

be more cautious about assault in more recent years.[6, 8] Interestingly, census block group level race, using the multivariate model, was not a significant indicator of odds of assault. The individual level conclusions for race were again more supported by the univariate analysis where, the census block groups with non-Hispanic blacks were at significantly lower risks for assault than the block groups with all four races, while those with non-Hispanic whites were at higher risk for assault. Again, this may be an example of the ecologic fallacy, since the census block group level race data represents aggregations of individuals and observed associations may be different than those observed at the individual level, indicating that the census level associations may not be interpretable as injury risk at the individual level. [21]

Contrary to the *a priori* hypothesis, neither median household income nor percent of population below poverty level were significant predictors of assault versus other injury odds, and increases in percentage of population without a high school diploma were actually protective against assault, looking at the multivariate analyses. These results were further supported by the univariate analysis where low socioeconomic status was protective for assault, and all socioeconomic variables were significant. Strangely, February was significantly associated with higher odds of assault versus another type of injury in comparison to December. This could be due to a number of reasons, one of which is that since February has the fewest number of days in a month, those working hourly jobs make less money and ultimately have more debt, leading to a greater number of assaults and robberies to make up this deficit.

Suicide

The *a priori* hypothesis for suicide was that white race, male gender, and higher socioeconomic status would be associated with higher odds of suicide versus another type of injury. This hypothesis was supported by the data, since whites had higher odds of suicide than both black and Hispanics, on an individual level. Those of other races had higher odds of suicide versus other injuries than whites, interestingly. This was supported by the census block group level data observed from multivariate analysis, where the odds ratios associated with census block groups with non-Hispanic whites only and those with non-Hispanic whites and other races only were 1.307 and 1.776, respectively, for emergency department visits related to suicide versus other injuries when compared to those census block groups with all four race groups. This was also supported by the univariate analyses since those census block groups with non-Hispanic whites and other race groups only had the highest odds of suicide, while those census block groups containing non-Hispanic whites had the lowest odds, compared to the census block groups containing all four races.

Males had higher odds of suicide emergency department visits compared to other injury visits than did females. In further support of the hypothesis, as the percent of the population with less education than a high school diploma increased, the odds of having visited the emergency department related to suicide compared to other injury visits decreased, when looking at the multivariate model. This was nullified a bit by the fact that percent of the population below poverty level and median household income were non-significant in the multivariate model. All three socioeconomic variables were significant after univariate analysis, thus providing further support that those of higher

socioeconomic status were more likely to visit the emergency department for suicide over their peers of lower socioeconomic status.

All Injuries

The *a priori* hypothesis for all injuries in general was that higher socioeconomic status and white race would both be significant predictors of higher odds of an injury versus another type of emergency department visit, as would male gender and younger age. Younger age and male gender were found to be significant predictors of higher odds of any type of injury versus another type of emergency department visit. White race was a predictor of higher odds of any injury than black race at the individual level, but was a predictor of lower odds than Hispanic race or other race at the individual level, both supporting and refuting the hypothesis. The multivariate census block group level race data did not support these conclusions, since those block groups with non-Hispanic whites alone had the strongest protective odds ratio for any injury while those block groups with none of the reported race groups had the highest odds ratio for likelihood of any injury versus another type of emergency department visit. These conclusions were supported by the univariate analysis of census block group race where those block groups with non-Hispanic blacks all had lower odds of injuries than those with all four races, and those blocks with non-Hispanic whites and Hispanics had higher odds.

The hypothesis that higher socioeconomic status would be associated with higher odds of any injury versus other types of emergency department visits was supported by the multivariate and univariate data since higher median income and lower percentages of

both education lower than high school diploma and population below poverty level were all associated with higher odds of any injury.

Strengths and Weaknesses

One strength of this study is its large size, indicating that there was more than enough power to observe the intended effects. Another strength is that data were collected from a variety of regions around Atlanta, with very different socioeconomic and racial compositions, which is beneficial for analyses at the census level. Census data are beneficial for a number of reasons: they have a rich array of variables of interest for socioeconomic status, race, education (among others), and looking at data at a large scale allows for confidentiality as well as for different analyses of how a neighborhood impacts an individual.

One weakness of this study is that there was only one indicator of census block group race. There was an interest in looking at the continuous census level race variables for non-Hispanic whites, non-Hispanic blacks, Hispanics and other races, but multicollinearity was high, as tested by Variance Inflation Factors, so they were excluded from analysis. Since the factors of this race variable altered in significance between univariate and multivariate analysis, there is indication that there might have been high multicollinearity between this variable and the other census level data as well, but was not picked up by the Variance Inflation Factors. By looking at multiple indicators of race, one would be able to garner a clearer picture on how race at the census block group level impacts injuries. In this study, there were instances where the one variable of census level race indicated an opposite relationship to individual level race, and having more census level race variables would help to create a clearer picture of how race truly impacts

injuries at different levels. There was an interest in looking at the average number of people per household by census block group, but this variable too had high multicollinearity, and was therefore excluded from analysis.

Another weakness of this study is that the injury data were collected from hospital chart ICD-9 E codes. This means that from one hospital to another, the coding practice could be different. While this could alter the true incidence of injuries, training programs at hospitals have helped to alleviate these worries. This study also does not take into account comorbidities by only using the first ICD-9 E code, so an injury may have been reported as a secondary reason for the emergency department visit rather than just the primary reason, and thus the incidence of emergency department injuries in this study may be lower than the true incidence. However, since the interest is in looking at the primary cause of emergency department visits, it is sensible to look at the primary visit cause alone.

Areas for further research

This study addressed an area of research that hadn't yet been studied in detail: non-fatal injuries in adults in urban regions. However, this study only regarded those injuries with the highest incidences (i.e. falls) or those that were historically related to socioeconomic status and race (i.e. assault and suicide). One future area of research would be to examine other types of non-fatal injuries and how race and socioeconomic status in an urban environment impact these incidences. To determine if the results found in this study are generalizable, studies would need to be done in other regions, particularly in other large cities. Some research has been conducted in New York City, but it would be of interest to study other large cities as well, particularly some on the west

coast.[8,9] A second area for future research would be to conduct a more in depth analysis of precipitation and month of the year to see how this truly does affect injuries, specifically falls, motor vehicle accidents and bicycle accidents, which are the injury types most susceptible to environmental conditions. A third area for further research would be to consider specific injuries over all emergency department visits to determine how the odds ratio estimates change. A final area of future research would be to look at all ICD-9 E codes to determine how the incidence of specific injuries change as a result of looking at primary cause injuries as well as co-morbid injuries.

Conclusions

This study suggests that socioeconomic status and race are significant indicators of different types of non-fatal injuries, but that the association between individual race and neighborhood (or census block group) race is convoluted and sometimes contradictory. Socioeconomic status is continuously a strong factor in injuries, and emergency department visits in general, but the relationship is occasionally opposite of what is predicted. In general, it appears that the burden of emergency department visits for injuries in the metro Atlanta area is on those of younger age and male gender, non-Hispanic whites and those other races, and those of higher socioeconomic status, but these associations vary greatly by injury type. Additional research is needed to examine how the use of emergency services by different racial and socioeconomic groups are related to these findings.

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Appendix A: Tables and Figures

Table 1: Descriptive Statistics

Variable	Level	N = 1308892	%
Type of Injury	Falls	32104	9.8
	Traffic Accident	12747	3.9
	Struck by Objects	6575	2.0
	Overexertion	854	0.3
	Assault	4476	1.4
	Drug Reaction	8983	2.7
	Surgery	752	0.2
	Bites	25	0.0
	Foreign Body	5026	1.5
	Venom	27	0.0
	Bike Injuries	1742	0.5
	Burns	10160	3.1
	Suicide	27497	8.4
	Accidental Drug Overdose	2732	0.8
	Other	212983	65.2
Injury ED Visit?	No	982209	75.0
	Yes	326683	25.0
Gender at the Individual Level	Female	729536	55.7
	Male	579302	44.3
	Missing	54	-
Race at the Individual Level	Non-Hispanic Black	315675	29.2
	Hispanic	55619	5.1
	Other	57658	5.3
	Non-Hispanic White	653210	60.4
	Missing	226730	-

Variable	Level	N = 1308892	%
Census Level Race	None	143320	10.9
	Non-Hispanic Black only	14692	1.1
	Non-Hispanic Black and Hispanic	14672	1.1
	Non-Hispanic White only	1315	0.1
	Non-Hispanic White and Hispanic	4681	0.4
	Non-Hispanic White and non-Hispanic Black	47141	3.6
	Non-Hispanic White, non-Hispanic Black and Hispanic	127866	9.8
	Other and non-Hispanic Black	12422	0.9
	Other, non-Hispanic Black and Hispanic	10223	0.8
	Other and non-Hispanic White	1334	0.1
	Other, non-Hispanic White and Hispanic	9485	0.7
	Other, non-Hispanic White, and non-Hispanic Black	76513	5.8
	Other, non-Hispanic White, non-Hispanic Black and Hispanic	845228	64.6
Age at the Individual Level	Mean	43.5	-
	Median	40	-
	Minimum	18.0	-
	Maximum	100	-
	Std Dev	17.9	-
	Missing	0	-
Percentage non-Hispanic White by Census Block Group	Mean	0.51	-
	Median	0.59	-
	Minimum	0	-
	Maximum	1	-
	Std Dev	0.33	-
	Missing	143320	-

Variable	Level	N = 1308892	%
Percentage non-Hispanic Black by Census Block Group	Mean	0.37	-
	Median	0.22	-
	Minimum	0	-
	Maximum	1	-
	Std Dev	0.34	-
	Missing	143320	-
Percentage Hispanic by Census Block Group	Mean	0.069	-
	Median	0.036	-
	Minimum	0	-
	Maximum	0.84	-
	Std Dev	0.096	-
	Missing	143320	-
Percentage “Other” race by Census Block Group	Mean	0.0083	-
	Median	0.0043	-
	Minimum	0	-
	Maximum	0.10	-
	Std Dev	0.011	-
	Missing	143320	-
Median Household Income by Census Block Group	Mean	49,200	-
	Median	48,000	-
	Minimum	0	-
	Maximum	200,000	-
	Std Dev	20,200	-
	Missing	0	-

Variable	Level	N = 1308892	%
Percentage of People Without High School Diploma by Census Block Group	Mean	0.20	-
	Median	0.17	-
	Minimum	0	-
	Maximum	0.91	-
	Std Dev	0.13	-
	Missing	0	-
Percentage of People Below Poverty Level by Census Block Group	Mean	0.12	-
	Median	0.079	-
	Minimum	0	-
	Maximum	0.81	-
	Std Dev	0.13	-
	Missing	0	-
Distribution of Race by Census Block Group			

Table 2: Univariate analysis of Falls versus All Injuries

Covariate	Level	Odds Ratio	Lower 95% CI	Upper 95% CI	Odds Ratio P-Value
Age		**0.818**	**0.812**	**0.824**	**<0.001**
Gender at the Individual Level	Female	**0.364**	**0.356**	**0.373**	**<0.001**
	Male	--	--	--	--
Race at the Individual Level	Black	**0.509**	**0.493**	**0.525**	**<0.001**
	Hispanic	**1.733**	**1.664**	**1.805**	**<0.001**
	Other	1.045	0.994	1.098	0.083
	White	--	--	--	--
Race at the Census Block Group Level	None	**1.319**	**1.250**	**1.392**	**<0.001**
	Non-Hispanic Black and Hispanic	**0.636**	**0.554**	**0.729**	**<0.001**
	Non-Hispanic Black only	**0.660**	**0.576**	**0.755**	**<0.001**
	Non-Hispanic White and Hispanic	**1.368**	**1.009**	**1.854**	**0.044**
	Non-Hispanic White and non-Hispanic Black	1.105	0.921	1.326	0.281
	Non-Hispanic White only	**0.809**	**0.748**	**0.876**	**<0.001**
	Non-Hispanic White, non-Hispanic Black and Hispanic	0.964	0.910	1.021	0.208
	Other and non-Hispanic Black	**0.734**	**0.638**	**0.844**	**<0.001**
	Other, non-Hispanic Black and Hispanic	**0.642**	**0.546**	**0.754**	**<0.001**
	Other and non-Hispanic White	**1.687**	**1.283**	**2.220**	**<0.001**
	Other, non-Hispanic White and Hispanic	**1.543**	**1.376**	**1.731**	**<0.001**
	Other, non-Hispanic White, and non-Hispanic Black	0.987	0.926	1.053	0.694
	Other, non-Hispanic White, non-Hispanic Black and Hispanic	--	--	--	--

Percentage of People Without a High School Diploma by Census Block Group		**0.999**	**0.998**	**0.999**	**<0.001**
Median Household Income by Census Block Group		**1.117**	**1.111**	**1.122**	**<0.001**
Percentage of People Below Poverty Level by Census Block Group		**0.998**	**0.998**	**0.998**	**<0.001**

Table 3: Univariate analysis of Assault versus All Injuries

Covariate	Level	Odds Ratio	Lower 95% CI	Upper 95% CI	Odds Ratio P-Value
Age		**0.814**	**0.798**	**0.829**	**<0.001**
Gender at the Individual Level	Female	**1.212**	**1.142**	**1.287**	**<0.001**
	Male	--	--	--	--
Race at the Individual Level	Black	**0.401**	**0.367**	**0.439**	**<0.001**
	Hispanic	**0.524**	**0.440**	**0.623**	**<0.001**
	Other	**0.709**	**0.612**	**0.822**	**<0.001**
	White	--	--	--	--
Race at the Census Block Group Level	None	1.141	0.981	1.328	0.088
	Non-Hispanic Black and Hispanic	0.839	0.601	1.172	0.302
	Non-Hispanic Black only	0.716	0.501	1.024	0.068
	Non-Hispanic White and Hispanic	1.103	0.443	2.745	0.8326
	Non-Hispanic White and non-Hispanic Black	**1.786**	**1.200**	**2.656**	**0.004**
	Non-Hispanic White only	1.000	0.817	1.224	0.999
	Non-Hispanic White, non-Hispanic Black and Hispanic	1.081	0.925	1.263	0.330
	Other and non-Hispanic Black	**0.496**	**0.315**	**0.782**	**0.003**
	Other, non-Hispanic Black and Hispanic	**0.391**	**0.224**	**0.683**	**0.001**
	Other and non-Hispanic White	1.908	0.952	3.821	0.069
	Other, non-Hispanic White and Hispanic	**1.493**	**1.089**	**2.047**	**0.013**
	Other, non-Hispanic White, and non-Hispanic Black	0.914	0.763	1.096	0.332
	Other, non-Hispanic White, non-Hispanic Black and Hispanic	--	--	--	--

Percentage of People Without a High School Diploma by Census Block Group		**0.998**	**0.998**	**0.999**	**<0.001**
Median Household Income by Census Block Group		**1.099**	**1.084**	**1.114**	**<0.001**
Percentage of People Below Poverty Level by Census Block Group		**0.998**	**0.998**	**0.999**	**<0.001**

Table 4: Univariate analysis of Suicide versus All Injuries

Covariate	Level	Odds Ratio	Lower 95% CI	Upper 95% CI	Odds Ratio P-Value
Age		**0.911**	**0.904**	**0.917**	**<0.001**
Gender at the Individual Level	Female	**0.806**	**0.787**	**0.826**	**<0.001**
	Male	--	--	--	--
Race at the Individual Level	Black	**0.664**	**0.644**	**0.685**	**<0.001**
	Hispanic	**0.756**	**0.710**	**0.806**	**<0.001**
	Other	**1.142**	**1.085**	**1.203**	**<0.001**
	White	--	--	--	--
Race at the Census Block Group Level	None	**1.412**	**1.336**	**1.492**	**<0.001**
	Non-Hispanic Black and Hispanic	**0.736**	**0.643**	**0.842**	**<0.001**
	Non-Hispanic Black only	**0.686**	**0.597**	**0.789**	**<0.001**
	Non-Hispanic White and Hispanic	1.332	0.966	1.837	0.080
	Non-Hispanic White and non-Hispanic Black	1.061	0.874	1.287	0.551
	Non-Hispanic White only	1.027	0.952	1.108	0.497
	Non-Hispanic White, non-Hispanic Black and Hispanic	0.957	0.902	1.016	0.153
	Other and non-Hispanic Black	**0.710**	**0.612**	**0.822**	**<0.001**
	Other, non-Hispanic Black and Hispanic	**0.542**	**0.452**	**0.651**	**<0.001**
	Other and non-Hispanic White	**2.100**	**1.620**	**2.721**	**<0.001**
	Other, non-Hispanic White and Hispanic	1.109	0.967	1.272	0.139
	Other, non-Hispanic White, and non-Hispanic Black	1.004	0.939	1.073	0.908
	Other, non-Hispanic White, non-Hispanic Black and Hispanic	--	--	--	--

Percentage of People Without a High School Diploma by Census Block Group		**0.999**	**0.999**	**0.999**	**<0.001**
Median Household Income by Census Block Group		**1.062**	**1.056**	**1.068**	**<0.001**
Percentage of People Below Poverty Level by Census Block Group		**0.999**	**0.999**	**0.999**	**<0.001**

Table 5: Univariate analysis of All Injuries versus other Emergency Department Visits

Covariate	Level	Odds Ratio	Lower 95% CI	Upper 95% CI	Odds Ratio P-Value
Age		**0.875**	**0.873**	**0.877**	**<0.001**
Gender at the Individual Level	Female	**0.630**	**0.625**	**0.635**	**<0.001**
	Male	--	--	--	--
Race at the Individual Level	Black	**0.667**	**0.660**	**0.673**	**<0.001**
	Hispanic	**1.295**	**1.272**	**1.320**	**<0.001**
	Other	0.989	0.970	1.008	0.268
	White	--	--	--	--
Race at the Census Block Group Level	None	**1.197**	**1.174**	**1.221**	**<0.001**
	Non-Hispanic Black and Hispanic	**0.801**	**0.770**	**0.835**	**<0.001**
	Non-Hispanic Black only	**0.805**	**0.773**	**0.838**	**<0.001**
	Non-Hispanic White and Hispanic	**1.155**	**1.030**	**1.295**	**0.013**
	Non-Hispanic White and non-Hispanic Black	**1.168**	**1.098**	**1.242**	**<0.001**
	Non-Hispanic White only	**0.854**	**0.832**	**0.877**	**<0.001**
	Non-Hispanic White, non-Hispanic Black and Hispanic	**0.972**	**0.953**	**0.992**	**0.007**
	Other and non-Hispanic Black	**0.758**	**0.725**	**0.793**	**<0.001**
	Other, non-Hispanic Black and Hispanic	**0.841**	**0.802**	**0.882**	**<0.001**
	Other and non-Hispanic White	**1.371**	**1.229**	**1.529**	**<0.001**
	Other, non-Hispanic White and Hispanic	**1.211**	**1.158**	**1.267**	**<0.001**
	Other, non-Hispanic White, and non-Hispanic Black	**0.978**	**0.956**	**1.000**	**0.047**
	Other, non-Hispanic White, non-Hispanic Black and Hispanic	--	--	--	--

Percentage of People Without a High School Diploma by Census Block Group		**0.999**	**0.999**	**0.999**	**<0.001**
Median Household Income by Census Block Group		**1.070**	**1.068**	**1.072**	**<0.001**
Percentage of People Below Poverty Level by Census Block Group		**0.999**	**0.999**	**0.999**	**<0.001**

Table 6: Multivariate analysis of Falls versus All Injuries

Covariate	Level	Odds Ratio	Lower 95% CI	Upper 95% CI	Odds Ratio P-Value
Age		**0.817**	**0.811**	**0.823**	**<0.001**
Gender at the Individual Level	Female	**0.595**	**0.587**	**0.602**	**<0.001**
	Male	--	--	--	--
Race at the Individual Level	Black	**0.583**	**0.567**	**0.600**	**<0.001**
	Hispanic	**1.478**	**1.430**	**1.527**	**<0.001**
	Other	**1.072**	**1.032**	**1.114**	**<0.001**
	White	--	--	--	--
Race at the Census Block Group Level	None	1.005	0.942	1.072	0.890
	Non-Hispanic Black and Hispanic	0.968	0.762	1.230	0.793
	Non-Hispanic Black only	0.917	0.737	1.141	0.438
	Non-Hispanic White and Hispanic	0.950	0.690	1.310	0.755
	Non-Hispanic White and non-Hispanic Black	**0.778**	**0.645**	**0.938**	**0.009**
	Non-Hispanic White only	0.955	0.867	1.052	0.352
	Non-Hispanic White, non-Hispanic Black and Hispanic	1.017	0.950	1.089	0.623
	Other and non-Hispanic Black	**1.248**	**1.013**	**1.539**	**0.038**
	Other, non-Hispanic Black and Hispanic	1.158	0.915	1.465	0.224
	Other and non-Hispanic White	1.042	0.779	1.394	0.781
	Other, non-Hispanic White and Hispanic	1.033	0.914	1.167	0.607
	Other, non-Hispanic White, and non-Hispanic Black	0.986	0.913	1.065	0.719
	Other, non-Hispanic White, non-Hispanic Black and Hispanic	--	--	--	--

Percentage of People Without a High School Diploma by Census Block Group		**0.9995**	**0.9993**	**0.9997**	**<0.001**
Median Household Income by Census Block Group		**1.060**	**1.050**	**1.070**	**<0.001**
Percentage of People Below Poverty Level by Census Block Group		1.000	1.000	1.000	0.077
Month	1	0.993	0.955	1.033	0.725
	2	1.020	0.980	1.062	0.329
	3	0.961	0.924	1.000	0.052
	4	1.023	0.984	1.064	0.251
	5	0.962	0.925	1.001	0.057
	6	1.002	0.962	1.043	0.936
	7	1.008	0.969	1.048	0.699
	8	1.022	0.983	1.061	0.275
	9	0.995	0.957	1.035	0.816
	10	0.987	0.949	1.026	0.517
	11	1.020	0.981	1.061	0.316
	12	--	--	--	--

Table 7: Multivariate analysis of Assault versus All Injuries

Covariate	Level	Odds Ratio	Lower 95% CI	Upper 95% CI	Odds Ratio P-Value
Age		**0.795**	**0.779**	**0.810**	**<0.001**
Gender at the Individual Level	Female	**1.109**	**1.073**	**1.145**	**<0.001**
	Male	--	--	--	--
Race at the Individual Level	Black	**0.658**	**0.604**	**0.717**	**<0.001**
	Hispanic	**0.721**	**0.630**	**0.825**	**<0.001**
	Other	**1.156**	**1.027**	**1.301**	**0.016**
	White	--	--	--	--
Race at the Census Block Group level	None	0.907	0.719	1.145	0.413
	Non-Hispanic Black and Hispanic	1.368	0.718	2.606	0.341
	Non-Hispanic Black only	1.267	0.686	2.338	0.450
	Non-Hispanic White and Hispanic	0.724	0.250	2.099	0.552
	Non-Hispanic White and non-Hispanic Black	1.388	0.893	2.160	0.145
	Non-Hispanic White only	1.196	0.886	1.614	0.243
	Non-Hispanic White, non-Hispanic Black and Hispanic	1.268	1.000	1.608	0.050
	Other and non-Hispanic Black	0.910	0.421	1.965	0.810
	Other, non-Hispanic Black and Hispanic	0.166	0.027	1.019	0.053
	Other and non-Hispanic White	1.511	0.737	3.096	0.259
	Other, non-Hispanic White and Hispanic	1.218	0.846	1.753	0.288
	Other, non-Hispanic White, and non-Hispanic Black	1.114	0.859	1.446	0.416
	Other, non-Hispanic White, non-Hispanic Black and Hispanic	--	--	--	--

Percentage of People Without a High School Diploma by Census Block Group		**0.9995**	**0.9990**	**0.9999**	**0.017**
Median Household Income by Census Block Group		1.008	0.982	1.035	0.550
Percentage of People Below Poverty Level by Census Block Group		1.000	0.999	1.001	0.946
Month	1	0.920	0.825	1.026	0.132
	2	**1.134**	**1.024**	**1.255**	**0.015**
	3	0.962	0.866	1.070	0.478
	4	0.962	0.864	1.072	0.483
	5	0.965	0.869	1.072	0.508
	6	1.074	0.969	1.192	0.175
	7	1.023	0.922	1.134	0.673
	8	1.016	0.917	1.125	0.763
	9	0.973	0.877	1.080	0.609
	10	1.034	0.935	1.145	0.512
	11	0.952	0.855	1.060	0.374
	12	--	--	--	--

Table 8: Multivariate analysis of Suicide versus All Injuries

Covariate	Level	Odds Ratio	Lower 95% CI	Upper 95% CI	Odds Ratio P-Value
Age		**0.904**	**0.898**	**0.911**	**<0.001**
Gender at the Individual Level	Female	**0.911**	**0.899**	**0.922**	**<0.001**
	Male	--	--	--	--
Race at the Individual Level	Black	**0.788**	**0.765**	**0.812**	**<0.001**
	Hispanic	**0.810**	**0.771**	**0.850**	**<0.001**
	Other	**1.327**	**1.274**	**1.382**	**<0.001**
	White	--	--	--	--
Race at the Census Block Group Level	None	**1.225**	**1.145**	**1.311**	**<.0001**
	Non-Hispanic Black and Hispanic	0.910	0.725	1.142	0.4165
	Non-Hispanic Black only	**0.759**	**0.605**	**0.953**	**0.0174**
	Non-Hispanic White and Hispanic	1.157	0.829	1.615	0.3919
	Non-Hispanic White and non-Hispanic Black	0.889	0.726	1.089	0.2557
	Non-Hispanic White only	**1.307**	**1.191**	**1.433**	**<0.001**
	Non-Hispanic White, non-Hispanic Black and Hispanic	**1.084**	**1.009**	**1.166**	**0.028**
	Other and non-Hispanic Black	**0.764**	**0.597**	**0.977**	**0.032**
	Other, non-Hispanic Black and Hispanic	**0.555**	**0.409**	**0.752**	**<0.001**
	Other and non-Hispanic White	**1.776**	**1.359**	**2.320**	**<0.001**
	Other, non-Hispanic White and Hispanic	0.913	0.788	1.058	0.226
	Other, non-Hispanic White, and non-Hispanic Black	**1.110**	**1.024**	**1.204**	**0.011**
	Other, non-Hispanic White, non-Hispanic Black and Hispanic	--	--	--	--

Percentage of People Without a High School Diploma by Census Block Group		**0.9994**	**0.9992**	**0.9996**	**<0.001**
Median Household Income by Census Block Group		0.992	0.981	1.003	0.149
Percentage of People Below Poverty Level by Census Block Group		1.000	1.000	1.000	0.612
Month	1	1.004	0.962	1.047	0.866
	2	0.983	0.940	1.027	0.436
	3	1.014	0.972	1.057	0.528
	4	0.968	0.927	1.011	0.145
	5	1.020	0.978	1.063	0.359
	6	1.004	0.961	1.048	0.866
	7	1.013	0.971	1.056	0.561
	8	1.011	0.970	1.054	0.592
	9	1.014	0.972	1.057	0.516
	10	0.997	0.956	1.040	0.894
	11	0.970	0.929	1.013	0.169
	12	--	--	--	--

Table 9: Multivariate analysis of All Injuries versus other Emergency Department Visits

Covariate	Level	Odds Ratio	Lower 95% CI	Upper 95% CI	Odds Ratio P-Value
Age		**0.874**	**0.872**	**0.879**	**<0.001**
Gender at the Individual Level	Female	**0.795**	**0.791**	**0.798**	**<0.001**
	Male	--	--	--	--
Race at the Individual Level	Black	**0.752**	**0.745**	**0.759**	**<0.001**
	Hispanic	**1.199**	**1.182**	**1.217**	**<0.001**
	Other	**1.030**	**1.014**	**1.045**	**<0.001**
	White	--	--	--	--
Race at the Census Block Group Level	None	**1.075**	**1.050**	**1.099**	**<0.001**
	Non-Hispanic Black and Hispanic	0.956	0.890	1.026	0.2146
	Non-Hispanic Black only	0.983	0.922	1.049	0.606
	Non-Hispanic White and Hispanic	1.002	0.889	1.129	0.978
	Non-Hispanic White and non-Hispanic Black	0.985	0.923	1.050	0.642
	Non-Hispanic White only	**0.912**	**0.882**	**0.943**	**<0.001**
	Non-Hispanic White, non-Hispanic Black and Hispanic	**1.047**	**1.022**	**1.072**	**<0.001**
	Other and non-Hispanic Black	**0.921**	**0.857**	**0.989**	**0.023**
	Other, non-Hispanic Black and Hispanic	1.032	0.957	1.112	0.414
	Other and non-Hispanic White	1.094	0.976	1.226	0.122
	Other, non-Hispanic White and Hispanic	0.997	0.950	1.045	0.888
	Other, non-Hispanic White, and non-Hispanic Black	**0.970**	**0.944**	**0.997**	**0.030**
	Other, non-Hispanic White, non-Hispanic Black and Hispanic	--	--	--	--

Percentage of People Without a High School Diploma by Census Block Group		**0.9999**	**0.9998**	**0.9999**	**<0.001**
Median Household Income by Census Block Group		**1.048**	**1.044**	**1.052**	**<0.001**
Percentage of People Below Poverty Level by Census Block Group		**0.9999**	**0.9998**	**0.9999**	**<0.001**
Month	1	1.006	0.992	1.021	0.414
	2	1.004	0.989	1.020	0.567
	3	1.002	0.987	1.016	0.836
	4	1.007	0.992	1.022	0.362
	5	1.005	0.990	1.020	0.508
	6	1.002	0.987	1.017	0.834
	7	0.992	0.978	1.007	0.297
	8	0.999	0.984	1.013	0.858
	9	1.001	0.987	1.016	0.862
	10	0.995	0.981	1.009	0.496
	11	0.989	0.975	1.004	0.143
	12	--	--	--	--

Figure 1: Rate of Falls versus all Emergency Department visits by ZIP Code in metro-Atlanta, 2001-2004

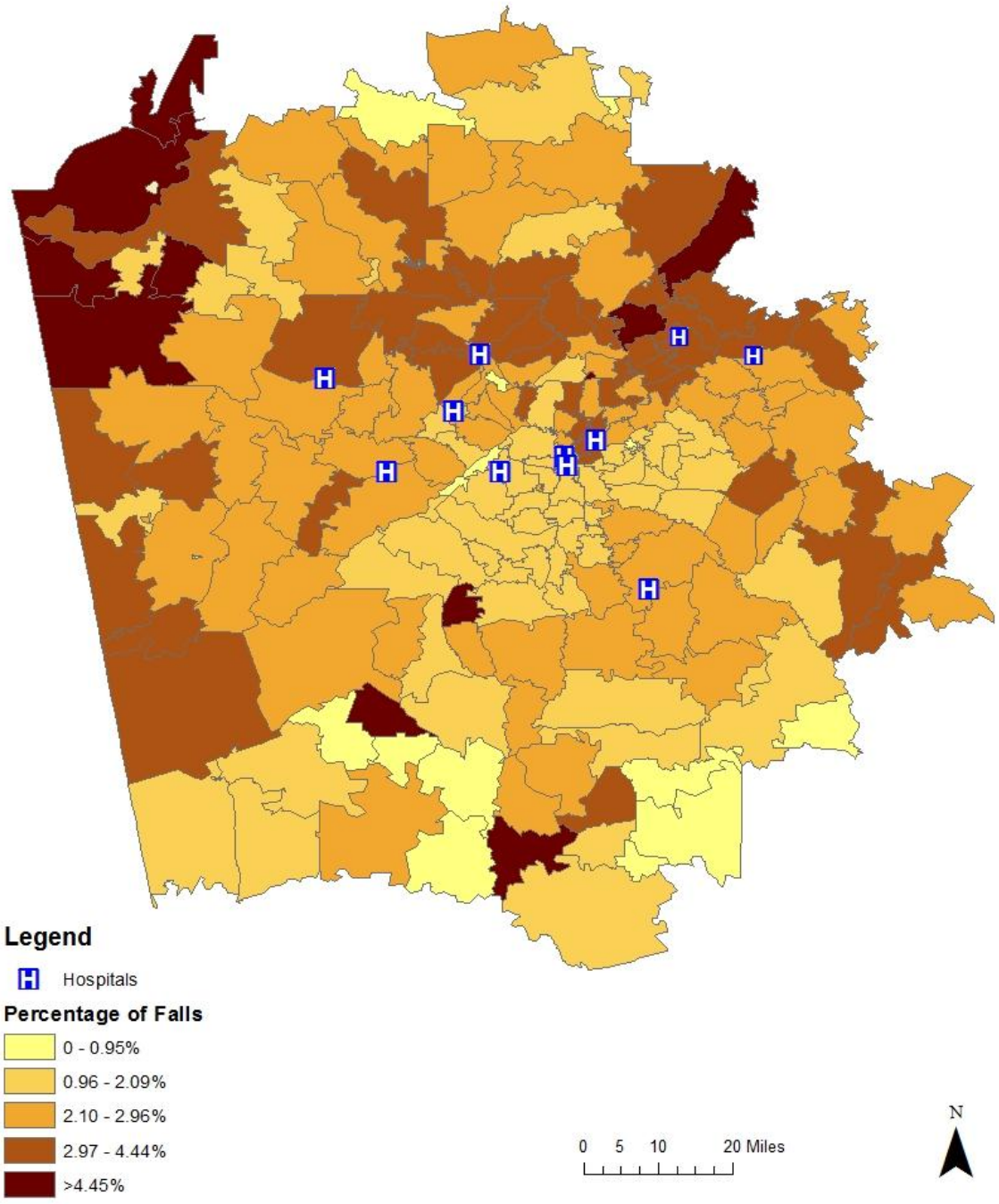

Figure 2: Rate of Assault versus all Emergency Department visits by ZIP Code in metro-Atlanta, 2001-2004

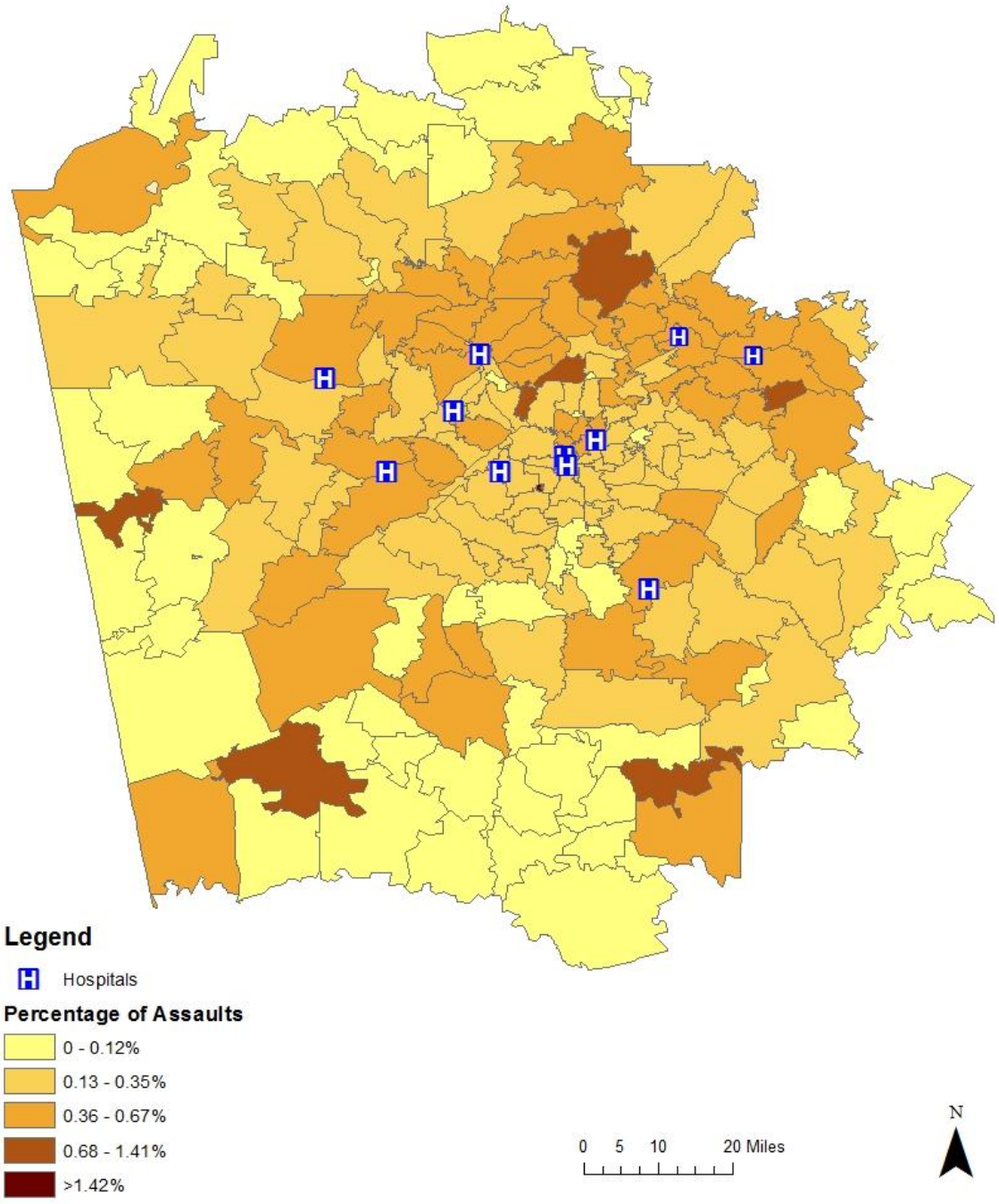

Figure 3: Rate of Suicide versus all Emergency Department visits by ZIP Code in metro-Atlanta, 2001-2004

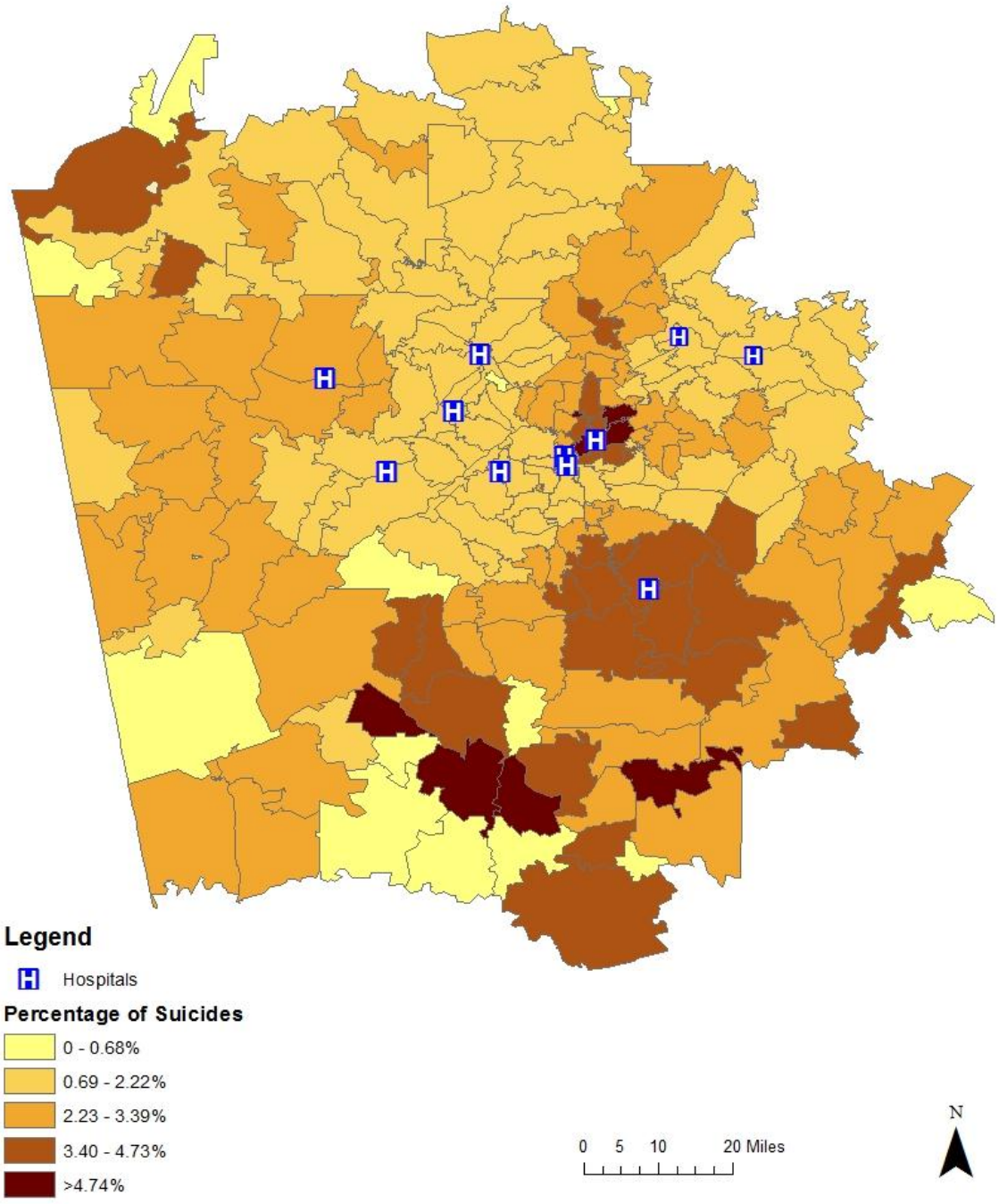

Figure 4: Rate of Injuries versus all Emergency Department visits by ZIP Code in metro-Atlanta, 2001-2004

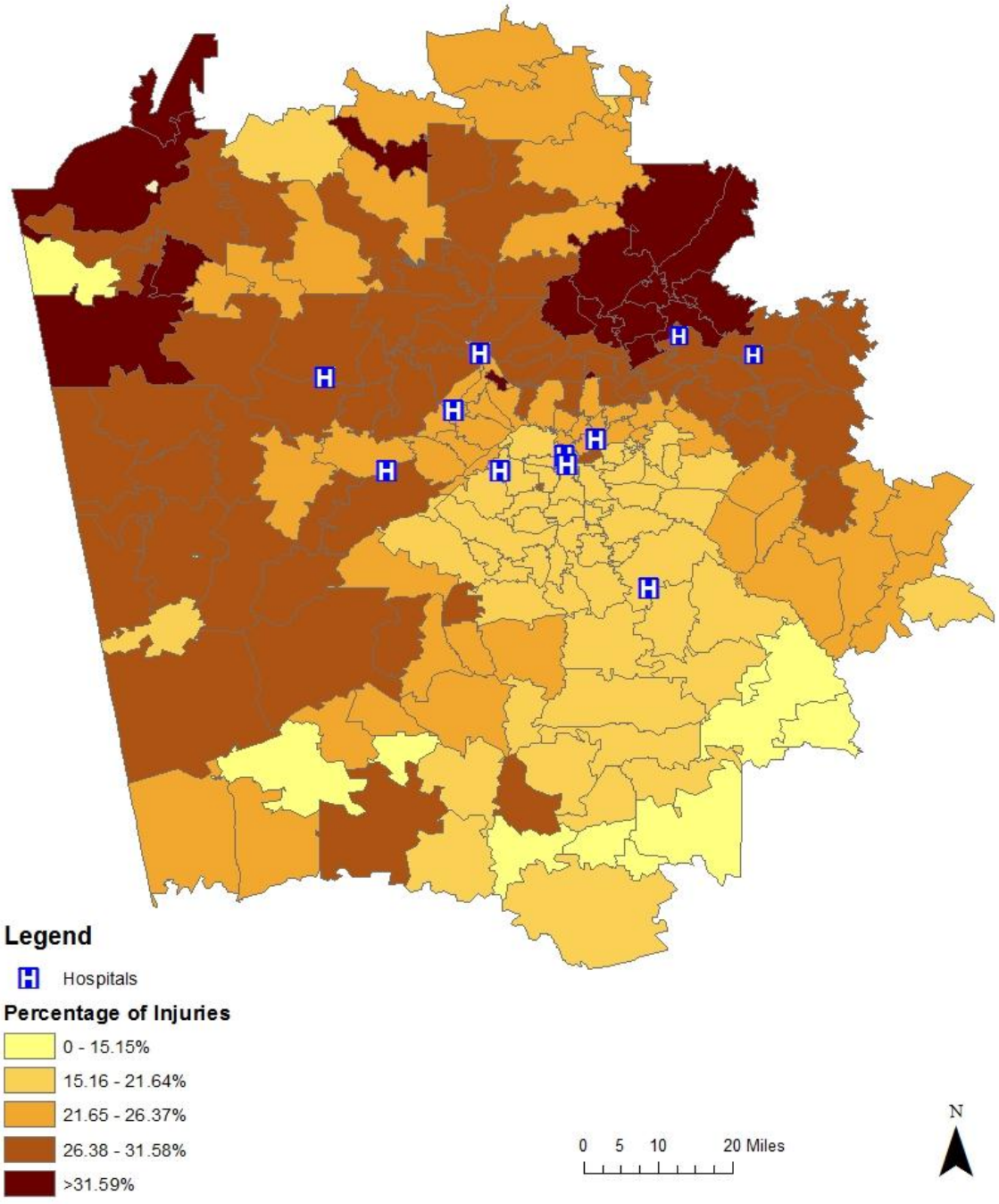

Figure 5: Rate of Falls versus all Injuries by ZIP Code in metro-Atlanta, 2001-2004

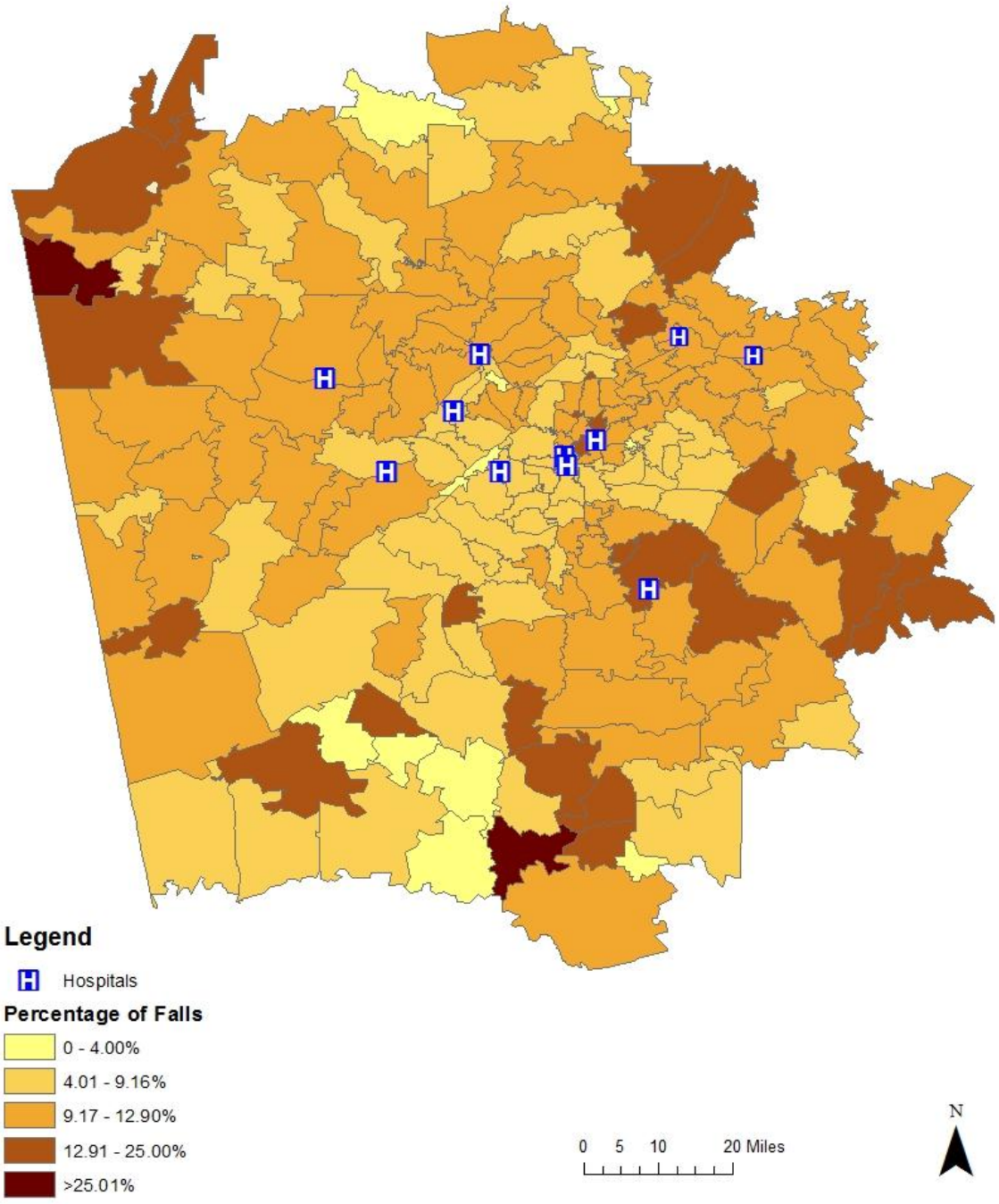

Figure 6: Rate of Assault versus all Injuries by ZIP Code in metro-Atlanta, 2001-2004

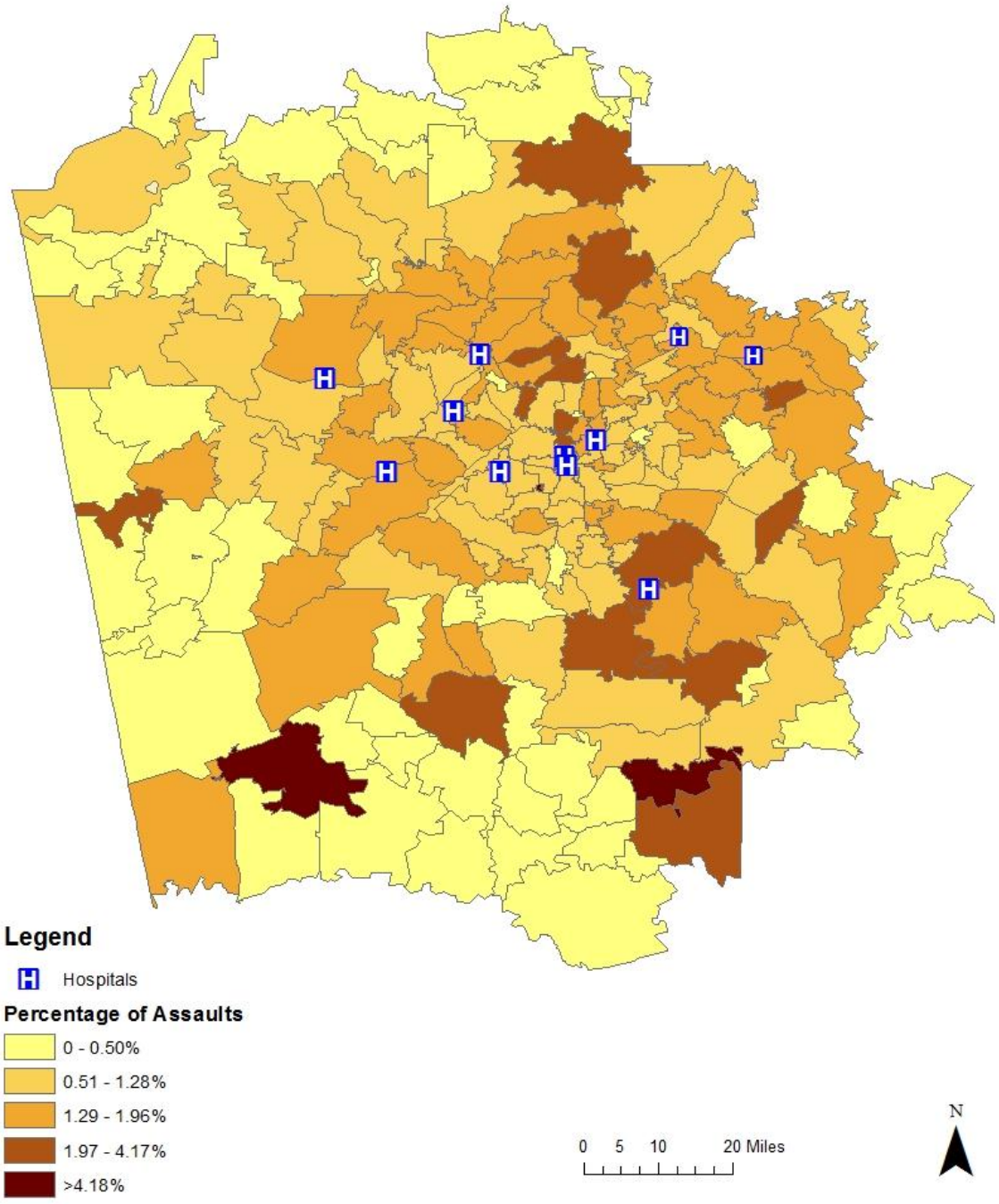

Figure 7: Rate of Suicide versus all Injuries by ZIP Code in metro-Atlanta, 2001-2004