ISSUE BRIEF
November 2023

Georgia Traffic Safety Facts

Examining Crashes and Drivers in Rural Areas

2019-2021 Data

SUMMARY: This issue brief examines differences in crashes, driving behavior, and post-crash care in Georgia's rural and urban counties using 2019-2021 Georgia crash data, 2019-2021 linked Georgia Crash-EMS-Hospital data, and the Centers for Disease Control and Prevention (CDC) 2020 Social Vulnerability Index (SVI). The goal of this investigation was to: (1) examine the difference in risky driving behaviors between local and non-local drivers involved in fatal and serious injury crashes (KA crashes) in rural and urban counties; (2) compare the differences in restraint use (seatbelt and child safety systems) among passenger vehicle occupants in rural and urban counties and, (3) describe the differences in post-crash care and expenses in rural and urban counties. These differences were examined using descriptive statistics, bivariate mapping, and inferential methods (chi-square tests, t-tests, regression analyses, and Kruskal-Wallis test). The results showed that there was a greater proportion of non-interstate traffic crashes in rural counties that resulted in serious injuries or fatalities than non-interstate traffic crashes in urban counties. Higher proportions of unrestraint, speeding, alcohol impairment, and distracted driving were found among drivers in rural crashes. Most notably, local rural drivers were more likely to have unrestrained passenger vehicle occupants with KA injuries compared to non-local rural drivers and all urban drivers. There was also a positive association between SVI and lack of restraint use—unrestraint use increases with community social vulnerability. Although the median distance from a rural county crash site for all injuries to a post-crash care facility was significantly longer than from an urban crash site, the median EMS travel times were the same. However, KA injuries that originated from a rural county crash site had a longer travel time to post-crash care compared to non-KA injuries in rural county crash sites. Patients involved in motor vehicle traffic crashes had higher hospital charges and longer lengths of stay in urban hospitals than in rural hospitals. The payor sources for rural and urban hospitals were similar except that there is a higher proportion of public payor (Medicaid and Medicare) in rural counties.

Introduction

Rural Areas vs. Rural Roadways

This report examines the unique traffic safety challenges and concerns on rural roads in the state of Georgia. There are common characteristics of rural areas that may or may not be located near or within urbanized areas.[1] These characteristics may include traditional main street communities, college communities, edge communities (those located at the edge of metropolitan statistical areas), military edge communities, and gateway communities (those adjacent to public lands). Historically, Georgia rural communities are characterized as having predominantly farming, recreation-oriented, or resource-based industries.

Transportation research studies have determined rural classifications in multiple ways, including considerations for population estimates or land use. Rural populations are determined by the U.S. Census Bureau's 2021 American Community Survey, where counties with less than 50,000 persons are considered rural counties. However, the U.S. Department of Transportation's classifications of rural roadways (and thus rural roadway segments) are based on

[1] An Active Roadmap: Best Practices in Rural Mobility. Smart Groth American (National Complete Streets Coalition), July 2023

land use at the census tract level and categorized as urban, urbanized, or rural. It is important to note that the land use and population categorization of urban and rural counties are not mutually exclusive; rural roadway segments can be located in urban counties, and urban roadway segments can be located in rural counties. For the purpose of this report and investigation and with consideration for the traffic safety practitioners in Georgia, rural counties are defined at the county level based on population estimates and not by land use on the census tract levels.

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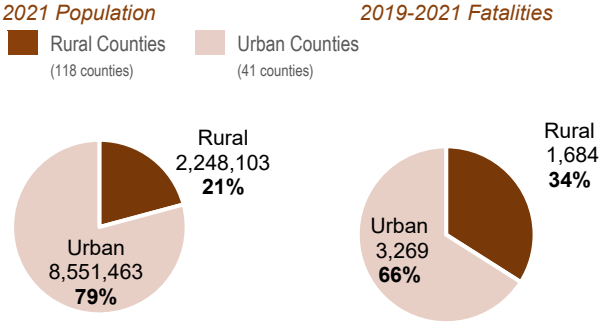
Statewide Traffic Fatality Trends[3]

More than one-third (34%) of Georgia's traffic fatalities occurred in rural counties—though only 21% of the population lives in rural counties. Rural counties consistently represented 21% to 22% of Georgia's population across the past decade. Between 2019 and 2021, there were 1,684 traffic fatalities across Georgia's 118 rural counties (Figure 1), compared to 3,269 traffic fatalities across Georgia's 41 urban counties. This is an average of 561 per year in rural counties and 1,090 per year in urban counties.

Figure 1. **Georgia Population and Traffic Fatalities by Rural/Urban Counties**



While urban counties have more traffic fatalities, the fatality rate per 100M vehicle miles traveled (VMT) was nearly 1.3 times greater in 2021 (1.82 in rural counties versus 1.37 in urban counties). Over the past decade, the *fatality rate per 100M VMT* in rural counties increased by 14% from 1.59 in 2012 to 1.82 in 2021—compared to 44% in urban counties (from 0.95 to 1.37). During the same period, the *fatality rate per 100,000 population* in rural counties increased by 28% from 19.6 in 2012 to 25.0 in 2021—compared to 38% in urban counties (12.0 to 16.6).

Similar to traffic fatalities, most traffic-related serious injuries occurred in urban counties, and most individuals receiving post-crash treatment at an ED and/or hospital facility were urban county residents. Twenty-four percent of police-reported traffic-related serious injuries occurred in rural counties, and 76% occurred in urban counties. Twenty-two percent of patients receiving post-crash care at an ED and/or hospital were rural county residents, and 78% were urban county residents.

According to GDOT's 2021 Mileage by Route and Road System Report, 27% of the vehicle miles traveled in rural counties were designated for urbanized land use, and 8% of the vehicle miles traveled in urban counties were designed for rural land use. Urbanized roadways in rural counties have a higher risk of traffic-related fatalities and serious injuries compared to urbanized roadways in urban counties. In 2021, the proportion of crashes that resulted in a fatality on *urbanized roadways (defined by land use) in rural counties* was 2.2 times the proportion of crashes that resulted in a fatality on urbanized roadways in urban counties. The occurrence of fatal crashes on *urbanized interstates in rural counties* is 10.9 times the occurrence of fatal crashes on urbanized interstates in urban counties.

[2] Rural counties have a population of less than 50,000 according to the United States Decennial Census of 2010 or any future such census (O.C.G.A. Section 31-6-2).

[3] Crash Outcomes Data Evaluation System. (2023, October). Rural and Urban Comparison: 2021 data. (Georgia Traffic Safety Facts). Atlanta, GA: Governor's Office of Highway Safety.

Driving Behaviors Urban vs. Rural Counties

The traffic behaviors among drivers and passenger vehicle occupants in rural and urban counties are also different. According to the "Observational Survey of Seat Belt Use in Georgia" study conducted by the Injury Prevention Research Center at Emory University, rural counties had lower seat belt usage rates compared to urban counties. In 2023, seat belt rates were highest in counties in the Atlanta Metropolitan Statistical Area (90.3%), followed by counties in other Metropolitan Statistical Areas (87.5%), and counties in rural counties (81.7%). Historically, rural counties have had a higher proportion of fatally or seriously injured passenger vehicle occupants that were unrestrained compared to urban counties. In 2021, 52% of passenger vehicle occupants fatally injured in rural counties were unrestrained, compared to 45% in urban counties. Thirty-one percent of passenger vehicle occupants seriously injured in rural counties were unrestrained compared to 16% in urban counties.

Over the decade (2012-2021), the proportion of speeding-related traffic fatalities was higher in urban counties than in rural counties. In 2021, 22% of all traffic fatalities in urban counties involved a speeding driver, compared to 18% of all traffic fatalities in rural counties. However, the rate of speeding-related fatal crashes per 100M VMT was higher in rural counties compared to urban counties—0.30 speeding-related fatal crashes per 100M VMT in rural counties versus 0.27 in urban counties.

Similarly, the proportion of alcohol-impaired-related fatalities (traffic fatalities that involved at least one driver with a reported blood alcohol concentration level of 0.08 grams per deciliter or higher) was higher in urban counties than in rural counties. In 2021, 22% of all traffic fatalities in urban counties were alcohol-related, and 21% of all traffic fatalities in rural counties were alcohol-related. However, the rate of alcohol-related fatal crashes per 100M VMT was higher in rural counties compared to urban counties—0.38 alcohol-related fatal crashes per 100M VMT in rural counties versus 0.31 in urban counties.

In some rural counties, there is a perception that there has been an increase in pass-through traffic (non-local drivers commuting through rural counties). According to the "Rural Road Evaluation Report" conducted by the Traffic Safety Research and Evaluation Group at the University of Georgia, local residents of Stewart County reported an increase in pass-through traffic that contributed to traffic congestion and wear-and-tear on local roadways, particularly by tractor trailers and logging trucks. Additionally, there is a perception that non-local drivers are unfamiliar with the rural roadway conditions (i.e., roadway curves, low lighting, marked/unmarked lanes, animal crossings, etc.) and may have a higher risk of involvement in severe crashes.

Research Objectives

The goal of this investigation was to:

1. Examine the difference in driving behaviors between local and non-local drivers involved in fatal and serious injury crashes (**KA** crashes) in rural and urban counties;
2. Compare the differences in restraint use (seatbelt and child safety systems) among passenger vehicle occupants in rural and urban counties; and,
3. Describe the differences in post-crash care and expenses in rural and urban counties.

Methods

Serious Injury and Fatal Crashes

The KABCO Injury Classification Scale, established by the Model Minimum Uniform Crash Criteria (MMUCC), defines the severity of injuries that occur in motor vehicle traffic-related crashes. The KABCO scale has the following classification of injury: killed/fatal injury (K), serious/suspected serious injury (A), visible/suspected minor or visible injury (B), complaint/possible injury or

complaint (C), and not injured/no apparent injury (O). The state of Georgia specifically defines suspected serious injuries as injuries reported by law enforcement and is used when any injury, other than fatal injury, prevents the injured person from walking, driving, or normally continuing the activities the person was capable of before the injury occurred. A suspected serious injury is any injury other than fatal that results in one or more of the following: severe laceration resulting in exposure of underlying tissues/muscle/organs or resulting in significant loss of blood, broken or distorted extremity (arm or leg), crush injuries, suspected skull, chest or abdominal injury other than bruises or minor lacerations, significant burns (second and third degree burns over 10% or more of the body), unconsciousness when taken from the crash scene, or paralysis.

For the purpose of this research investigation, only KA crashes (those that result in a traffic fatality or as suspected serious injury) were used in the analysis for the first two research objectives. The most severe injury at the vehicle level was used in the driver risky behavior analyses, and duplicate crash records were removed.

Local vs. Non-Local Drivers

The 5-year average commute time for Georgians reported in the US Census was 28.6 minutes (2017– 2021). The National Household Travel Survey reported the average distance driven from home for urban and rural drivers in the US in 2021 was 9.9 miles and 14 miles, respectively, and that 71.8% of trips in Georgia were under 10 miles in 2021 (https://nhts.ornl.gov).

To determine the average travel distance for Georgia drivers, 2017-2021 Georgia crash records were used as a proxy and estimate for all trips. These records were filtered to include only KAB crashes, as these crashes have accurate location records. These records were further filtered for reports that included a latitude and longitude of the crash location that indicated the crash was in Georgia and also included the address of the driver of the vehicle (n=171,178). The zip code of the driver's residential address was used to determine the latitude and longitude of the driver's residence, and the crash location was the crash latitude and longitude given in the report.

Summary statistics for the distance from place of residence to the crash site were calculated, the minimum crash distance was under 1 mile, the maximum was 328 miles, the median was 6.5 miles, and the interquartile range was 10 miles. The 80th percentile of distance was 14.8 miles. This distance was rounded to 15 miles—more than 80% of Georgia drivers crashed less than 15 miles from place of residence between 2017 and 2021. We defined a non-local driver as a driver who crashed more than 15 miles from the residential address recorded in the crash report.

Linking Methodology

The 2019-2021 Crash, EMS, Emergency Department, and Hospitalizations were linked using the probabilistic linking techniques in LinkSolv Record Linkage Software. LinkSolv Record Linkage Software was used for standardizing the reported data for record linkage purposes and computing Bayesian probabilities that determine if candidate record pairs are true links. Links that were assigned a probability greater than 0.95 were selected for analysis. This technology finds true linked pairs by comparing data values on candidate pairs of records and calculating the probability that each pair is a true match given comparison outcomes: agreement, disagreement, or missing.

Across all three datasets (crash, EMS, and ED/hospital), 67,774 unique sets of records were linked for 2019-2021 (3 years). These records were used to determine hospital charges and payor sources. However, fewer records had complete location data to determine the EMS distance and travel time from the crash site to the post-crash care facility (n=54,577).

Distance and Time to Hospital Post-Crash Care

The linked dataset (n=54,577) was used to find the distance from the crash site to Georgia ED, hospitals, and trauma centers as of 2021. The crash site coordinates and the post-care facility coordinates were used to determine the radial distance from the crash site to the post-care facility. The statistical differences in the EMS travel distance from the crash site to post-crash care were compared using t-tests in SAS software.

This same linked dataset was filtered for records that included "patient treated and transported" in the EMS record and reported an EMS travel time to post-crash care in the record. To validate the results from the linked data, all 2019-2021 EMS records that were coded as motor vehicle (in the ICD-10 field) and included "patient treated and transported" were studied. The results of this study matched the results of the linked data. The linked dataset was used in this report because these were confirmed to be motor vehicle traffic-related events that received post-crash care.

CDC's Social Vulnerability Index

The CDC SVI identifies socially vulnerable populations by combining 15 sociodemographic data elements from the 2021 American Community Survey estimates. The SVI value (ranging from zero to one) is a percentile rank that equates to the percentage of counties and census tracts that are at or below the SVI value—the greater the SVI, the more tracts that are below the value, and the greater the vulnerability. The SVI county index indicates how counties within Georgia *rank* among themselves, showing the vulnerability of each county relative to all Georgia counties.

At the county level, the average SVI for all counties in Georgia (inherently through the calculation) is 0.50. For this analysis, counties with SVI *lower* than 0.50 are considered "low" vulnerability. Counties with an SVI of 0.50 or *above* have "high" vulnerability.

At the census tract level, the overall SVI scores were also grouped into quintiles to compare the differences in unrestrained fatalities and serious injuries by levels of vulnerability.

Analysis

The analytical approach used for each research objective is described as follows.

1. Driving behaviors for local and non-local drivers involved in traffic crashes (within the categories of rural and urban crashes) were analyzed by counts across all categories. Interstate crashes were excluded from the analysis to focus on pass-thru traffic on state and local roads for the first research objective—investigating the differences in risky driving behaviors among local and non-local drivers. However, for the other research objectives (restraint use and travel to post-crash care), interstate crashes were included in the analysis.

   The distributions of local and non-local drivers engaged in risky driving behaviors in rural and urban counties were examined for homogeneity using Chi-Square Analysis on SAS software. The analysis compared the differences between local and non-local drivers within the rural/urban categories. Additionally, the analysis compared the differences between rural and urban drivers within local/non-local categories.

2. Restraint use analysis used three years of KA injuries in passenger vehicles obtained from the 2019-2021 Georgia crash dataset (n=5,282) and 2021 CDC SVI data for Georgia counties and census tracts. A bivariate map was created to display the spatial relationship between SVI indexes and the proportion of unrestrained KA passenger vehicle occupants at the county level using ArcMap v.10.8.2. Additionally, a Kruskal-Wallis test was conducted to examine differences in the proportion of unrestrained KA passenger vehicle occupants across the census tract SVI quintiles in rural counties, urban counties, and statewide. Linear regression t-tests were conducted to determine if there was

an association between the overall SVI quintile (census-tract level) and the proportion of unrestrained KA passenger vehicle occupants.

3. The filtered three-year, 2019-2021 Georgia Crash-ED/Hospital linked dataset (n=54,577) was used to calculate descriptive statistics for distance and time traveled to the post-crash care facility. Statistical differences in EMS travel times and distance were compared using t-tests in SAS software. The full three-year linked dataset (n=67,774) was used to calculate descriptive statistics for hospital charges and payor sources.

Results

Comparing Risky Driving Behaviors among Local and Non-Local Drivers

A greater proportion of non-interstate traffic crashes in rural counties result in serious injuries or fatalities than non-interstate traffic crashes in urban counties. Between 2019 and 2021, 2.0% of motor vehicle traffic crashes in rural counties resulted in a serious injury or fatality—compared to 0.9% in urban counties. The involvement of non-local drivers in non-interstate KA crashes is 1.22 times greater in rural than urban counties. Non-local drivers represent 51.3% of non-interstate severe crashes in rural counties and 42.2% of non-interstate KA crashes in urban counties.

Figure 2 shows the percentage of drivers involved in non-interstate KA crashes by driver risky driving behavior, driver residential status (local/non-local), and crash location (rural/urban) between 2019 and 2021.

Drivers with Unrestrained Passenger Vehicle (PV) Occupants

Rural local and non-local drivers [figure 2, dark brown filled and open circles] involved in non-interstate KA crashes were more likely to have unrestrained passenger vehicle occupants compared to urban local and non-local drivers [figure 2, light brown filled and open circles]. Between 2019 and 2021:

- 44% of *local rural* drivers involved in a non-interstate KA crash had unrestrained occupants, compared to 28% of *local urban* drivers ($p < 0.0001$).
- 39% of *non-local rural* drivers involved in a non-interstate KA crash had unrestrained occupants, compared to 26% of *non-local urban* drivers ($p < 0.0001$).

Moreover, local drivers involved in non-interstate KA crashes in both rural and urban areas were more likely to have unrestrained passenger vehicle occupants compared to non-local drivers in both rural and urban (Table A2).

- 44% of local rural drivers in interstate KA crashes had unrestrained occupants, compared to 39% of non-local rural drivers ($p = 0.0003$).
- 28% of *local urban* drivers involved in a non-interstate KA crash had unrestrained occupants, compared to 26% of non-local *urban d*rivers ($p = 0.041$).

Speeding Drivers

A greater proportion of rural local and non-local drivers involved in non-interstate KA crashes were speeding compared to urban local and non-local drivers. Between 2019 and 2021:

- 13% of *local rural* drivers involved in a non-interstate KA crash were speeding, compared to 11% of *local urban* drivers ($p < 0.0001$).
- 14% of *non-local rural* drivers involved in a non-interstate KA crash were speeding, compared to 10% of *non-local urban* drivers ($p < 0.0001$).

Non-local rural drivers were more commonly involved in speeding-related non-interstate KA crashes compared to any other driver in urban or rural counties. However, there are no statistical

differences between local and non-local speeding drivers within rural counties or urban counties (Table A2). In other words, the involvement of speeding *non-local* drivers in rural counties is no different than that of speeding *local* drivers in rural counties. Similarly, the involvement of speeding *non-local* drivers in urban counties is no different than that of speeding *local* drivers in urban counties.

Alcohol-Impaired Drivers

A greater proportion of rural local and non-local drivers involved in non-interstate KA crashes were alcohol-impaired compared to urban local and non-local drivers. Between 2019 and 2021:

- 23% of *rural local* drivers involved in a non-interstate KA crash were alcohol-impaired, compared to 15% of *urban local* drivers (p <0.0001).
- 22% of *rural non-local* drivers involved in a non-interstate KA crash were alcohol-impaired, compared to 14% of *urban non-local* drivers (p <0.0001).

Rural local drivers are more commonly involved in alcohol-related, non-interstate KA crashes compared to any other driver in urban or rural counties. However, there are no statistical differences between local and non-local alcohol-impaired drivers within rural counties or urban counties (Table A2).

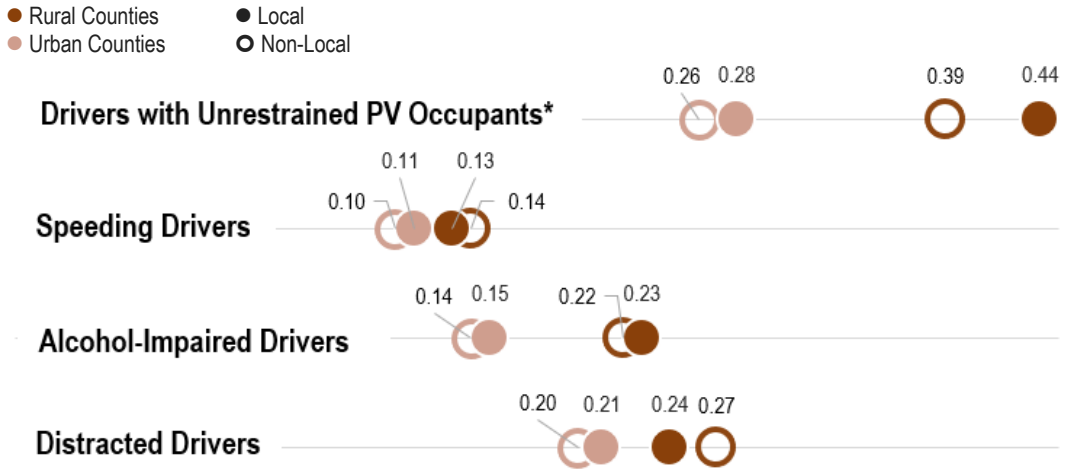
Distracted Drivers

A greater proportion of rural local and non-local drivers involved in non-interstate KA crashes were distracted compared to urban local and non-local drivers. Between 2019 and 2021:

- 24% of *rural local* drivers involved in a non-interstate KA crash were distracted, compared to 21% of *urban local* drivers (p <0.0001).
- 27% of *rural non-local* drivers involved in a non-interstate KA crash were distracted, compared to 20% of *urban non-local* drivers (p <0.0001).

Rural non-local drivers are more commonly involved in distraction-related, non-interstate KA crashes compared to any other driver in urban or rural counties. However, there are no statistical differences between local and non-local distracted drivers within rural counties or urban counties (Table A2).

Figure 2. **Percentage of Drivers Involved in Serious Injury or Fatal Traffic Crashes that Engaged in Risky Driving Behaviors by Region and Driver Locality, 2019-2021**



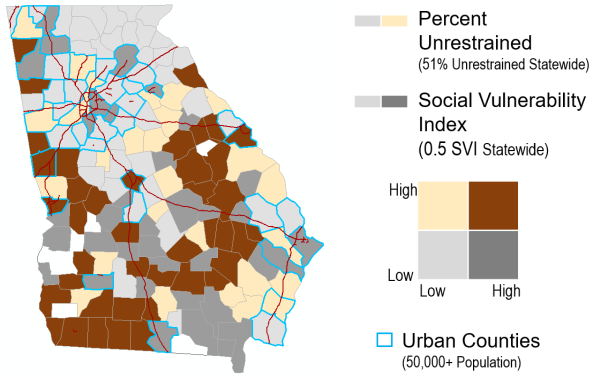
Comparing Unrestrained Passenger Vehicle Occupant Fatalities and Serious Injuries in Rural and Urban Counties

Rural counties in Georgia are more vulnerable than urban counties, as indicated by the 2020 SVI index. In 2020, the 118 rural counties in Georgia had an overall SVI of 0.53, and the 41 urban counites had an overall SVI of 0.40. According to the *"Rural and Urban Comparison*" Georgia Traffic Safety Facts, rural counties also have a higher proportion of seriously or fatally injured passenger vehicle occupants than urban counties. Figure 3 shows the percentage of fatally and seriously injured passenger vehicle occupants who were unrestrained by the county's social vulnerability.

There are more rural counties with high social vulnerability and a high percentage of PV unrestrained serious and fatal injuries compared to urban counties. Conversely, there are more urban counties with low vulnerability and a low percentage of PV unrestrained serious and fatal injuries than rural counties.

- Between 2019 and 2021, 33% of Georgia rural counties (37 out of 111 rural counties) had high SVI and high unrestraint—compared to 10% of urban counties with high SVI and high unrestraint (4 out of 41). The rural counties with the highest SVI and highest percentage of unrestrained PV occupants are Terrell, Talbot, Calhoun, and Taylor counties (Figure A2 in the appendix). The urban counties with the highest SVI and highest unrestraint are Richmond and Troup counties.
- Between 2019 and 2021, 27% of Georgia rural counties (30 out of 111 rural counties) had low SVI and unrestraint compared to 49% of urban counties with low SVI and low unrestraint (20 out of 41). The rural counties with the lowest SVI and lowest percentage of unrestrained PV occupants are Fannin and Haralson counties. The urban counties with the lowest SVI and lowest unrestraint are Walton and Effingham counties.

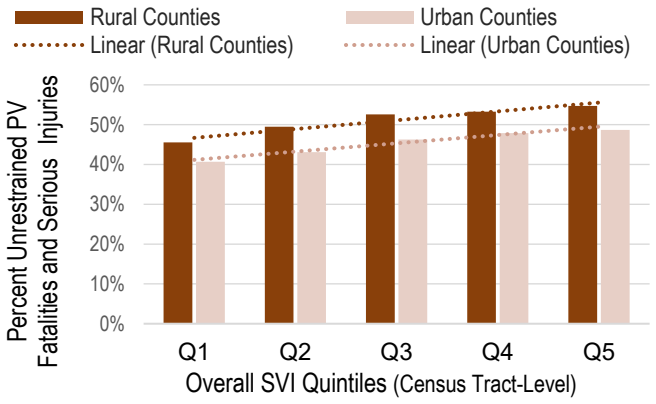
Figure 3. **Bivariate Map of Percent of Seriously and Fatally Injured Passenger Vehicle Occupants that were *Un*restrained and Social Vulnerability by County (All Ages), 2019-2021**



Note: Between 2019-2021, seven (7) counties had less than five seriously and fatally injured passenger vehicle occupants.

Figure 4 displays the percentage of seriously and fatally injured passenger vehicle occupants who were unrestrained by census tract overall SVI quintiles by Georgia rural and urban counties. Within each quintile, the percentage of seriously and fatally injured passenger vehicle occupants who were unrestrained increases as the social vulnerability index increases in both rural and urban counties. The Kruskal Wallis results (Table A3) show a significant difference in unrestraint across the vulnerability quintiles in urban counties; however, the difference is not significant in rural counties. Linear regression t-tests suggest the relationship between SVI quintile and unrestraint is significant for both rural ($p= .0111$, $r^2=0.91$) and urban ($p=.0041$, $r^2=0.95$) counties.

Figure 4. **Percent of Seriously and Fatally Injured Passenger Vehicle Occupants that were Unrestrained among Overall Social Vulnerability Index Quintiles by Georgia Region, 2019-2021**



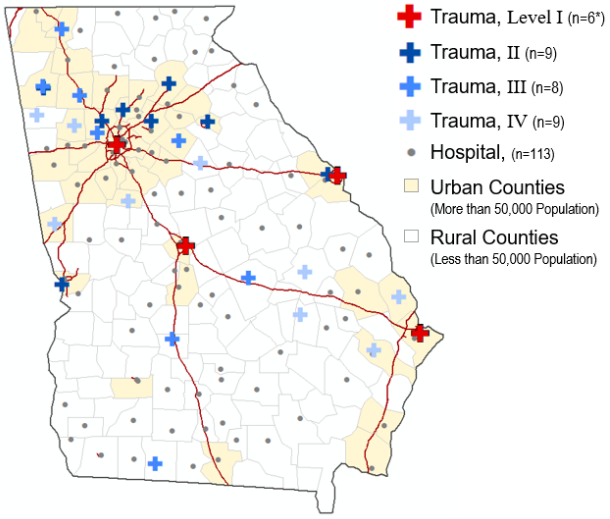
Post-Crash Care

Figure 5 shows the location of trauma care facilities and hospitals in Georgia as of 2021. More than half (54%) of all facilities are located in urban counties, and 46% are located in rural counties.

- 22% of trauma centers are in rural counties (7 out of 32); all trauma levels I and II are in urban counties.
- 52% of non-trauma, post-crash emergency departments and hospitals are in rural counties (59 out of 113).

In 2021, the majority (96%) of all post-crash hospitalizations occurred in hospitals located in urban counties.

Figure 5. **Georgia Trauma Center and Hospitals, 2021**



Source: Office of EMS and Trauma, 2021
*In 2021, Fulton County had three Level I Trauma Centers: Children's Healthcare of Atlanta at Egleston, Grady Memorial Hospital Atlanta, and Atlanta Medical Center.

Table 1 shows the distribution of post-crash care by hospital level and rural/urban crash site using the linked crash-hospital data. These post-care patients were treated at an emergency department or admitted to a hospital.

Between 2019 and 2021, 70% of patients that originated in an urban crash site were seen in a trauma facility as opposed to 39% of patients that originated in a rural crash site. Most patients originating from a rural crash site were treated at a non-trauma facility (61%). Nearly one-third (32%) of patients originating from an urban crash site were treated at a trauma level I facility.

Table 1. **Distribution of Post-Crash Care by Hospital Level by Rural/Urban Crash Site, 2019-2021**

Trauma Level	Rural Crash Site	Urban Crash Site	Statewide
Trauma Facilities	39%	70%	63%
Trauma I	10%	**32%**	28%
Trauma II	14%	27%	24%
Trauma III	9%	10%	10%
Trauma IV	7%	1%	2%
Hospital	**61%**	30%	37%
All Hospitals	**100%**	**100%**	**100%**

Note: Not all patients treated at a trauma hospital were classified as trauma patients. Totals may not equal 100% due to rounding. The trauma level classifications were as of 2021.

Distance Traveled to Post-Crash Care

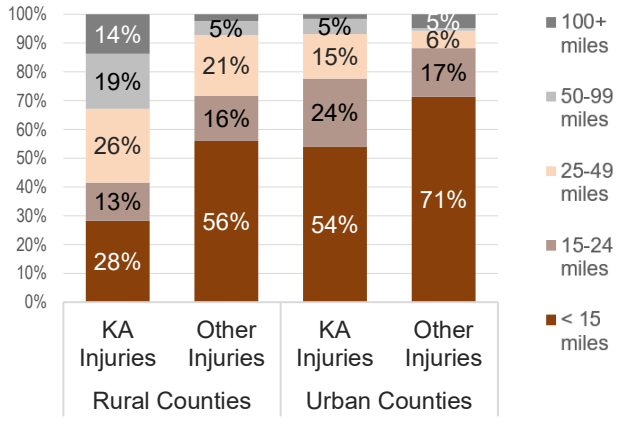
The average EMS distance from the crash location to post-crash care for all injuries between 2019-2021 was significantly longer (p=<0.0001) in rural counties compared to urban counties. The average distance to post-crash care was 21.1 miles in rural counties and 12.4 miles in urban counties (Table 4A).

Figure 5 shows the distribution of distance traveled from rural/urban county crash site to post-crash care for KA injuries and other injuries. KA injuries in rural counties were more likely to be transported 15 miles or more to post-crash care compared to KA injuries in urban counties (p<0.0001). Nearly three-quarters (72%) of KA injuries in rural counties traveled 15 miles or more to post-crash care, compared to 46% of KA injuries in urban counties.

Other injuries (non-KA) in rural counties were more likely to travel less than 15 miles to post-crash care compared to KA injuries (p<0.0001). Between 2019 and 2021, 56% of other injuries in rural counties traveled less than 15 miles to post-crash care, compared to 28% of KA injuries in rural counties. Over half of all other injuries in rural and urban counties were transported to a

post-crash care facility within 15 miles—56% in rural counties and 71% in urban counties.

Figure 6. **Distribution of *Distance* Traveled from Rural/Urban County Crash Site to Post-Crash Care for Fatally and Serious Injured (KA injuries) and Other Injuries, 2019-2021**

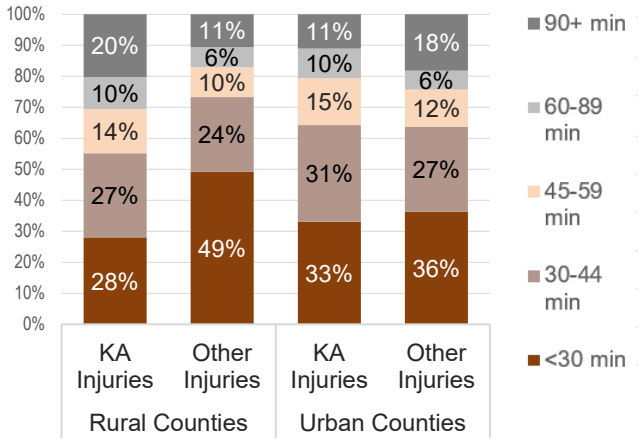


Time Traveled to Post-Crash Care

The overall average EMS travel time from the crash location to post-crash care for ***all*** injuries between 2019-2021 was significantly (t=7.06, p<.0001) longer (though unsubstantially--less than 2 minutes maximum estimated difference) in rural counties compared to urban counties. The average distance to post-crash care was 34 minutes in rural counties and 35 minutes in urban counties (Table 4A). However, the difference in travel times is significantly different based on injury severity.

Figure 6 shows the distribution of time traveled from rural/urban county crash site to post-crash care for KA injuries and other injuries. KA injuries in rural counties were more likely to be transported 30 minutes or more to post-crash care compared to KA injuries in urban counties (p<0.0001). Nearly three-quarters (72%) of KA injuries in rural counties traveled 30 minutes or more to post-crash care, compared to 67% of KA injuries in urban counties.

Figure 7. **Distribution of *Time* Traveled from Rural/Urban County Crash Site to Post-Crash Care for Fatally and Serious Injured (KA injuries) and Other Injuries, 2019-2021**



Other injuries (non-KA) in rural counties were more likely to travel less than 30 minutes to post-crash care compared to KA injuries (p<0.0001) -- 49% of other injuries in rural counties traveled less than 30 minutes to post-crash care, compared to 28% of KA injuries in rural counties. On the other hand, there were insignificant differences in the travel time to post-crash care in urban counties between KA injuries and other injuries—33% of KA urban injuries and 36% of other urban injuries were transported in less than 30 minutes from the crash location.

Hospital and Emergency Room Charges

More post-crash hospitals are located in urban counties than rural counties—85 out of 145 are in urban counties, and 60 are in rural counties. Of the 85 hospitals in urban counties, 32% are trauma facilities. Only 8% of the rural hospital were trauma facilities.

The median hospital length of stay for post-crash patients was higher in urban hospitals than in rural hospitals. Patients originating from a rural county crash site had a median stay of 5.0 days in urban hospitals compared to 3.0 days in rural hospitals (Table A8). Patients originating from an urban county crash site had a median stay of 4.0

days in urban hospitals. Between 2019 and 2021, no patients originating in urban county crash sites were admitted to a rural hospital.

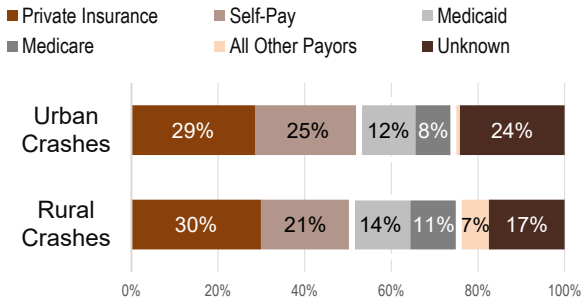
The median hospital charges for post-crash patients were higher in urban hospitals than rural hospitals. Patients originating from a rural county crash site incurred median hospital charges of $99,100 in urban hospitals compared to $41,000 incurred in rural hospitals (Table A6). Patients originating from an urban county crash site incurred median hospital charges of $105,700 in urban hospitals. Between 2019 and 2021, no patients originating in urban county crash sites were admitted to a rural hospital.

The same trends for incurred charges were apparent in “emergency room only” post-crash care (patients who were seen and released from the emergency department and/or not admitted to the same hospital). The median emergency room charges for patients originating from a rural crash site were greater than for patients originating from an urban county crash site (Table A7).

- Patients originating from a rural county crash site incurred median emergency room charges of $15,700 in *urban* ED—2.15 times more than patients originating from urban crash sites treated in *urban* ED.
- Patients originating from a rural county crash site incurred median emergency room charges of $4,500 in *rural* ED—1.67 times more than patients originating from urban crash sites treated in *rural* ED.

Figure 8 shows the proportion of ED and hospital patients by payor source type and rural/urban county crash site. The proportion of ED and hospital patients who paid with public payor sources (Medicare and Medicaid) were greater among those originating from rural crashes (25%) compared to those originating from urban crashes (20%). Private insurance payor source was nearly equal among patients originating from rural or urban county crash sites, 29% and 30%, respectively.

Figure 8. **Proportion of Emergency Department and Hospital Patients by Payor Source Type and Rural/Urban County Crash Sites**



*Hospitalizations included patients seen and treated in the Emergency Department and/or admitted into the hospital.

Conclusion

This study illustrates that rural counties have a significantly higher proportion of drivers involved in KA crashes who engaged in risky driving behaviors such as speeding, alcohol impairment, distraction, and not using safety belt systems (unrestrained). Most notably, local rural drivers are more likely to have unrestrained passenger vehicle occupants with KA injuries compared to non-local rural drivers and all urban drivers. Additionally, there is a positive and significant correlation between the CDC's social vulnerability index (SVI) and unrestrained PV occupants with KA injuries. As the vulnerability of the population increases (at the census tract or county levels), the proportion of unrestrained PV occupants with KA injuries also increases.

The majority of the trauma care facilities are located in urban counties; all trauma level I and II facilities are in urban counties. Most patients originating from a rural county crash site were treated in a non-trauma facility, and most patients originating from an urban county crash site were treated in a trauma facility. Although the median distance from a rural county crash site for *all injuries* to a post-crash care facility was significantly longer than from an urban crash site, the median EMS travel times were the same. However, KA injuries that originated from a rural county crash site had a longer travel

time to post-crash care compared to other non-KA injuries in rural county crash sites. This suggests that EMS may have traveled further from a rural crash site to a post-crash facility that has resources to treat a more severely injured patient (i.e., trauma level I centers in urban counties).

Patients involved in motor vehicle traffic crashes had higher hospital charges and longer lengths of stay in urban hospitals than in rural hospitals. Patients originating from a rural county crash incurred higher emergency room charges compared to patients originating from urban crashes in both rural and urban hospitals. Public payor sources (Medicaid and Medicare) were more frequently used among patients originating from rural county crash sites compared to patients originating from urban county crash sites. Private insurance was the most commonly used payor source with similar proportions for both patients originating from rural or urban county crash sites.

Additional Information:

See the *2021 Rural and Urban Comparison* Georgia Traffic Safety Facts for more information on traffic crashes, serious injuries, and fatalities in rural and urban counties.

References:

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Georgia Crash Outcomes Data Evaluation System. (2023, November). Examining Crashes and Drivers in Rural Areas: 2019-2021 data. (Georgia Traffic Safety Facts). Atlanta, GA: Governor's Office of Highway Safety.

Table A1. **Percentage of Drivers Involved in Serious Injury or Fatal Traffic Crashes that Engaged in Risky Driving Behaviors by Region and Driver Locality, 2019-2021**

Risky Driving Behavior by Driver Locality	Urban County Crash Site		Rural County Crash Site		Statistical Test	
	Count	Percent	Count	Percent	Chi-2	Probability
Restraint	2,817	27%	1,722	41%	264	<.0001
Local	1,777	28%	922	44%	227.3	<.0001
Non-local	1,004	26%	788	39%	154.6	<.0001
Speeding	1,329	11%	628	14%	23.66	<.0001
Local	837	11%	302	13%	5.14	0.0233
Non-local	470	10%	319	14%	21.03	<.0001
Alcohol Impairment	1,887	15%	1,051	22%	133.6	<.0001
Local	1,171	15%	566	23%	84.6	<.0001
Non-local	655	14%	494	22%	64.3	<.0001
Distraction	239	2%	156	3%	29.31	<.0001
Local	135	2%	72	3%	13.99	0.0002
Non-local	100	2%	83	4%	12.51	0.0004

NOTE: the percentages are calculated in the universe among crashes with enough information for restraint use; the stat results for the positive behavior (restrained, not speeding) are not shown, though they are used in the calculation of the probability.

Table A2. **Percentage of Drivers Involved in Serious Injury or Fatal Traffic Crashes that Engaged in Risky Driving Behaviors by Region and Driver Locality, 2019-2021**

Risky Driving Behavior by Rural/Urban Crash Site	Local Drivers		Non-Local Drivers		Statistical Test	
	Count	Percent	Count	Percent	Chi-2	Probability
Restraint	2,699	32%	1,792	31%	3.86	0.0494
Urban	1,777	28%	1,004	26%	4.18	0.0408
Rural	922	44%	788	39%	12.81	0.0003
Speeding	1,139	12%	789	12%	0.0342	0.8533
Urban	837	11%	470	10%	1.67	0.1952
Rural	302	13%	319	14%	1.72	0.1896
Alcohol Impairment	1,727	17%	1,149	17%	0.3005	0.5836
Urban	1,171	15%	655	14%	2.01	0.1563
Rural	566	23%	494	22%	1.18	0.2764
Distraction	207	2%	183	3%	6.349	0.0117
Urban	135	2%	100	2%	2.5	0.1132
Rural	72	3%	83	4%	1.37	0.2412

NOTE: the percentages are calculated in the universe among crashes with enough information for restraint use; the stat results for the positive behavior (restrained, not speeding) are not shown, though they are used in the calculation of the probability.

Figure A1. **Percent of Seriously and Fatally Injured Passenger Vehicle Occupants that were *Un*restrained by Social Vulnerability for each Georgia County, 2019-2021**

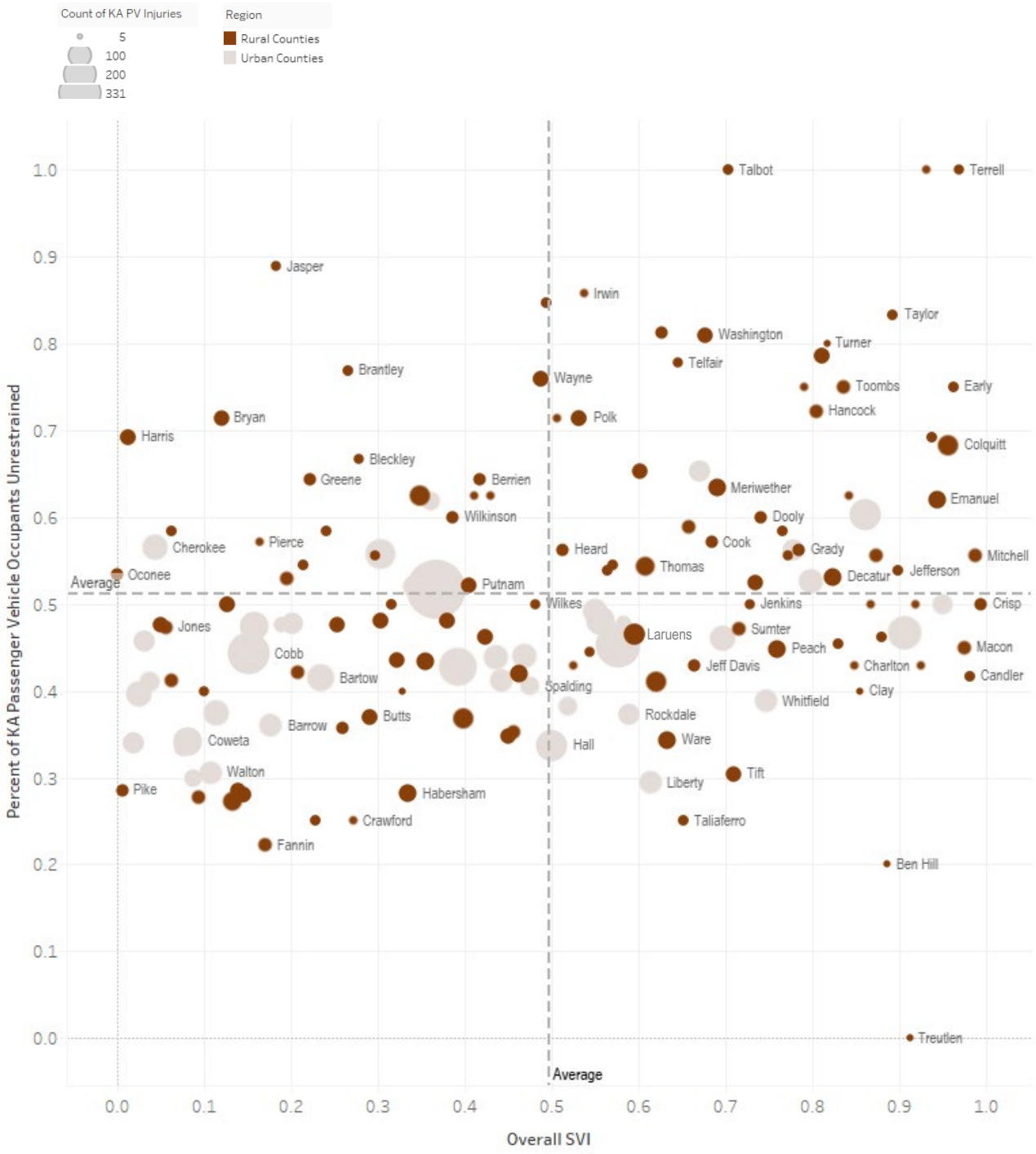

Table A3. **Kruskal Wallis Test Results of Difference in Percent of Seriously and Fatally Injured Passenger Vehicle Occupants that were Unrestrained among Overall Social Vulnerability Index Quintiles by Georgia Region**

Region / Quintile		n	Mean Rank	χ^2	df	p
Statewide	Q1 [least vulnerable]	243	726.32	34.1	4	<.001
	Q2	353	808.38			
	Q3	390	901.7			
	Q4	370	910.07			
	Q5 [most vulnerable]	365	908.32			
Rural	Q1	38	255.78	4.93	4	0.295
	Q2	89	276.76			
	Q3	158	269.72			
	Q4	147	302.12			
	Q5	135	293.7			
Urban	Q1	205	532.79	10.35	4	0.035
	Q2	264	548.94			
	Q3	232	592.84			
	Q4	223	611.72			
	Q5	230	601.48			

Table A4. **Statistical Measures of *Hospital* Charges for Rural/Urban Hospital by Rural/Urban County Crash Sites**

Hospital Charges Statistical Measures	Rural County Crash Site		Urban County Crash Site	
	Rural Hospital	Urban Hospital	Rural Hospital	Urban Hospital
Minimum	$ 4,200	$ 14,700	**	$ 2,700
Maximum	$ 477,400	$ 2,462,300	**	$ 4,281,800
Median	$ 41,000	$ 99,100	**	$ 105,700
Mean	$ 60,100	$ 155,300	**	$ 179,200
Standard Deviation	$ 62,300	$ 185,200	**	$ 234,800

Source: CODES 2019-2021 Crash-Hospital Linked Dataset

Note: Rural/urban hospital is determined by the facility county location
**There were no records of patients originating from an urban county crash site and admitted to a rural hospital

Table A5. **Statistical Measures of *Emergency Room* Charges for Rural/Urban Hospitals by Rural/Urban County Crash Sites**

Hospital Charges Statistical Measures	Rural County Crash Site		Urban County Crash Site	
	Rural Hospital	Urban Hospital	Rural Hospital	Urban Hospital
Minimum	$ 200	$ 200	$ 300	$ 200
Maximum	$ 78,600	$ 132,100	$ 23,800	$ 396,100
Median	$ 4,500	$ 15,700	$ 2,700	$ 7,300
Mean	$ 7,100	$ 17,300	$ 4,600	$ 13,200
Standard Deviation	$ 7,900	$ 14,100	$ 5,200	$ 14,600

Source: CODES 2019-2021 Crash-Hospital Linked Dataset

Note: Rural/urban hospital is determined by the facility's county location. Those admitted into the same hospital facility were excluded from the emergency room classifications.

Table A6. **Statistical Measures of *Hospital Length of Stay (Days)* for Rural/Urban Hospitals by Rural/Urban County Crash Sites**

Hospital Charges Statistical Measures	Rural County Crash Site		Urban County Crash Site	
	Rural Hospital	Urban Hospital	Rural Hospital	Urban Hospital
Minimum	1	1	**	1
Maximum	36.0	119.0	**	182.0
Median	3.0	5.0	**	4.0
Mean	5.2	8.1	**	7.6
Standard Deviation	5.6	10.1	**	10.6

Source: CODES 2019-2021 Crash-Hospital Linked Dataset

Note: Rural/urban hospital is determined by the facility's county location. Includes only patients who were admitted into a hospital.
**There were no records of patients originating from an urban county crash site and admitted to a rural hositpal