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Urban and Rural Child Deaths from Motor Vehicle Crashes: United States, 2015-2019

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Abstract

Objective—The objective of the study was to examine child deaths in motor vehicle crashes by rurality, restraint use, and state child passenger restraint laws.

Study design—2015-2019 Fatality Analysis Reporting System data were analyzed to determine deaths and rates by passenger and crash characteristics. Optimal restraint use was defined using age and the type of the restraint according to child passenger safety recommendations.

Results—Death rates per 100 000 population were highest for non-Hispanic Black (1.96; [1.84, 2.07]) and American Indian or Alaska Native children (2.67; [2.14, 3.20]) and lowest for Asian or Pacific Islander children (0.57; [0.47, 0.67]). Death rates increased with rurality with the lowest rate (0.88; [0.84, 0.92]) in the most urban counties and the highest rate (4.47; [3.88, 5.06]) in the most rural counties. Children who were not optimally restrained had higher deaths rates than optimally restrained children (0.84; [0.81, 0.87] vs 0.44; [0.42, 0.46], respectively). The death rate was higher in counties where states only required child passenger restraint use for passengers aged ≤6 years (1.64; [1.50, 1.78]) than that in those requiring child passenger restraint use for passengers aged ≤7 or ≤8 years (1.06; [1.01, 1.12]).

Conclusions—Proper restraint use and extending the ages covered by child passenger restraint laws reduce the risk for child crash deaths. Additionally, racial and geographic disparities in crash deaths were identified, especially among Black and Hispanic children in rural areas. Decision makers can consider extending the ages covered by child passenger restraint laws until at least age 9 to increase proper child restraint use and reduce crash injuries and deaths. *(J. Pediatr 2022;250:93-9).*

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In 2019, the rate of motor vehicle traffic deaths in the US per 100 million vehicle miles traveled on rural roads (1.65) was twice that of urban roads (0.86).[1] Lack of restraint use is one factor known to contribute to these higher rural death rates.[2,3] Although rates of restraint use have increased across all age groups over the last few decades, a higher proportion of fatally injured rural occupants remain unrestrained than urban occupants.[2]

A 2017 study of Fatality Analysis Reporting System (FARS) data used a 6-level rural-urban continuum to explore differences in adult passenger vehicle occupant death rates and the proportion of passenger vehicle occupants who were unrestrained at the time of fatal crash.[3] This study found that as rurality increases, adult passenger vehicle occupant death rates increased and the proportion of unrestrained passenger vehicle occupants killed increased. Furthermore, the proportion of unrestrained passenger vehicle occupants killed was lower in primary seat belt law states than that in secondary seat belt law states—even in the most rural areas. However, these differences by rurality have not been well evaluated in children.

Differences in restraint use are important to understand as motor vehicle crashes (MVCs) are a leading cause of death among children in the US.[4] Proper child restraint use reduces the risk of serious and fatal injury by up to 80% when compared with seat belt use alone.[5-7] The Community Guide recommends child safety seat use laws based on strong evidence of their effectiveness for increasing restraint use and decreasing injuries and death to child passengers.[8]

The aims of this study are to examine child deaths in MVCs by rurality, restraint use, and state child passenger restraint laws.

Methods

Child MVC deaths and rates, for occupants aged <18 years, were estimated using data from the 2015-2019 FARS.[9] FARS is maintained by the National Highway Traffic Safety Administration (NHTSA) and is a census of all US crashes on public roadways involving one or more deaths occurring within 30 days of the crash. Occupants who were categorized as riding on the exterior, in a trailing unit, or cargo area or not coded as passengers of a motor vehicle in transport (ie, not passenger vehicle occupants) at the time of the crash were excluded from analyses. “Passenger vehicles” included passenger cars, light trucks, vans, or sports utility vehicles.

County urban and rural levels were categorized using the 2013 rural-urban continuum codes (RUCCs) developed by the US Department of Agriculture.[10] RUCCs were collapsed into 6 categories: most urban (counties in metropolitan areas of ≥1000 000 population; RUCC 1), urban (counties in metropolitan areas of 250 000-999 999 population; RUCC 2), least urban (counties in metropolitan areas of <250 000 population; RUCC 3), least rural (counties in nonmetropolitan areas with an urban population ≥20 000; RUCCs 4 and 5), rural (counties in nonmetropolitan areas with an urban population of 2500-19 999; RUCCs 6 and 7), and most rural (counties in nonmetropolitan areas with an urban population ≤2500;). All states and the District of Columbia were included in the analyses. The analytical data set included a total

of 1697 counties: 319 most urban, 297 urban, 235 least urban, 202 least rural, 485 rural, and 159 most rural counties.

Deaths and rates per 100 000 population were estimated for passenger and crash characteristics. The age of child passengers was divided into 5 groups: 0-1, 2-4, 5-8, 9-12, and 13-17 years. Race/ethnicity, which is obtained from the death certificate, was categorized as 5 mutually exclusive categories: Hispanic, non-Hispanic White, non-Hispanic Black, non-Hispanic American Indian or Alaska Native, and non-Hispanic Asian or Pacific Islander. The type of impact included rollover and nonrollover, where nonrollover impact was defined using the first instance of injury to the passengers (front impact, side impact, rear impact).

Optimal restraint use was defined using age and the type of the restraint system to align with child passenger safety recommendations from the American Academy of Pediatrics and the Centers for Disease Control and Prevention: children aged ≤1 year in a rear-facing child safety seat, 2-4 years in a rear-facing or forward-facing child safety seat, 5-8 years in a forward-facing child safety seat or booster seat, and 9-12 years in a booster seat or lap and shoulder belt.[11-13] Children aged 13-17 years were optimally restrained if they were wearing a lap and shoulder belt.

Counties were categorized by state child passenger restraint laws. State law data were obtained from the Insurance Institute for Highway Safety effective beginning June 1, 2015, or earlier and therefore reflect Insurance Institute for Highway Safety's interpretation of each state's policy at that time.[14] Child passenger restraint laws were grouped into 2 categories: states with laws that require children ≤6 years to be in a child passenger restraint and states that require child passenger restraints for children through age 7 or 8 years.

Rates were calculated per 100 000 population using vintage 2019 bridged-race postcensal population estimates created by the Centers for Disease Control and Prevention.[15] Ninety-five percent CIs were calculated using the normal approximation when the number of deaths was ≥100. When the number of deaths was <100, CIs were calculated using the gamma method for the Poisson distribution.[16] Data analyses were completed using SAS 9.4. Rates were statistically significant at the $\alpha = 0.05$ level if the 95% CIs did not overlap. To protect the confidentiality of decedents, rates were suppressed for <20 deaths and the number of deaths was suppressed for <10 deaths.

Results

In the US, during 2015-2019, 5126 child (1.40 per 100 000; 95% CI = [1.36, 1.43]) occupants died in passenger vehicle crashes (Table). Death rates varied by age, race/ethnicity, and region. Children aged 13-17 years had the highest rate of deaths (2.10; [2.01, 2.19]). Death rates were highest for non-Hispanic Black (1.96; [1.84, 2.07]) and American Indian or Alaska Native children (2.67; [2.14, 3.20]) and lowest for non-Hispanic Asian or Pacific Islander children (0.57; [0.47, 0.67]). By region, rates were highest in the South (1.89; [1.82, 1.96]) and lowest in the Northeast (0.57; [0.51-0.63]).

The rates of deaths increased as counties became more rural, with the lowest rate (0.88; [0.84, 0.92]) in the most urban counties and the highest rate (4.47; [3.88, 5.06]) in the most rural counties, over 5-fold from the most urban to the most rural (Table). This pattern was generally seen by age, sex, race/ethnicity, and region, although significant differences were not usually seen between similarly sized counties (eg, urban and least urban counties, least urban and least rural counties, and rural and most rural counties). Rates for children aged 13-17 years in the most rural counties (6.85; [5.57, 8.34]) were 4.7 times that of the rates in the most urban counties (1.46; [1.36, 1.56]). Death rates among Hispanic children increased over 7-fold from the most urban counties (0.84; [0.77, 0.92] to the most rural counties (6.12; [3.92, 9.11]), whereas those for non-Hispanic White and Black children increased over 5-fold (White: 0.63; [0.58, 0.68] to 3.33; [2.75, 3.91]; Black: 1.35; [1.23, 1.47] to 7.52; [5.18, 10.57]). At every county urban and rural level, the death rate for non-Hispanic Black children was higher than that for non-Hispanic White children. Death rates in the West changed the most, with rates in the most urban counties (0.81; [0.73, 088]) being 5.5 times lower than that of rates in the most rural counties (4.47; [2.83, 6.70]).

Child passenger vehicle occupant death rates varied by optimal restraint use and the type of impact and county urban and rural status. Children who were not optimally restrained had higher death rates than optimally restrained children (0.84; [0.81, 0.87] vs 0.44; [0.42, 0.46], respectively). Death rates were highest for children in rollover (0.44; [0.42, 0.46]) and nonrollover front-impact (0.43; [0.40, 0.45]) crashes and lowest for those in nonrollover rear-impact crashes (0.15; [0.14, 0.17]). Like child demographic characteristics, death rates increased with increasing rurality, and significant differences were not usually seen between urban and least urban counties, least urban and least rural counties, and rural and most rural counties. Among those not optimally restrained, the death rate for the most rural counties (2.91; [2.44, 3.39]) was 5.6 times that of most urban counties (0.52; [0.49, 0.55]). Further, for every urban and rural county level, death rates were higher for children not optimally restrained than those for optimally restrained children. Death rates for rollovers increased almost 8-fold from the most urban to the most rural counties (0.23; [0.21, 0.25] to 1.76; [1.41, 2.17]). Those for front-impact nonrollover crashes increased 5-fold from the most urban to the most rural counties (0.25; [0.23, 0.27] to 1.29; [1.00, 1.65]).

Among children aged ≤8 years, differences in death rates and the percent of children unrestrained were seen when examining child passenger restraint laws (Figure). The death rate was higher in counties where the state law only required child passenger restraints for passengers aged ≤6 years (1.64; [1.50, 1.78]) than that in counties where the state law required passengers aged ≤7 or ≤8 years to be in a child passenger restraint (1.06; [1.01, 1.12]). For both groups, although some CIs did overlap, a stepwise increase in death rates was seen from the most urban to the most rural counties. More children were unrestrained in counties where the state law only required child passenger restraints for passengers aged ≤6 years (34.1%; [31.2, 37.1]) compared with counties where the state law required passengers aged ≤7 or ≤8 years to be in a child passenger restraint (24.3%; [23.1, 25.6]). This difference remained by county rurality groupings, except for those categorized as most urban and least rural.

Discussion

Significant differences in child passenger vehicle occupant death rates were found in the US for 2015-2019, with rates increasing by rurality. From the most urban to the most rural counties, death rates among children increased over 5-fold. This is consistent with other studies examining adults and children, in which increasing rurality was associated with higher motor vehicle occupant death rates.[3,17,18] Similar increases were also seen in child passenger vehicle occupant death rates by age, sex, race/ethnicity, and region.

Passenger vehicle occupant death rates were higher among children who were not optimally restrained than those among optimally restrained children, overall and for every county urban and rural level. Additionally, from the most urban to the most rural, child passenger vehicle occupant death rates increased 5.6 times more among those who were not optimally restrained. Numerous previous studies have shown an increased risk of severe injury and death among children who are not optimally restrained in a crash.[5-7,19-21] In an earlier study of child MVC deaths using FARS data, Wolf et al found that both suboptimal restraint use and crashes occurring on rural roads were key predictors of mortality.[21] The most effective way to prevent injuries and deaths in a crash is by using age and size-appropriate restraints on every trip.[5-7,22] The risk for injury in a crash is reduced by 71%-82% for children who use a child safety seat, when compared with seat belt use alone.[5,6] For children aged 4-8 years, booster seat use reduces the risk for serious injury by 45%, when compared with seat belt use alone.[5] A more recent analysis from NHTSA found that booster seat use reduced the risk of moderate-to-critical injuries by an estimated 86% when compared with seat belt use among children aged 7-8 years in nonrollover crashes, although that estimate needs to be interpreted with caution due to the wide CI.[23] NHTSA estimates 325 lives were saved by child safety seat use among children under 5 years old in 2017 and an additional number of 46 could have been saved with 100% child safety seat use.[24] Assuming similar estimates for 2015-2019, 100% child safety seat use could have saved over 1600 lives of children under 5 years of age.

The current study also found that child passenger vehicle occupant death rates were higher for counties where the state law only required a child safety seat or booster seats for passengers aged ≤6 years than those in states requiring a child safety seat or booster seat use through the age of 7 or 8 years. Child passenger restraint laws, which require children to travel in a child safety seat and then booster seats before using only adult seat belts, are effective at increasing restraint use and decreasing injuries and death among child passengers.[8] A study among children involved in crashes found that restrained children were 66% more likely to be buckled in appropriate restraints if their state law followed best practice recommendations.[25] Children aged 4-8 years in states with booster seat laws were more likely to be using a child safety seat and were 20% less likely to die in a frontal crash than children in states without booster seat laws.[26] A study of 5 states that increased the age requirement to 7 or 8 years for a child safety seat and booster seat use found that the rate of children using a child safety seat and booster seats increased nearly 3 times and the rate of children who sustained fatal or incapacitating injuries decreased by 17%.[27] Child passenger restraint laws exist in all 50 states and the District of Columbia, although the ages of children covered vary.[14] As of April 2022, only 4 states require a child safety

seat or booster seat use until the age of 9 years (Louisiana, Tennessee, Washington, and Wyoming).[28]

This study found significant differences in child passenger vehicle occupant death rates by race/ethnicity. Similar to previous studies, non-Hispanic Black and Hispanic children had higher death rates than White children.[29] For non-Hispanic Black children, these differences were found at every urban and rural level. Although this study did not examine optimal restraint use by race/ethnicity, other studies have found increased suboptimal use of restraints for Black and Hispanic children compared with White children.[30,31] The disparity in child passenger vehicle occupant death rates by race/ethnicity suggests further study to better understand the cause and identify tailored solutions.

This study is subject to several limitations. First, FARS data only provide information on fatal crashes, so we could not assess nonfatal injuries. Second, FARS data come from police reports of MVCs and death certificates rather than self-report, which could result in racial/ethnic misclassification. Additionally, 9.9% of deaths had unknown or other race/ethnicity and were excluded from racial stratification analyses. Third, optimal restraint use data were missing for 8.2% of children, which could have resulted in an overestimate or underestimate of restraint use. Finally, from 2014 to 2018, 3 states (Oklahoma, North Dakota, and South Carolina) extended the ages covered by their child passenger restraint law through the age of 7 years, and Utah's primary enforcement seat belt law became effective May 17, 2015.[14] Despite these limitations, using FARS data provides a robust examination of child POV deaths on public roadways in urban and rural areas of the US.

Proper restraint use and extending the ages covered by child passenger restraint laws reduce the risk for child crash deaths.[5-8,19,27,31] Improving child passenger safety policies to align with best available evidence can increase use and save lives. Decision makers can consider extending the ages covered by child passenger restraint laws until at least the age of 9 years to increase proper child restraint use and reduce crash injuries and deaths. In addition, significant racial and geographic disparities in child MVC deaths were identified. Future studies could identify effective strategies to improve child restraint use, especially in disproportionately affected populations.

Glossary

CDC	Centers for Disease Control and Prevention
FARS	Fatality Analysis Reporting System
MVC	Motor vehicle crashes
NHTSA	National Highway Traffic Safety Administration
RUCCS	Rural-urban continuum codes

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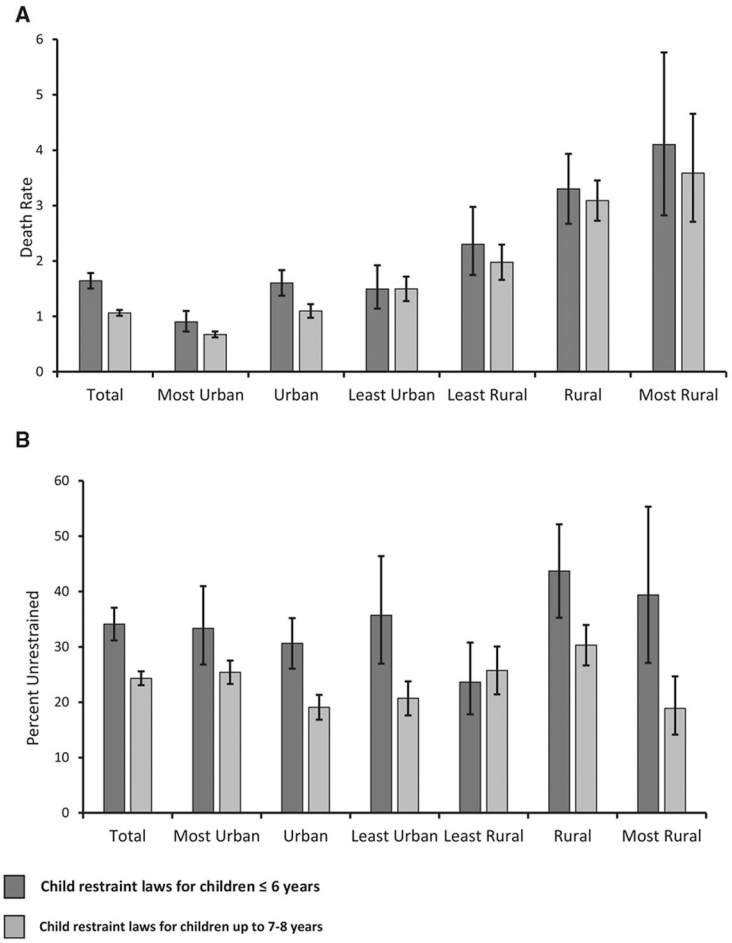

Figure.

Child passenger death rates[1] and percent unrestrained among passenger decedents aged 0-8 years by child passenger laws[2] and county urban and rural category,[3] US, 2015-2019, FARS.[4] **A,** Child passenger death rates. **B,** Percent unrestrained.

1. Rates were calculated per 100 000 population using Vintage 2019 Bridged-race Postcensal Population Estimates created by the US Department of Health and Human Services' (HHS's) CDC: https://www.cdc.gov/nchs/nvss/bridged_race.htm. 95% CIs (indicated by error bars) were calculated using the normal approximation when the number of deaths was 100 or more. When the number of deaths was less than 100, CIs were calculated using the gamma method for the Poisson distribution. For additional information on this methodology: Murphy SL, Xu JQ, KochanekKD, Arias E, Tejada-Vera B. Deaths: Final data for 2018. National Vital Statistics Reports; vol 69 no 13. Hyattsville, MD: National Center for Health Statistics. 2010. Availableat: https://www.cdc.gov/nchs/data/nvsr/nvsr69/nvsr69-13-508.pdf.

2. The child passenger law was defined as a law that required child passengers to travel in appropriate child passenger restraints, such as car seats or boosters, through the specified age (≤6 years or 7-8 years). These laws were effective beginning June 1,2015, or before and were classified using information from the Insurance Institute for Highway Safety (IIHS). Available at: https://www.iihs.org/topics/seat-belts/seat-belt-law-table.

3. The county urban and rural category is defined used the 2013 RUCCs defined by the United States Department of Agriculture's (USDA's) Economic Research Service: https://www.ers.usda.gov/data-products/rural-urban-continuum-codes.aspx. Most urban (RUCC = 1); urban (RUCC = 2); least urban (RUCC = 3); least rural (RUCC = 4 or 5); rural (RUCC = 6 or 7); most rural (RUCC = 8 or 9).

4. FARS is a nationwide census of traffic fatalities in the US collected by the US Department of Transportation's (USDOT's) National Highway Traffic Safety Administration (NHTSA): https://www.nhtsa.gov/research-data/fatality-analysis-reporting-system-fars

Table.

Child passenger deaths (0-17 years old) by demographic characteristics, optimal restraint use, and type of impact and county urban and rural category[*], US, 2015-2019, FARS[†]

			Metropolitan						Nonmetropolitan					
	Total		Most urban		Urban		Least urban		Least rural		Rural		Most rural	
	N	Rate (95% CI[‡])	N	Rate (95% CI)	N	Rate (95% CI)	N	Rate (95% CI)	N	Rate (95% CI)	N	Rate (95% CI)	N	Rate (95% CI)
Total	5126	1.40 (1.36-1.43)	1805	0.88 (0.84-0.92)	1160	1.47 (1.38-1.55)	586	1.81 (1.66-1.96)	451	2.20 (1.99-2.40)	903	3.58 (3.34-3.81)	221	4.47 (3.88-5.06)
Age (years)														
0-1	513	1.31 (1.20-1.42)	164	0.74 (0.63-0.86)	107	1.28 (1.04-1.60)	78	2.24 (1.77-2.97)	49	2.27 (1.68-3.10)	93	3.56 (2.87-4.36)	22	4.37(2.74-6.61)
2-4	715	1.19(1.11-1.28)	240	0.71 (0.62-0.81)	174	1.35 (1.15-1.55)	72	1.35 (1.06-1.70)	64	1.93 (1.48-2.46)	132	3.27 (2.71-3.83)	33	4.21 (2.90-5.91)
5-8	876	1.08 (1.01-1.15)	299	0.66 (0.59-0.74)	203	1.16(1.00-1.32)	89	1.24 (1.00-1.53)	93	2.05 (1.66-2.52)	158	2.86 (2.41-3.30)	34	3.15(2.18-4.40)
9-12	829	1.00(0.93-1.07)	256	0.56 (0.49-0.62)	175	0.98(0.83-1.12)	121	1.66 (1.36-1.95)	66	1.42 (1.09-1.80)	178	3.09 (2.64-3.55)	33	2.91 (2.01-4.09)
13-17	2193	2.10(2.01-2.19)	846	1.46 (1.36-1.56)	501	2.23 (2.03-2.42)	226	2.48(2.16-2.81)	179	3.05 (2.60-3.49)	342	4.67(4.18-5.17)	99	6.85 (5.57-8.34)
Sex[§]														
Male	2631	1.40 (1.35-1.46)	968	0.93 (0.87-0.98)	606	1.50 (1.38-1.62)	287	1.73 (1.53-1.94)	217	2.07 (1.79-2.34)	440	3.40 (3.08-3.72)	113	4.45 (3.63-5.27)
Female	2491	1.39 (1.33-1.44)	834	0.83 (0.77-0.89)	554	1.43 (1.31-1.55)	299	1.89 (1.67-2.10)	233	2.32 (2.02-2.62)	463	3.76 (3.42-4.10)	108	4.50 (3.65-5.34)
Race/ethnicity[¶]														
Hispanic	1075	1.16(1.09-1.23)	501	0.84 (0.77-0.92)	260	1.28 (1.13-1.44)	87	1.52 (1.22-1.88)	69	2.10(1.63-2.65)	134	4.13 (3.43-4.83)	24	6.12(3.92-9.11)
White, Non-Hispanic	2237	1.15(1.10-1.20)	585	0.63 (0.58-0.68)	466	1.06(0.96-1.16)	301	1.42 (1.26-1.58)	243	1.71 (1.49-1.92)	515	2.80 (2.55-3.04)	127	3.33(2.75-3.91)
Black, Non-Hispanic	1087	1.96 (1.84-2.07)	479	1.35 (1.23-1.47)	272	2.50(2.21-2.80)	103	2.49(2.01-2.97)	71	3.47(2.71-4.38)	129	5.07 (4.19-5.94)	33	7.52(5.18-10.57)
American Indian or Alaska Native, Non-Hispanic	98	2.67(2.14-3.20)	10	_ [**]	14	–	—	—	18	–	30	3.69 (2.49-5.27)	18	–
Asian or Pacific Islander,	120	0.57 (0.47-0.67)	53	0.33 (0.25-0.43)	25	0.73(0.47-1.08)	13	–	11	–	15	–	–	–

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			Metropolitan						Nonmetropolitan					
	Total		Most urban		Urban		Least urban		Least rural		Rural		Most rural	
	N	Rate (95% CI[‡])	N	Rate (95% CI)	N	Rate (95% CI)	N	Rate (95% CI)	N	Rate (95% CI)	N	Rate (95% CI)	N	Rate (95% CI)
Non-Hispanic														
Region														
Northeast	334	0.57(0.51-0.63)	153	0.39 (0.32-0.45)	92	0.79 (0.64-0.97)	27	0.98(0.65-1.43)	34	1.37(0.95-1.91)	26	1.49 (0.97-2.18)	–	–
South	2686	1.89 (1.82-1.96)	901	1.21 (1.13-1.29)	635	1.94 (1.78-2.09)	316	2.44(2.17-2.71)	209	2.75(2.38-3.12)	513	4.26 (3.90-4.63)	112	4.75 (3.83-5.63)
Midwest	1052	1.36 (1.27-1.44)	317	0.85 (0.76-0.95)	195	1.38 (1.19-1.58)	141	1.47 (1.23-1.71)	110	1.71 (1.39-2.03)	205	2.42 (2.09-2.76)	84	4.36 (3.48-5.40)
West	1054	1.18(1.11-1.25)	434	0.81 (0.73-0.88)	238	1.15(1.01-1.30)	102	1.44 (1.16-1.72)	98	2.42 (1.97-2.95)	159	5.27 (4.45-6.09)	23	4.47 (2.83-6.70)
Optimal restraint use[††]														
Yes	1611	0.44 (0.42-0.46)	554	0.27 (0.25-0.29)	382	0.48 (0.43-0.53)	213	0.66 (0.57-0.75)	138	0.67 (0.56-0.78)	257	1.02 (0.89-1.14)	67	1.36 (1.05-1.72)
No	3096	0.84(0.81-0.87)	1061	0.52 (0.49-0.55)	685	0.87 (0.80-0.93)	334	1.03(0.92-1.14)	275	1.34 (1.18-1.50)	597	2.36 (2.17-2.55)	144	2.91 (2.44-3.39)
Type of impact[‡‡]														
Rollover	1618	0.44 (0.42-0.46)	477	0.23 (0.21-0.25)	352	0.44 (0.40-0.49)	195	0.60 (0.52-0.69)	144	0.70 (0.59-0.82)	363	1.44 (1.29-1.59)	87	1.76 (1.41-2.17)
Nonrollover														
Front impact	1562	0.43 (0.40-0.45)	510	0.25 (0.23-0.27)	362	0.46(0.41-0.50)	184	0.57 (0.49-0.65)	179	0.87(0.74-1.00)	263	1.04 (0.92-1.17)	64	1.29 (1.00-1.65)
Side impact	1222	0.33(0.31-0.35)	461	0.22 (0.20-0.25)	298	0.38 (0.33-0.42)	141	0.44(0.36-0.51)	87	0.42 (0.34-0.52)	187	0.74 (0.63-0.85)	48	0.97(0.72-1.29)
Rear impact	563	0.15(0.14-0.17)	267	0.13(0.11-0.15)	118	0.15(0.12-0.18)	51	0.16(0.12-0.21)	32	0.16(0.11-0.22)	78	0.31 (0.24-0.39)	17	—[††]

Most urban (RUCC = 1); urban (RUCC = 2); least urban (RUCC = 3); least rural (RUCC = 4 or 5); rural (RUCC = 6 or 7); most rural (RUCC = 8 or 9).

[*] County urban and rural category is defined by using the 2013 RUCCs defined by the US Department of Agriculture's (USDA's) Economic Research Service: https://www.ers.usda.gov/data-products/rural-urban-continuum-codes.aspx.

[†] FARS is a nationwide census of traffic fatalities in the US collected by the US Department of Transportation's (USDOT's) NHTSA: https://www.nhtsa.gov/research-data/fatality-analysis-reporting-system-fars.

[‡] Rates were calculated per 100 000 population using Vintage 2019 Bridged-race Postcensal Population Estimates created by the US Department of Health and Human Services' (HHS's)CDC: https://www.cdc.gov/nchs/nvss/bridged_race.htm. 95% CIs were calculated using the normal approximation when the number of deaths was 100 or more. When the number of deaths was less than 100, CIs were calculated using the gamma method for the Poisson distribution. For additional information on this methodology: Murphy SL, Xu JQ, Kochanek KD, Arias E, Tejada-Vera B. Deaths: Final data for 2018. National Vital Statistics Reports; vol 69 no 13. Hyattsville, MD: National Center for Health Statistics. 2010. Available at: https://www.cdc.gov/nchs/data/nvsr/nvsr69/nvsr69-13-508.pdf.

[§] Sex was missing for 4 passenger decedents.

[¶] Fifty-two (1.0%) passenger decedents categorized as non-Hispanic multiple and other races were excluded from analyses; 457 (8.9%) passenger decedents had unknown race and/or ethnicity.

[**] Rates were suppressed for <20 deaths; the number of deaths was suppressed for <10 deaths.

[††] Optimal restraint use is defined using age and the type of the restraint system. Passengers were optimally restrained when 0- to 1-year-olds were seated in rear-facing child restraint systems, 2- to 4-year-olds in rear-facing or forward-facing systems, 5- to 8-year olds in forward-facing or booster systems, and 9-to 12-year-olds in booster systems or a lap and shoulder seat belt. Thirteen-to 17-year olds were optimally restrained if they were wearing a lap and shoulder belt. Optimal restraint use was unknown for 419 (8.2%) passenger decedents.

[##] Nonrollover impact type was determined based on the first instance of injury to the passengers. For 161 (3.14%) passenger decedents, the type of nonrollover impact was noncollision (39), top or undercarriage (34), or unknown (88).