

Older Adult Pedestrian Injury in Rhode Island, 2017–2020

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ABSTRACT

OBJECTIVE: To understand the epidemiology and clinical outcomes of older adult pedestrian injury in Rhode Island.

METHODS: Descriptive univariate analysis of data from Rhode Island Hospital's trauma registry on patients admitted for pedestrian-related injuries between 2017–2020.

RESULTS: The rate of pedestrian injury in older adults was 1.5 times the rate in adults age 18–49. Injured older adult pedestrians experienced a higher rate of serious adverse events during hospitalization (18.0%) than their younger counterparts (10.3%) and had almost twice the mortality rate (14.9% versus 7.6%). Across ages, pedestrian injury rates are higher in densely populated areas, and those injured disproportionately are male and have comorbid alcohol and substance use disorders.

CONCLUSIONS: The increased risk of pedestrian injury in older adults is evident and necessitates intervention. Further research is warranted on the root causes of higher pedestrian injury and mortality rates among older adults.

KEYWORDS: pedestrian; injury prevention; older adult; traffic accident

INTRODUCTION

Walking provides substantial physical and mental health benefits across all ages. It has been shown to reduce all-cause mortality,¹ with the greatest impact seen in adults over 65.² Moreover, walking promotes more environmentally³ and economically⁴ sustainable communities, enhancing overall quality of life.⁵ However, the United States has lagged behind other high-income countries in reducing pedestrian fatality and serious injury rates.⁶ In the past decade, the U.S. saw the largest percentage increase in pedestrian fatalities among 30 countries in the Organization for Economic Cooperation and Development (OECD), the majority of whom saw decreases in pedestrian fatalities.⁷

While older adults have the most to gain from shifting to active transport modalities,⁸ as pedestrians they face the greatest risk of injury⁹ and fatality.¹⁰ The fatality rate for older adult pedestrians is twice the rate of the overall U.S.

population, and the rate of severe injury among older adults is almost twice the national average⁶ and rising.¹¹ Rhode Island has not been immune to this development. Between 2014–2018, adults 65 and older, accounted for 38% of pedestrian fatalities in Rhode Island,¹² almost twice the national rate.¹³ Studying the clinical course and outcomes for older adult injured pedestrians can better illustrate the impact on our community and healthcare system and inform investments in safer communities for pedestrians. For this reason, we reviewed recent data on Rhode Island adults hospitalized with pedestrian-related injuries.

METHODS

This is a descriptive study of adults admitted for pedestrian-related injuries to Rhode Island Hospital, the state's only adult Level I Trauma Center, between 2017–2020. The study was approved by the Lifespan Institutional Review Board. Deidentified data was collected from the Rhode Island Hospital trauma registry for patients admitted between January 1, 2017 to December 31, 2020 who were over age 18 and whose injury code fell under "MVT-Pedestrian" or "Pedestrian, other" on the ICD-10-CM External Cause of Injury Matrix.¹⁴ Data points included MRN, age, sex, race, ethnicity, comorbidities, home and injury zip code, mechanism of injury, ICD-10 diagnoses, injury severity score, hospital and ICU length of stay, adverse hospital events, and mortality outcome.

We examined population rates of pedestrian injury within 10-year age brackets using American Community Survey (ACS) 2019 5-Year census data. Based on the markedly higher injury rate in adults over 50, we expanded the definition of "older adults" in this study to include those age 50 and over and be inclusive of this potentially higher risk group. We designated age 50 as our cutoff for comparison of demographics and clinical outcomes between "adults (18–49)" and "older adults" age 50 and over.

Population estimates were obtained from the ACS 2019 5-year census data to calculate pedestrian injury rates disaggregated by age, sex, and county. We used univariate descriptive analysis to compare comorbidities, mechanism of injury, and clinical outcomes between adults (18–49) and older adults.

RESULTS

The initial data set included 516 adult trauma patients admitted to Rhode Island Hospital between 2017–2020. Four cases did not meet inclusion criteria as the injury mechanism was not pedestrian-related, leaving a final data set of 512 patients.

Pedestrian injuries in this study included pedestrians injured on foot and other conveyance (e.g., skateboard, roller-skates). There are no notable differences in the mechanism of injury between adults (18–49) and older adults. Most cases involve pedestrians injured in a traffic accident with unspecified motor vehicles (331 cases) or involving a car, pick-up truck, or van (100 cases).

The rate of pedestrian injury across adult age groups are summarized in **Table 1** and is notably higher among older adults. Below age 50, the average rate is *50.0 per 100,000* whereas in older adults it is *75.5 per 100,000* with a peak rate of *89.9 per 100,000* among adults ages 70–79. This higher rate of pedestrian injury in older adults persists when we disaggregate the data by sex. Across age groups, the rate of injury is higher among men than women. Among older adults, the rate of injury is *93.0 per 100,000* among men versus *61.6 per 100,000* among women.

Table 1. Rate of pedestrian injury among Rhode Island adults, 2017–2020

Age range, years	Total		Male		Female	
	Cases	Rate per 100,000	Cases	Rate per 100,000	Cases	Rate per 100,000
18–29	88	46.4	56	57.9	32	34.5
30–39	71	53.0	43	64.3	28	41.7
40–49	64	50.7	39	62.6	25	39.1
50–59	98	64.6	5	78.3	41	52.0
60–69	88	68.3	55	89.1	33	49.2
70–79	65	89.9	35	107.9	30	75.2
80+	38	79.1	16	96.5	22	69.9

The Rhode Island Hospital Trauma Registry includes a limited list of common comorbidities. Medical problems that increase in prevalence with age are seen at a higher rate among older adult pedestrians, including hypertension (48.8% in older adults versus 7.6% in adults 18–49), respiratory disease/COPD (5.9% versus 1.3%), diabetes (17.3% versus 4.9%), and functionally dependent health status (7.6% versus 2.7%). Higher rates of ADHD and substance use disorder are seen in adults (18–49) than older adults. Across ages, substance use rates among injured pedestrians are notably high. Specifically, 11.2% (age 18–49) and 12.5% (age 50+) have alcohol use disorder and 23.8% (18–49) and 8.7% (age 50+) have substance use disorder.

The data set did not include injury zip code for 110 of the total 512 cases. Rates of pedestrian injury were calculated in each RI county, and across all counties the rate was higher

in older adults. Moreover, the rate of injury in Providence County – *55.9 per 100,000* among older adults and *39.1 per 100,000* in adults 18–49 – is nearly double the rate in other RI counties, which average *25.8 per 100,000* and *13.6 per 100,000*, respectively.

This data set included 874 distinct ICD-10 diagnosis codes. The most frequently occurring diagnosis among all adult injured pedestrians is fracture of the knee, tibia, or fibula (377 events), followed by vertebral fracture (307 events), fracture of the skull or facial structures (221 events), and fracture of the hip or pelvis (162 events). In each of these categories, the relative frequency of the injury is higher in older adults. Additionally, the relative frequency of injury in older adults is particularly high for clavicular fracture (0.85), subarachnoid hemorrhage (0.73), spinal cord injury (0.84), and injury to the major arteries (0.88).

The data set included 22 distinct adverse events occurring during hospitalization, ranging from minor (e.g., pressure ulcer or DVT) to more serious and life-altering (e.g., pulmonary embolism or cardiac arrest with CPR). **Table 2** summarizes the serious adverse events occurring in each age group. Higher rates of serious adverse events during hospitalization are seen in older adults (18.0%) and adults 18–49 (10.3%).

The mortality rate during admission for pedestrian injury is higher among older adults, with a rate of 14.9% versus 7.6% among those age 18–49.

Table 2. Serious adverse events occurring during hospitalization injured pedestrian adults in Rhode Island, comparison between those age 18–49 and those age 50+

Adverse event	Number of Cases	
	Age 18–49	Age 50+
Myocardial infarction	0	1
Unplanned intubation	3	10
Reintubation	3	4
Pulmonary embolism	2	3
Alcohol withdrawal	5	8
Cardiac arrest with CPR	0	4
Iatrogenic injury	0	4
Incidental	7	16
Escalation in care	3	2

DISCUSSION

This study demonstrates that between 2017–2020, the pedestrian injury rate among patients presenting to Rhode Island Hospital was 1.5 times higher for older adults (75.5 per 100,000) than adults 18–49 (50.0 per 100,000). Furthermore, older adult pedestrians experienced more serious adverse events during hospitalization (18.0% versus 10.3%) and had higher mortality rates (14.9% versus 7.6%).

The higher injury rate among older adult pedestrians seen at Rhode Island Hospital parallels a concurrent national rise

in older adult pedestrian fatalities.¹⁰ Recent studies have explored the cause of increased injury risk in older adults. In a systematic review of the literature, Wilmut et al¹⁵ proposed several individual factors at play including perceived versus actual behavior control, underestimation of walking time, time-to-arrival judgements, waiting endurance, and cognitive function. Naumann et al⁹ defined ‘pedestrian injury’ more broadly than this study – including additional ICD-9-CM injury codes like falling and over-exerting oneself – and found that the leading mechanism of injury in older adults was falls often involving a curb.

Our finding that older adult pedestrians experience a worse clinical course and outcomes is consistent with existing literature. Rod et al’s¹⁶ systematic review and meta-analysis of injury outcomes for 1 million pedestrians found that globally, pedestrians over age 60 have a higher risk of severe or fatal injury when involved in a pedestrian collision. Similarly, Reske-Nielsen et al’s¹⁷ review of geriatric trauma found that older pedestrians struck by a vehicle have a higher incidence of severe injury and death compared to younger patients, and older adult motor vehicle collision patients were more likely to present with severe injuries caused by low-speed collisions. In general, older hospitalized patients experience more adverse events than their younger counterparts,¹⁸ with potential causative factors including clinical complexity, comorbidity, illness severity, reduced functional ability, and lower quality of care.¹⁹

This study found a higher rate of pedestrian injury among Rhode Island males, regardless of age. This parallels national studies showing that men outnumber women among fatally injured pedestrians,¹⁰ making up 70% of pedestrians killed in traffic collisions.²⁰ This cannot be attributed to differences in exposure, since men in the U.S. do not walk more than women.²¹ We suspect this correlation is at least partially confounded by the effect of alcohol use. There is strong evidence that men drink more than women²² and that alcohol use is associated with pedestrian fatalities.²³

Data on drug screening and blood-alcohol-concentration were not obtained for this study. However, this study found high rates of substance use history among injured pedestrians, in most cases much higher than the prevalence of those disorders in the general Rhode Island population. Among injured pedestrians, 11.2% (age 18–49) and 12.5% (age 50+) have alcohol use disorder versus 6.9% of the adult general population in Rhode Island,²⁴ and 23.8% (18–49) and 8.7% (age 50+) have a diagnosis of substance use disorder versus 8.9% of RI adults.¹² Substance use impairs coordination and judgment and can lead to riskier pedestrian behaviors, increasing the risk of injury and death. In older pedestrians, it is possible that polypharmacy, which can cause similar impairments in judgment, alertness, motor skills, and coordination, may similarly contribute to injury risk.

In this study, the rate of pedestrian injury was remarkably higher in densely populated areas of Rhode Island, with rates

in Providence County nearly double those in other RI counties. This mirrors existing evidence that urban environments are particularly dangerous for pedestrians; in 2014 almost 80% of pedestrian fatalities nationally occurred in urban areas.²⁵ This suggests that injury prevention efforts ought to target more densely populated areas. To better assess the impact of the built environment (pedestrian infrastructure, walking paths, green spaces) on pedestrian injury in Rhode Island, we need more granular geographic data on the location of pedestrian collisions. This could involve linking medical records of injured pedestrians with associated police reports and environmental data. Such an investigation could inform the specific environmental countermeasures to decrease pedestrian injury. Meanwhile, automated speed enforcement, median crossing islands, pedestrian hybrid beacons, and road diets can effectively improve pedestrian safety on high-capacity urban roads.¹¹ Other measures that reduce motor vehicle speeds, both road characteristics and reducing speed limits, are also effective pedestrian safety measures.²⁶

Racial and ethnic disparities in health care access and equity are well-documented.²⁷ The data provided by the Rhode Island Hospital Trauma Registry included patient race and ethnicity abstracted from the electronic health record (EHR). However, the existing EHR data fields for race provide ill-defined categories. Moreover, while in principle this data is self-reported, in practice there are often inconsistencies between EHR-derived data and patients’ self-identified race and ethnicity.²⁸ For this reason, this study excluded analysis of race and ethnicity of injured pedestrians. Importantly, other studies have found increased rates of pedestrian injury and fatality among racial and ethnic minorities,²⁹ highlighting that the health disparities typically seen in historically marginalized groups extend to the pedestrian population. We speculate that this is strongly tied to environmental conditions associated with lower resources and neighborhood social inequities, such as less investment in pedestrian infrastructure: crosswalks, sidewalks, walk signals, refuge islands, green spaces, and safe play areas for children. Future studies on pedestrian injury that directly examine geographic differences in allocation of resources and social inequities, rather than examining race and ethnicity as proxies for these environmental factors, would more effectively highlight the reasons for health disparities and inform appropriate interventions.

A recent report by the Governors Highway Safety Association found that while nationwide driving declined by 13% in early 2020 due to the COVID-19 pandemic, pedestrian fatalities remained the same as in early 2019 – thus the nation saw a 20% relative increase in pedestrian deaths.²³ Simultaneously, at the peak of the initial lockdown, we saw a decrease in walking nationwide,³⁰ suggesting that pedestrian exposure was further decreased and the relative fatality rate was likely higher. Specifically, we saw a decrease in utility

walking and increase in recreational walking. Previously, residents of low-income areas walked more than residents of high-income areas; after implementation of COVID-19 response measures, we saw this pattern reverse with residents of high-income areas walking more.³⁰ This again highlights the importance of examining environmental factors, resource allocation, and neighborhood social inequities in study of pedestrian behaviors, injury, and fatality.

LIMITATIONS

Our sample is limited to adults admitted for trauma at Rhode Island Hospital and thus excludes patients who did not have Rhode Island Hospital trauma services activated but still required outpatient or rehabilitative care, as well as those declared deceased at the site of collision. Thus, this study likely underestimates pedestrian injury rates. Second, the rates of pedestrian injury and fatality do not take into account exposure, e.g., miles walked by pedestrians of different ages, sex, and location. There was insufficient data on pedestrian behaviors in Rhode Island to calculate exposure-based rates. Third, patients with impaired hearing and vision often do not have this diagnosis documented in the EHR—therefore this is likely underreported in this study and may be a significant contributing factor to pedestrian injury. Lastly, using zip code for geographic location of injury did not provide granular enough data to examine the correlation between environmental factors and injury rates.

CONCLUSIONS

This study found that the pedestrian injury rate of patients admitted to Rhode Island Hospital was 1.5 times higher for older adults than adults (18–49). Older adult pedestrians also experienced more adverse events during hospitalization and had two times the mortality rate. This warrants further research on the causes of higher pedestrian injury and mortality rates in this group, as well as the most effective safety countermeasures.

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Disclosures

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