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Pedestrian Fatalities on Interstate Highways, United States, 1993-2012

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Title

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About the Sponsor

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Introduction

Pedestrians on the Interstate Highway System present a distinctive traffic safety problem and account for 10 percent of all pedestrian fatalities each year in the United States. Very little research, however, has been conducted to date to investigate the problem of or address pedestrians who are struck by motor vehicles on an Interstate highway. The objective of this report is to quantify and describe pedestrian fatalities on Interstates from 1993 through 2012 at the national and state levels.

Pedestrians may enter the Interstate intentionally, often despite restrictions and controls, while drivers and motor vehicle occupants may become “unintended” pedestrians when their vehicle is disabled by a crash or other incident (Johnson, 1997). Both are extremely vulnerable due to lack of pedestrian facilities and exposure to high-speed traffic. Speed limits on the Interstate range from 55 to 85 miles per hour (GHSA, 2014). A pedestrian struck by a vehicle at the low end of this range has an average risk of death of 90 percent, and the risk further increases with speed (Tefft, 2013).

Research comparing states has confirmed that an increase in Interstate lane miles is associated with an increase in the number of pedestrians fatally injured on the Interstate (Dewey, *et al*, 2003). The proportion of pedestrian fatalities occurring on the Interstate in a given state, as well as pedestrian Interstate fatality crash rates, may reflect factors such as the availability and accessibility of the state’s Interstate route(s) to pedestrian use, pedestrian exposure (both on and off the Interstate) which reflects the population, pedestrian risk, overall traffic risk, and ratios of lane miles and vehicle-miles of travel (VMT) on roadways of various types.

Countermeasures designed to safely accommodate pedestrians walking along as well as crossing roadways, including many of those codified in the Federal Highway Administration’s Pedestrian Safety Guide and Countermeasure Selection System (PEDSAFE, 2014), are not generally applicable to the Interstate highway environment. The Interstate is generally closed to pedestrians, making countermeasures like roadway and crossing design improvements, specialized enforcement, or traffic calming impractical. Limited countermeasures have been used by states to keep pedestrians off the Interstate and to aid unintended pedestrians, as well as to warn drivers, although the effectiveness of these countermeasures has not been evaluated (Johnson, 1997).

Methods

Data from the National Highway Traffic Safety Administration’s Fatality Analysis Reporting System (FARS) were obtained for the years 1993 – 2012 (FARS, 2013). This database contains data on all motor vehicle crashes on public roadways in the U.S. that result in a death within 30 days of the event.

All fatally injured pedestrians were identified using person type (pedestrian=5) and injury severity (fatal injury=4) as coded in FARS. Bicyclists, other cyclists, and pedestrians on personal conveyances were excluded. Interstate status was determined by using NHTSA’s Roadway Function Class Convention (rural principal arterial – interstate=1 and urban principal arterial – interstate=11).

The numbers of pedestrian Interstate fatalities, total pedestrian fatalities, and total fatal Interstate crashes were tabulated by year and state. Annual VMT data by state was downloaded from the Federal Highway Administration's website (FHWA, 2014). Exposure data for pedestrians on Interstates was not available. The proportion of all pedestrian fatalities that occur on Interstates, the rate per Interstate fatal crashes, and the rate per Interstate VMT were also calculated by year and by state. Crash and pedestrian level characteristics were also explored. Proportions of drivers and pedestrians with positive and illegal blood alcohol concentration (BAC) were computed using NHTSA's multiply imputed data for individuals whose BAC was missing (Rubin, *et al*, 1998).

Results

An average of 515 pedestrians were struck and killed by a motor vehicle on the Interstate each year from 1993 to 2012 (Table 1). Pedestrian Interstate fatalities ranged from 9.4 to 12.0 as a percentage of total pedestrian fatalities on all roadways, and from 1.1 to 1.5 percent of all traffic fatalities. Total traffic fatalities generally decreased during the study period, as did Interstate and non-Interstate pedestrian fatalities. For the first time in several years, traffic fatalities increased in 2012, as did total pedestrian fatalities. Pedestrian Interstate fatalities, however, decreased from 478 to 450, surpassed only by 2009 (391 fatalities) for the lowest annual pedestrian fatalities on the Interstate during the study period. The rate of pedestrian fatalities on the Interstate per 100 fatal Interstate crashes decreased from 14.5 in 1993 to a low of 9.4 in 2003, after which the rate increased again to 12.8 in 2012. The rate of pedestrian fatalities per 10 billion VMT decreased almost every year during the study period.

Table 2 displays the number of pedestrian fatalities on the Interstate in each state for the 20-year period, those as a percentage of total pedestrian fatalities and total traffic fatalities, and the rates per fatal Interstate crashes and per VMT.

Missouri and Wyoming have the highest proportion of pedestrian fatalities occurring on Interstates, while Maine and the District of Columbia have the lowest. Oregon and Texas have the highest rate of pedestrian fatalities per fatal Interstate crash, while Maine and Wyoming have the lowest. New Mexico and Texas have the highest rates of pedestrian fatalities per Interstate VMT, while Maine and Wisconsin have the lowest.

Most pedestrian fatalities on the Interstate occurred between 6:00 PM and 5:59 AM (74.4%). Nearly half of all such fatalities took place on Saturday or Sunday (Table 3). More pedestrian fatalities on the Interstate occurred in October than any other month, while the fewest such fatalities occurred in February. The weather was clear or cloudy for more than nine in ten pedestrian fatalities on the Interstate, although conditions were dark with no lighting for nearly half.

There were twice as many pedestrian Interstate fatalities where the land use was urban as there were where it was rural. Most pedestrian Interstate fatalities during the study period occurred on roadways that were free of construction and maintenance; however, between three and nine percent (6.3%, on average) each year occurred on roads with active construction or maintenance (Table 3). Less than 0.1 percent of vehicles involved were reported to be engaged in emergency use at the time of the crash.

Table 1. Pedestrian Fatalities on the Interstate by Year, United States, 1993-2012

Year	N	Percentage of total pedestrian fatalities	Percentage of total traffic fatalities	Rate per 100 fatal IS crashes	Rate per 10 billion interstate vehicle-miles of travel
1993	573	10.1	1.4	14.5	10.9
1994	590	10.7	1.4	14.5	10.8
1995	544	9.7	1.3	13.2	9.6
1996	553	10.1	1.3	12.3	9.5
1997	571	10.7	1.4	12.6	9.5
1998	510	9.8	1.2	11.0	8.1
1999	487	9.9	1.2	10.3	7.6
2000	510	10.7	1.2	10.4	7.7
2001	537	11.0	1.3	10.9	8.0
2002	543	11.2	1.3	11.1	7.9
2003	451	9.4	1.1	9.4	6.4
2004	525	11.2	1.2	10.6	7.3
2005	567	11.6	1.3	11.0	7.8
2006	476	9.9	1.1	9.8	6.5
2007	562	12.0	1.4	12.1	7.6
2008	508	11.5	1.4	12.2	7.1
2009	391	9.5	1.2	10.8	5.4
2010	475	11.0	1.4	12.7	6.6
2011	478	10.7	1.5	13.0	6.6
2012	450	9.5	1.3	12.8	6.2
Total	10,301	10.5	1.3	11.6	7.7

Table 2. Pedestrian Fatalities on the Interstate by State, United States, 1993-2012

State	N	Percentage of total pedestrian fatalities	Percentage of total traffic fatalities	Rate per 100 fatal IS crashes	Rate per 10 billion IS VMT
Alabama	164	11.1	0.8	7.5	6.8
Alaska	32	17.3	2.0	7.0	11.2
Arizona	275	9.5	1.4	9.0	11.7
Arkansas	162	20.0	1.3	12.9	11.2
California	1,318	9.4	1.8	14.1	8.2
Colorado	135	11.4	1.1	7.2	6.5
Connecticut	108	12.9	1.8	12.0	5.5
Delaware	27	7.2	1.1	17.3	10.4
District of Columbia	8	2.6	0.9	16.0	8.7
Florida	656	6.4	1.1	10.8	10.6
Georgia	447	14.1	1.5	12.9	8.2
Hawaii	22	4.2	0.9	13.5	6.1
Idaho	30	12.4	0.6	4.0	4.7
Illinois	294	8.6	1.1	9.7	5.0
Indiana	148	11.4	0.8	9.4	4.7
Iowa	64	14.1	0.7	8.2	4.8
Kansas	67	14.0	0.7	8.5	5.2
Kentucky	112	10.2	0.7	7.9	4.7
Louisiana	286	13.1	1.6	13.1	12.5
Maine	6	2.4	0.2	2.5	1.1
Maryland	172	7.9	1.4	13.8	5.5
Massachusetts	126	8.5	1.5	11.4	4.1
Michigan	271	8.8	1.1	12.9	6.5
Minnesota	74	8.5	0.7	8.8	3.2
Mississippi	107	9.7	0.6	6.8	8.3
Missouri	386	23.4	1.8	13.8	10.9
Montana	31	14.0	0.7	4.2	6.0
Nebraska	27	10.3	0.5	5.4	3.7
Nevada	101	9.6	1.5	9.8	11.2
New Hampshire	12	6.0	0.5	4.5	2.2
New Jersey	190	6.2	1.3	14.7	7.0
New Mexico	204	17.8	2.3	10.5	15.6
New York	310	4.5	1.1	16.6	6.3
North Carolina	309	9.1	1.0	14.9	8.6
North Dakota	10	9.6	0.5	6.3	3.1
Ohio	218	10.0	0.8	9.6	3.6
Oklahoma	223	21.3	1.5	12.6	12.2
Oregon	131	12.3	1.4	18.0	7.9
Pennsylvania	215	6.4	0.7	9.5	4.7
Rhode Island	32	13.6	2.1	13.4	7.5
South Dakota	173	8.4	0.9	9.2	7.2
South Dakota	21	10.3	0.7	5.5	4.5
Tennessee	239	14.4	1.0	8.9	6.5
Texas	1,795	21.1	2.6	19.1	18.0
Utah	89	14.1	1.5	5.8	5.4
Vermont	9	8.4	0.5	4.5	2.9
Virginia	207	11.5	1.2	9.6	4.7
Washington	141	10.1	1.2	11.9	4.8
West Virginia	45	9.0	0.6	4.7	4.2
Wisconsin	41	3.9	0.3	5.7	2.1
Wyoming	31	25.2	1.0	3.9	5.8
Total	10,301	10.5	1.3	11.6	7.7

Nearly three in four vehicles that struck a pedestrian on the Interstate were cars and light trucks, while nearly one in five was a large truck. Very few fatally-injured pedestrians were struck by motorcycles or buses, and vehicle type was unknown for 8.3 percent of vehicles (Table 3). Vehicles involved in fatal Interstate pedestrian crashes were most often going straight prior to the crash (71.4%). Another eight percent of vehicles were negotiating a curve. Less than five percent of vehicles in fatal Interstate pedestrian crashes were stopped in the roadway or changing lanes prior to the crash.

**Table 3. Pedestrian Fatalities on the Interstate:
Crash Characteristics, United States, 1993-2012
(N=10,301)**

Time of Day	%
Midnight to 5:59 AM	35.8
6:00 AM to 11:59 AM	11.8
Noon to 5:59 PM	13.3
6:00 PM to midnight	38.6
Unknown	0.5
Day of Week	
Monday - Friday	53.4
Saturday - Sunday	46.6
Time of Year	
December - February	25.1
March - May	23.4
June - August	24.3
September - November	27.2
Weather*	
Clear/Cloudy	91.2
Rain	7.5
Snow/sleet/hail	2.3
Lighting	
Daylight	22.9
Dark-not lighted	46.3
Dark but lighted	27.7
Dawn	1.6
Dusk	1.0
Other or unknown	0.5
Construction Zone Status	
None	93.7
Construction/Maintenance/Utility/Other Work Zone	6.3
Land Use	
Rural	33.4
Urban	66.6

Posted Speed Limit (mph)	
35 or less	1.2
40-50	6.2
55-65	73.2
70-75	17.7
Unknown	1.6
Hit-and-Run	
No hit-and-run	83.1
Hit-and-Run	16.8
Vehicle Type	
Car	39.9
Light truck	32.3
Large truck	18.7
Motorcycle	0.2
Bus	0.6
Other/unknown	8.3

*After 2006, two weather conditions could be listed for a crash. Thus, the proportions sum to greater than 100%.

Among drivers whose vehicle struck a pedestrian who was fatally injured on the Interstate for which such information was not missing,¹ 84.5 percent had no recorded crashes in the three years prior to the crash date, while 12.7 percent had one or more (2.8% of drivers had 2 or more crashes). Similarly, 90.0 percent of drivers had no previously recorded suspension or revocations in the same period, while 10.2 percent had one or more (4.7% of drivers had 2 or more suspensions). Most drivers (98.4%) who struck pedestrians on the Interstate for whom data was available did not have a prior driving while intoxicated (DWI) record in the previous three-year period, and 1.6 percent had one or more prior DWIs. One third of drivers in such crashes did not have any previous speeding or other moving violations in the three years prior, while the remaining third had one or more such violations. Much of the missing data is for drivers who fled the scene of the crash. Compared to drivers involved in all fatal traffic crashes during the 20-year study period, drivers who struck pedestrians who were killed on the Interstate were less likely to have experienced a crash as well as to have a recorded prior citation among those discussed. The majority of drivers who struck a pedestrian on the Interstate who was fatally injured had not been drinking, but 17.5 percent had a positive BAC. Most drivers with a positive BAC (13.8% of all drivers) were legally impaired (BAC \geq 0.08 g/dL), compared to the 21.4 percent of drivers in all fatal traffic collisions with BACs of 0.08 g/dL or greater.

Pedestrians fatally injured on the Interstate were most commonly male (80.2%) and between the ages of 20 and 39 (47.6%). The mean age was 38.4 years with a standard deviation of 0.157. A slight majority had no alcohol in their blood at the time of the crash; however, more than a third were legally intoxicated. Furthermore, nearly one third had a BAC of 0.15 grams per deciliter or greater. The proportion of pedestrians fatally injured on

¹ Previously recorded crashes were missing for 18.3 percent of drivers. Previous suspensions, DWIs, and speeding and other moving violations were missing for 14.0 percent of drivers.

the Interstate who were alcohol impaired decreased only slightly from 38.6 percent in 1993 to 35.7 percent in 2012. Most pedestrians (77.1%) were reported to have been on the roadway prior to impact, while 15 percent were reportedly on the shoulder or parking lane (Table 4).

Table 4. Characteristics of Pedestrians Fatally Injured on the Interstate, United States, 1993-2012 (N=10,301)

Sex	%
Male	80.2
Female	19.8
Unknown	0.1
Age (years)	
Younger than 5	0.3
5-14	1.8
15-19	6.4
20-39	47.6
40-64	35.6
65+	6.9
Unknown	1.5
Blood Alcohol Concentration (g/dL)	
0.0	57.6
Positive (> 0.0)	42.4
≥.08	37.2
≥.15	29.1
Pedestrian location at time of crash	
Roadway	77.1
Shoulder	15.1
Other/unknown	7.8

Discussion

The rates of pedestrian fatalities per fatal Interstate crash and per Interstate VMT vary widely across states. As mentioned in the introduction, research has confirmed the association between Interstate lane miles and the number of pedestrians fatally injured on the Interstate (Dewey, et al, 2003). Pedestrian fatalities occurring on the Interstate in a given state and their respective rates may reflect factors such as the availability and accessibility of the state's Interstate route(s) to pedestrian use, pedestrian exposure (both on and off the Interstate) which reflects the population, pedestrian risk, overall traffic risk, and ratios of lane miles and VMT on roadways of various types. Many of these factors are difficult to measure or otherwise quantify, and remain unmeasured (particularly in terms of pedestrian exposure), thereby limiting the conclusions that can be drawn from available data.

The results of this study are limited by the information available in FARS. Certain variables in FARS relating to fatal pedestrian collisions, such as pedestrian location at the time of the crash, is likely based on witness or driver reports and may not be highly accurate. Even with the additional non-motorist variables added in 2010, without detailed crash reports, it was not possible to determine whether fatally injured pedestrians on the Interstate were members of law enforcement, roadside service providers, prior occupants of disabled vehicles, or people intentionally entering the roadway on foot. A prior AAA Foundation study that employed a sample of police accident reports from Interstate pedestrian fatalities in Texas, Missouri, and North Carolina from 1992-1994 found that 40 percent were entering or crossing a lane of traffic, either irrationally and/or intending suicide, or solely to reach a point on the other side (Johnson, 1997). This study also found that nearly one third were “unintended” pedestrians who had been involved in a crash or working on a vehicle.

A survey conducted as part of the earlier study showed that limited countermeasures are employed in most states to keep pedestrians off the Interstate, and that some states had efforts aimed at aiding unintended pedestrians, such as emergency call boxes and roving roadside assistance. The study also noted signage used to warn drivers on the Interstate at points where pedestrians frequently cross.

Since the prior study was performed, “move over” laws have been passed in all U.S. states with the exceptions of Hawaii and the District of Columbia. These laws require drivers to take special actions, typically reduce speed or move to another lane, when passing an emergency vehicle stopped on the side of the road. The emergency vehicles included by the law vary by state, including tow trucks in some states. Research is needed to determine the impact of move over laws on law enforcement risk during roadside stops, and whether they impact the risk to other pedestrians on the Interstate.

Most importantly, all drivers or others that have occasion to work on Interstates, including police, emergency responders, tow truck operators, and maintenance workers need to understand how dangerous it is to be working or walking around an active Interstate.

Private drivers should be educated about these dangers, as well as the value of proper vehicle maintenance, which can help prevent drivers and their passengers from becoming unintended pedestrians. Drivers who experience mechanical problems with their vehicles or are involved in a crash without serious injuries should be advised to carefully move their vehicle as far away from the roadway as possible (exiting the Interstate if possible), and in most cases, remain in their vehicle with seat belt secured until help arrives.

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