Pedestrian Injury

in the

Washington DC Metropolitan Region

A Status Report on Pedestrian Injuries In the Washington DC Metropolitan Region

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Funded by:

Metropolitan Washington Council of Governments (COG)

September 2005

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I- EXECUTIVE SUMMARY

Overview

Approximately 3000 pedestrians are involved in crashes with motor vehicles every year in the DC Metro region. Of these, the vast majority (92%) sustained one or more injuries. A significant percentage of these (17%) required hospitalization of 24 hours or longer resulting in average hospital charges of $17,000 to $30,000 per patient depending on the region. Approximately 80 pedestrians die each year. Most of these injuries and deaths can be prevented by changing road design, vehicle design and/or the behavior of the pedestrian and/or driver.

Geographic Area of Study

For the purposes of this study, the DC Metro Region is defined as the counties and municipalities of Arlington, Fairfax (city and county), Falls Church City, Alexandria City, Prince William County, and Loudoun County in Virginia, the District of Columbia, and the counties of Anne Arundel, Prince George's, and Montgomery in Maryland. These will be referred to as DCMR throughout the report. Individual state areas will be referred to as DC, Northern Virginia and Central Maryland.

In Northern Virginia, persons of the following races are referred to as "*Other* ": (Native Hawaiian, Pacific Islander, American Indian, Alaska Native and Middle Eastern)

In Central Maryland and the District, persons of the following races are referred to as "*Other* ": (Hispanics, Native Hawaiian, Pacific Islander, American Indian, Alaska Native, Asians and Middle Eastern)

Regional Commonalties

- Male pedestrians were more likely to be involved in crashes, more likely to be hospitalized and more likely to sustain fatal injuries than females.
- The vast majority of pedestrian crashes involve passenger vehicles, but when the crash is with a bus or a truck, it is more than twice as likely to result in pedestrian death.
- Most crashes occurred during weekdays with the peak on Fridays.
- Most pedestrian crashes occurred during peak commute hours i.e., 6-9 AM and 5-7 PM.

Northern Virginia: 1999-2003

- Of the 3,118 pedestrians involved in car crashes between 1999 and 2003, 96% (2989) sustained one or more injuries.
- Sixteen percent (477) of pedestrians struck required hospital admission for more than 24 hours.
- Pedestrian injuries resulted in total hospital charges of $10,981,697 and averaged $23,022 per pedestrian hospitalized.
- Five percent of these crashes resulted in pedestrian fatality.

- Eighty-eight percent of the pedestrian deaths occurred on scene before transport to a hospital could occur.
- Males accounted for 58% of all pedestrian hospital admissions and 66% of all pedestrian deaths.
- Hispanics had the highest rate of pedestrian injury hospitalizations at a rate of 8/100,000.
- African Americans were the second most frequently hospitalized group for pedestrian injuries.
- Eighty-three percent of pedestrian injuries involved passenger vehicles.
- Trucks were involved in 2% and buses in 1% of all pedestrian crashes.
- Eleven percent of pedestrian crashes involving trucks and buses resulted in death on scene compared to 4% of the crashes involving passenger vehicles.
- Going straight ahead was the most common maneuver associated with pedestrian crashes by passenger vehicles and trucks.
- Making a left or right turn was the most common maneuver associated with pedestrian crashes by buses.
- Failure to cross at an intersection was the most common pedestrian action associated with the crash.

Washington DC: 2001- 2004

- Of the 2,153 pedestrians involved in crashes between 2000 and 2004, 92% had one or more injuries.
- Between 2001 and 2002, 364 pedestrians (17%) required hospital admissions for more than 24 hours.
- Average hospital charges for pedestrians that were admitted for more than 24 hours were more than $30,000.
- Three percent of all pedestrian crashes resulted in fatality.
- Males accounted for 66% of all pedestrian injuries in DC.
- Races other than Whites and Blacks were the group most likely to be injured as pedestrians at a rate of 33/100,000 population.
- Seventy-eight percent of pedestrian crashes involved passenger vehicles.
- Trucks and busses accounted for 5% and 2% of pedestrian crashes respectively.
- Eleven percent of the crashes involving buses resulted in deaths. Ten percent of the crashes involving trucks resulted in deaths compared to 3% of the crashes involving passenger vehicles.
- Making left or right turns was the most common maneuver prior to pedestrian crashes by buses.
- Pedestrian action prior to the crash is not available from DC data.
- The majority of pedestrian crashes occurred in the Northwest or Northeast quadrants of the city, however only 50% of the pedestrians are residents of DC.
- Of DC residents who were injured in pedestrian crashes, the greatest percentage lived in the Southeast quadrant.

Central Maryland: 2000-2003

- Of the 4,219 pedestrians involved in crashes between 2000 and 2003, 87% (3,683) sustained one or more injuries and 163 died on the scene.
- A total of 790 pedestrians (18%) required hospital admission for more than 24 hours.
- Pedestrian injuries resulted in hospital charges totaling $13, 217, 697 and averaged $16,731 per patient hospitalized.
- Five and one-half percent of all pedestrian crashes resulted in fatality
- Sixty percent of the mortalities among pedestrians occurred on scene, before transport could occur.
- Males accounted for 63% of all pedestrian hospital admissions and 62% of all pedestrian deaths.
- Races other than Whites and Blacks had the highest pedestrian injury rate at 14/100,000 population.
- Ninety-three percent of pedestrian injuries involved passenger vehicles.
- Both trucks and buses accounted for 2% each.
- Two percent of pedestrian crashes involving trucks resulted in deaths on scene compared to 4% of the crashes involving passenger vehicles and 7% of the crashes involving buses.
- Going straight ahead was the most common maneuver associated with pedestrian crashes by all vehicle types.
- Making a left or right turn was the second most common maneuver associated with pedestrian crashes by buses.
- Failure to cross at an intersection was the most common pedestrian action associated with the crash.

State of the Data

Data from Washington DC, Maryland and Virginia vary with respect to the data fields and years available, data definitions and priority for collection and electronic capture. This creates substantial difficulty in comparing these three areas of the DCMR. Unexpected variations between the three areas may be artifact of these differences. Given the existing gaps between data sets, it is not possible to make direct comparisons between Northern Virginia, Central Maryland and Washington DC on all variables of interest. When that occurs in the report, it will be noted.

II- INTRODUCTION

Walking is an important mode of transport for many residents of DCMR, especially for those with limited access to a car. One key aspect of effective traffic safety and injury prevention programs is a clear understanding of the number of injuries that occur, their nature and severity, who is being injured, how these injuries occur, and where they occur. Traffic safety and injury prevention professionals can use this information to identify and prioritize injury problems and target prevention programs. Through accurate data, program managers can focus their limited resources on a campaign to reduce pedestrian injuries among high-risk groups.

The purpose of this report is to provide a comprehensive status report on pedestrian injury in the DCMR and to assess the quality of available data to answer future questions related to pedestrian crashes. The report identifies data sources for the jurisdictions in Washington DC, Virginia counties and municipalities bordering on DC, and Maryland counties bordering on DC. Data includes pedestrian demographics (such as age, race, gender, ethnicity), vehicle information including vehicle type (commercial motor vehicles and passenger cars), vehicle and pedestrian actions prior to the crash, day of the week, time and locality. Hospital and medical data such as diagnosis, outcome of injury, hospital stay and charges are also included. Data have been analyzed to determine adequacy of data sources and commonalties in pedestrian crashes and to lay the foundation for identifying target populations and developing prevention strategies.

Methods

The following Virginia data sets were available and analyzed for the years 1999-2003:

- Injury mortality data provided by the Virginia Center for Health Statistics
- Injury related hospital discharge data provided by Virginia Health Information (VHI, Inc.)
- Police car crash data provided by Virginia Department of Motor Vehicles (DMV)
- The rates are calculated using 2000 population data obtained from US Census Bureau.

The following District of Columbia data sets were available and analyzed

- Crash data provided by District Department of Transportation (DDOT) 2000-2004
- Hospital discharge data provided by DC Hospital Association 2001-2002
- The rates are calculated using 2000 population data obtained from US Census Bureau.

The following Maryland data sets were available and analyzed for the years 2000-2003

- Crash data provided by the National Study Center for Trauma & EMS
- Hospital discharge data provided by the National Study Center for Trauma & EMS
- The rates are calculated using 2000 population data obtained from US Census Bureau.

Codes used to analyze data include the following:

- The injury morbidity data (non-fatal injuries) are coded using ICD-9 Codes: E810-E819 (.7)
- Injury deaths are assigned cause of injury deaths within ICD-10 Codes: V02-V04 (.1,.9)V09.2

Data collection is not uniform across the states or even between jurisdictions within a state. As a result, on occasion, statements will be made about one state without the ability to provide comparable information from other states. When this occurs in the report, it will be noted. Police reports remain an important source of information about the circumstances surrounding traffic injuries. However, police reports often lack detailed information about the injuries themselves. The forms used to collect crash data by the police in DC are not consistent with those used in Virginia making the data on crash profile inconsistent throughout this report. Finally, while DC crash reports were available for the years 2000-2004, hospital discharge data was only available for 2001-2002.

Within the limits of the available data, this report provides:

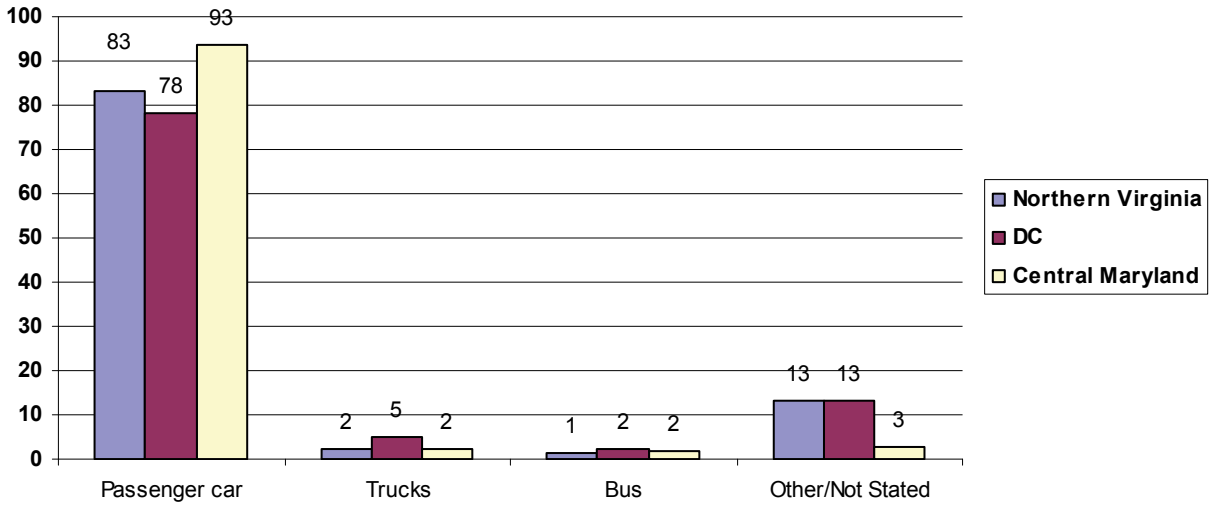
- Comprehensive baseline information about pedestrian crashes that will enable policymakers, researchers, city engineers and the public to assess the magnitude and impact of these events.
- Identification and better understanding of the population at risk
- Identification of driver, pedestrian and vehicular characteristics and actions associated with pedestrian crashes.
- Identification of high risk environments for pedestrian crashes.
- Provision of a foundation for determining resources and interventions needed to respond to the problem of pedestrian crashes.
- Recommendations regarding:
    - Potential evaluation strategies for existing and future prevention programs.
    - Coordination of data systems between the District, Maryland and Virginia that would better support surveillance efforts in the future

III- VEHICLE CRASH PROFILE

1– Vehicle Type

Of the 3,118 pedestrian crashes that occurred in Northern Virginia between 1999 and 2003, 83% involved passenger vehicles. Trucks were involved in 2% and buses in 1% of all pedestrian crashes. In DC, of 2,341 pedestrian crashes that occurred between 2000 and 2004, 78% of the crashes involved passenger vehicles. Trucks were involved in 5% and buses in 2% of all pedestrian crashes. In Central Maryland out of 4, 219 pedestrian crashes, 93% involved passenger vehicles. Trucks and buses accounted for only 2% each (Figure 1).

Figure 1: Pedestrian Crashes by Vehicle Type



Pedestrian crashes involving trucks and buses were more serious than those involving passenger vehicles. In Northern Virginia, 11% of pedestrian crashes involving trucks resulted in deaths. In DC, 10% of the crashes involving trucks resulted in deaths. In both Northern Virginia and DC, 11% of the crashes involving buses resulted in deaths (Figure 2 & Tables 1, 2 & 3 and Appendix pages 51—55). In Central Maryland, 2% of pedestrian crashes involving trucks resulted in deaths on scene compared to 4% of the crashes involving passenger vehicles and 7% of the crashes involving buses.

Figure 2: Mortality by Vehicle Type

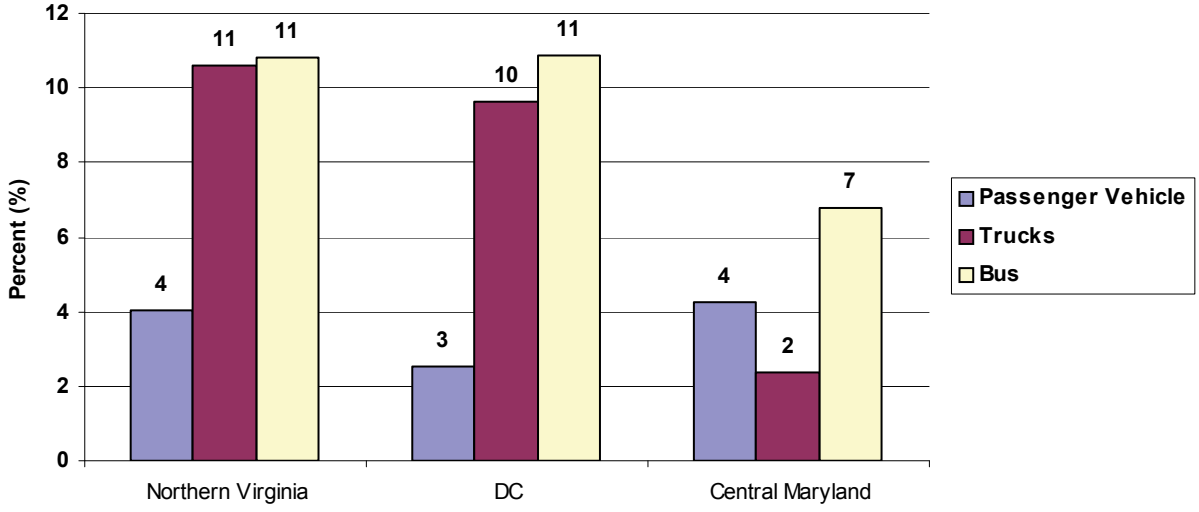


Table 1: Outcome of Pedestrian Crashes by Vehicle Type
Northern Virginia 1999 to 2003

Vehicle Type	Injury	Deaths	% Mortality
Passenger Vehicle	2494	101	4
Trucks	66	7	11
Buses	37	4	11
Other/Unknown	400	9	2
Total	**2998**	**121+ 24 DAA**	**5**

DAA = Death After Admission

Table 2: Outcome of Pedestrian Crashes by Vehicle Type
DC 2000 to 2004

Vehicle Type	Injury	Death	% Mortality
Passenger Vehicle	**1704**	**43**	**3**
Trucks	**104**	**10**	**10**
Bus	**45**	**5**	**11**
Other/Unknown	**299**	**10**	**3**
Total	**2153**	**68**	**3**

Table 3: Outcome of Pedestrian Crashes by Vehicle Type
Central Maryland 2000 to 2003

Vehicle Type	Injury	DOS	% Mortality
Passenger Vehicle	**3448**	**146**	**4**
Trucks	**84**	**2**	**2**
Bus	**59**	**4**	**7**
Other	**92**	**11**	**12**
Total	3683	163	7

2– Time of Crash

In all three areas, most crashes occurred during weekdays with the peak on Fridays (Figure 3). Most pedestrian crashes occurred during the busiest commute times of the day, 5-7 PM, followed by 6-9 AM (Figures 3, 4, 5 & 6).

Figure 3: Pedestrian Crashes by Day of the Week

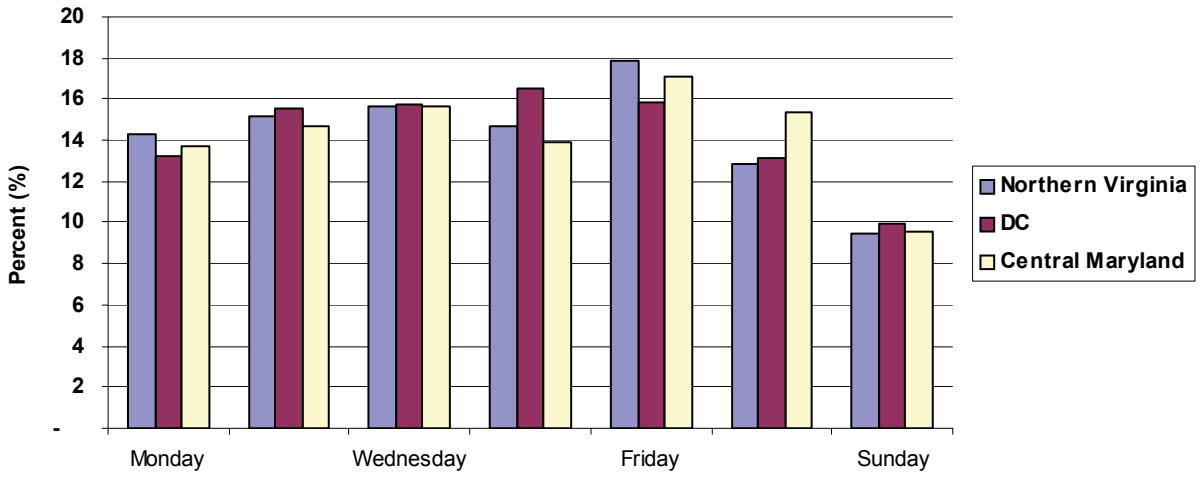


Figure 4: Pedestrian Crash by Time of Day
Northern Virginia Police Crash Data 1999 to 2003

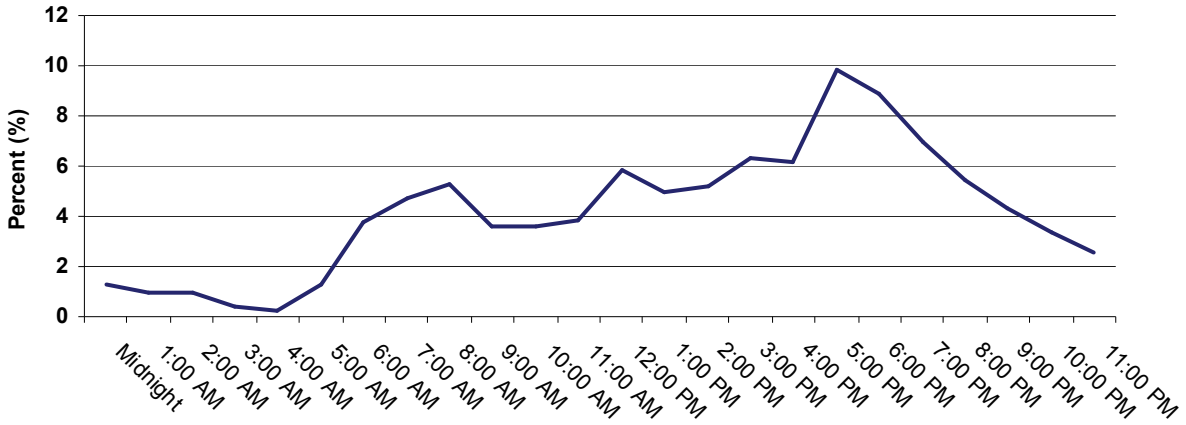


Figure 5: Pedestrian Crashes by Time of Day
DC 2000 to 2004

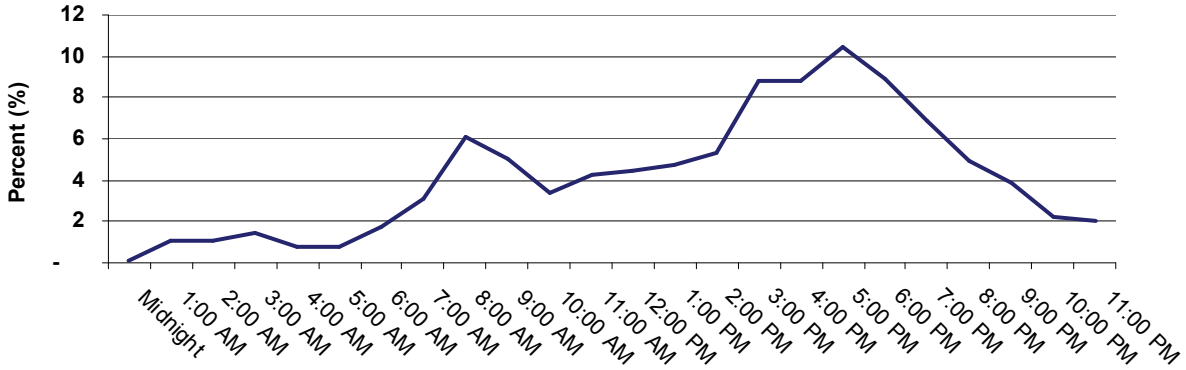
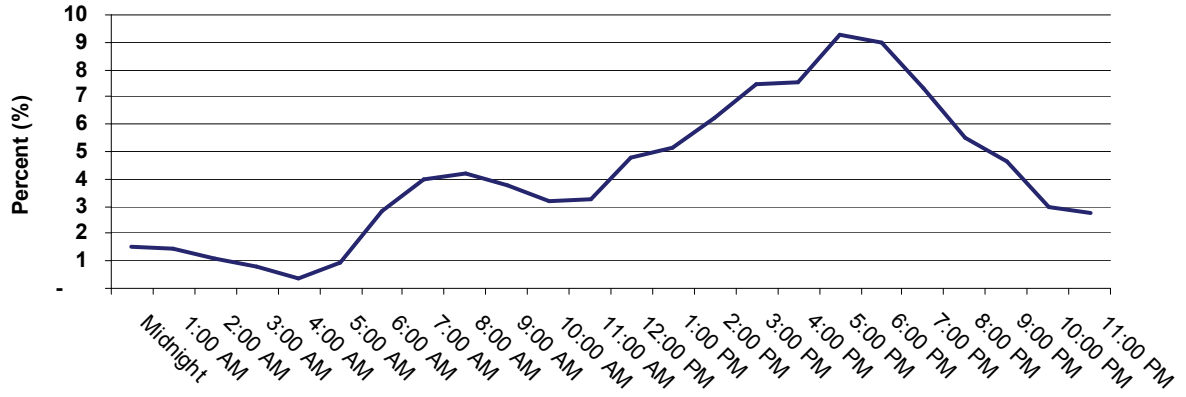


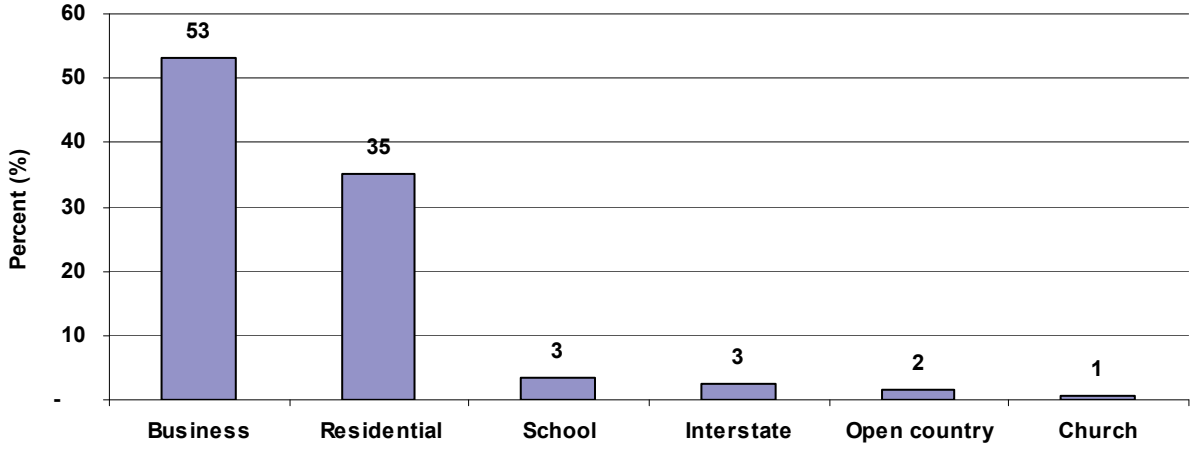
Figure 6: Pedestrian Crashes by Time of Day
Central Maryland 2000 to 2003



3- Locality of Crash

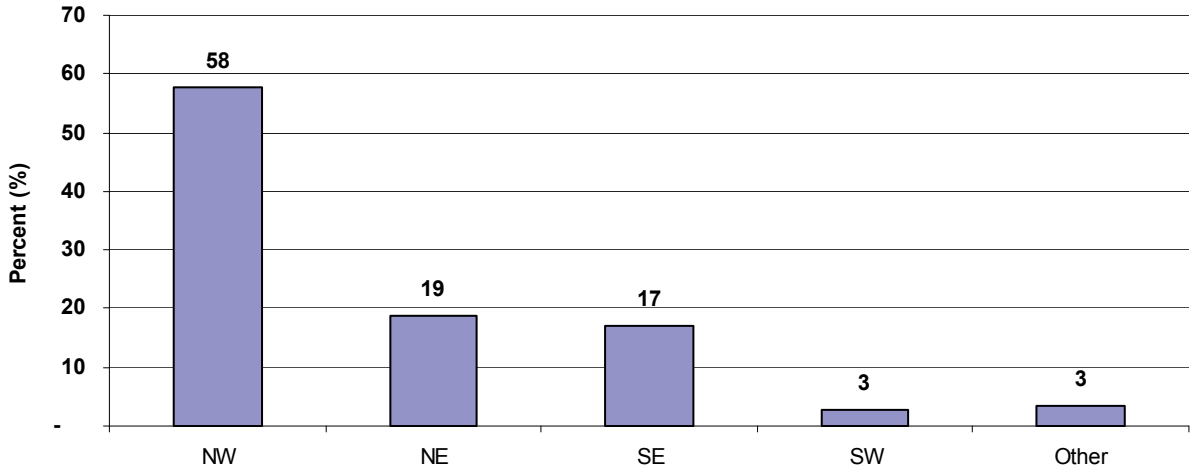
Crowding, measured as neighborhood population density, has also been associated with pedestrian injuries. In Northern Virginia, a higher percentage of pedestrian crashes occurred in business and residential areas (Figure 7).

Figure 7: Pedestrian Crash by Type of Locality
Northern Virginia 1999 to 2003



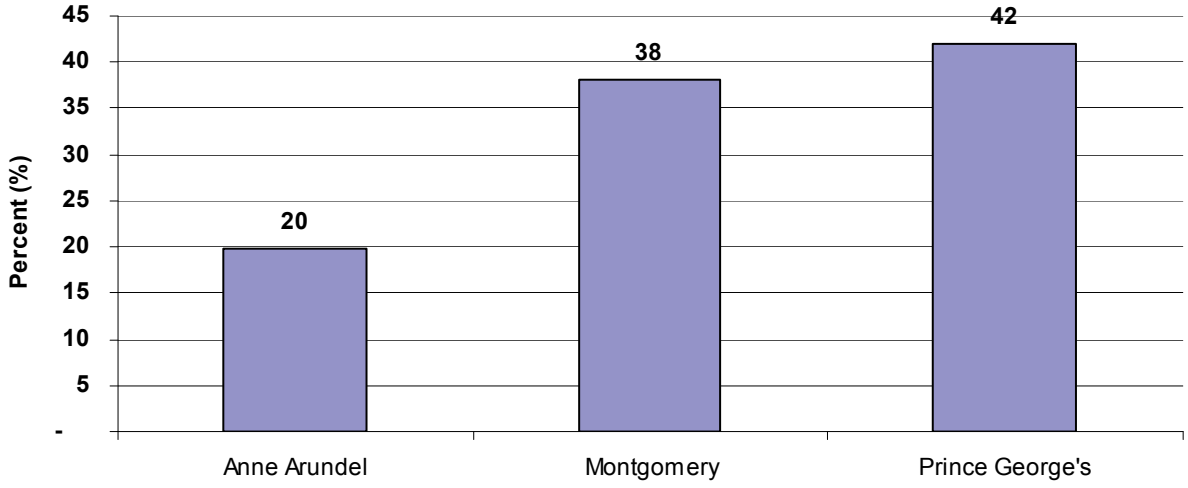
In DC, 58% of pedestrian crashes occurred in the Northwest quadrant followed by the Northeast quadrant of the city (Figure 8).

Figure 8: Pedestrian Crashes by City Quadrant
DC 2000 to 2004



In Central Maryland, 42% of pedestrian crashes occurred in Prince George's County. Montgomery County ranked the second accounting for 38% of all pedestrian crashes that occurred in Central Maryland (Figure 9).

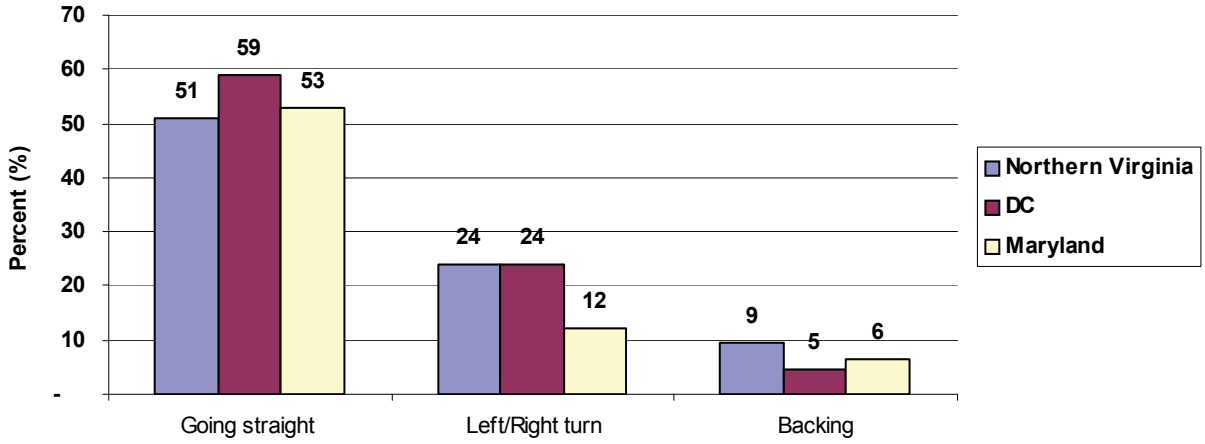
Figure 9: Pedestrian Crashes by County
Central Maryland 2000 to 2003



4- Vehicle Action Prior to Crash

In all three regions of the DCMR, most motor vehicles that were involved in pedestrian crashes were going straight ahead on the roadway prior to the crash. Making a left or right turn was the second most common vehicle action prior to a pedestrian crash. (Figure 10)

Figure 10: Pedestrian Crashes by Most Common Vehicle Action



5- Pedestrian Action Prior to Crash

In both Northern Virginia and Central Maryland, most pedestrian crashes occurred while pedestrians were "crossing not at intersection" (18% and 39% respectively). "Crossing at an intersection with no signal" was the second most common action by pedestrians prior to crash accounting for 12% in Northern Virginia and 21% in Central Maryland (Figures 11 & 12).

Figure 11: Pedestrian Crashes by Common Pedestrian Actions
Northern Virginia 1999 to 2003

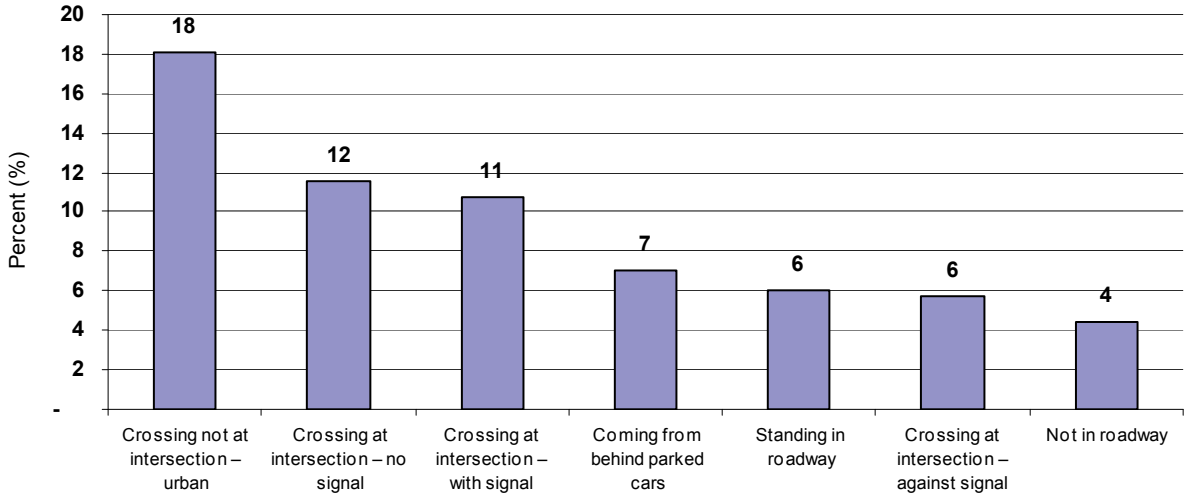
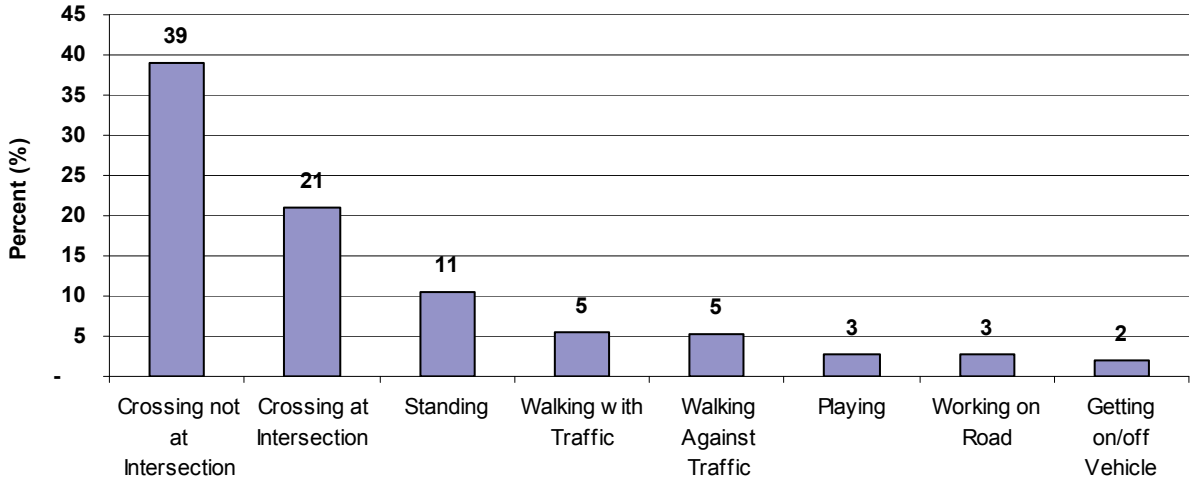


Figure 12: Pedestrian Action Prior to Crash
Central Maryland 2000 to 2003



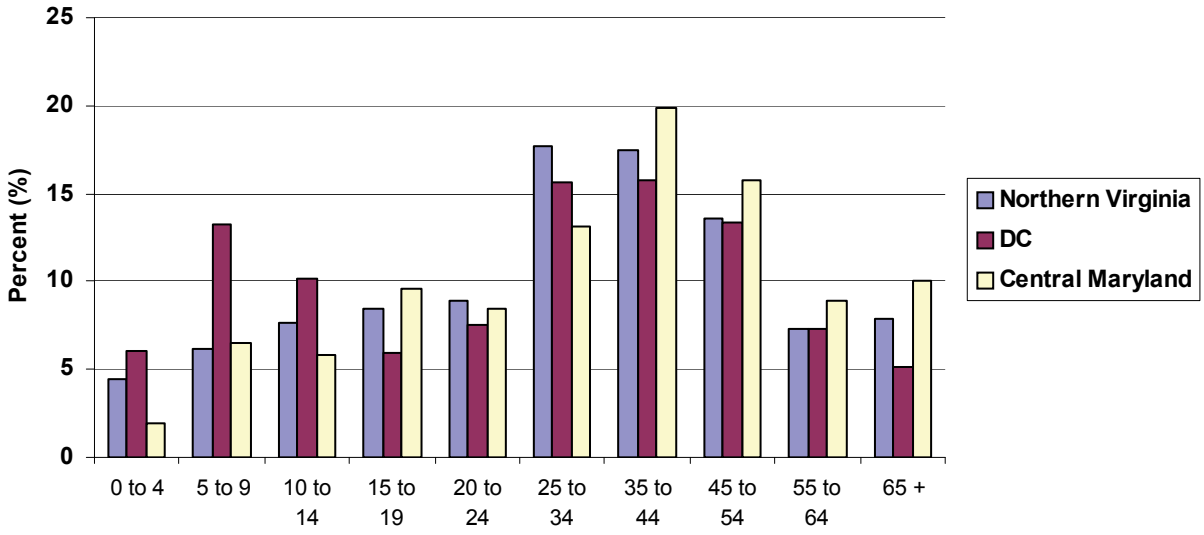
IV- PEDESTRIAN PROFILE

Pedestrian injuries are a significant source of morbidity, mortality and disability. Several social and economic indicators have been identified as risk factors for pedestrian injury e.g. poverty and unemployment have been associated with a higher rate of pedestrian injuries. Several studies have investigated socioeconomic disadvantage, large families and no access to a car as risk factors for pedestrian injury (Phyllis F Agran *et. al*). This section of the report provides information on pedestrian characteristics associated with high risk of injury in the DCMR.

1- Age

In both Northern Virginia and DC, persons aged 25 to 44 had the largest percentage of pedestrian crashes. In DC, children aged 5 to 9 were the third most likely to be involved in pedestrian crashes accounting for 13% of all the total. Children aged 5 to 9 in DC were more than twice as likely as the same age group in Northern Virginia and Central Maryland to be involved in pedestrian crashes. In Central Maryland, persons aged 35 to 44 and 45 to 54 had the highest percentage of pedestrian crashes (Figure 13).

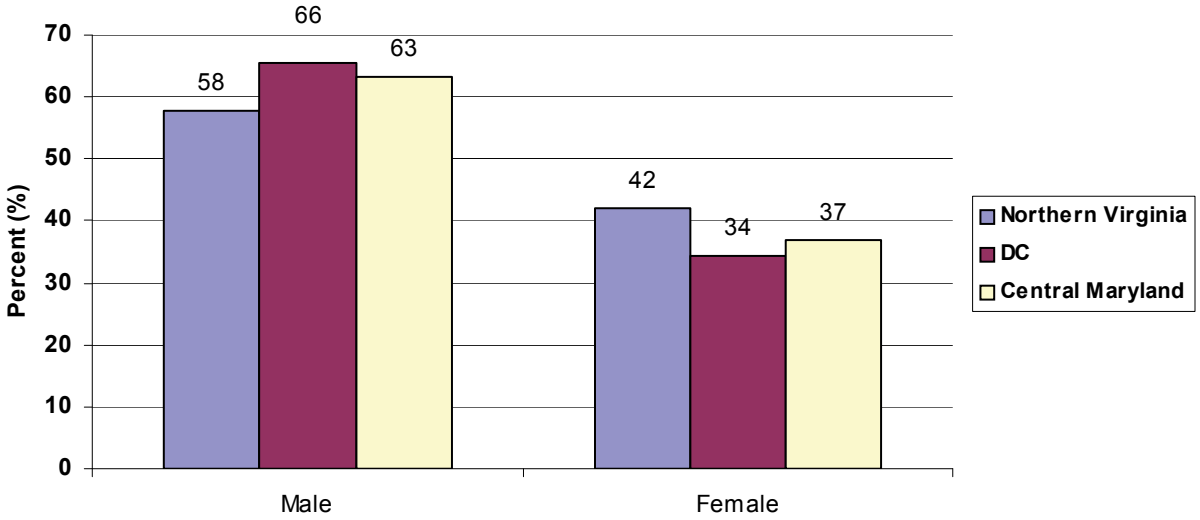
Figure 13 : Pedestrian Crashes by Age



2- Gender

Pedestrian gender was not available from the police crash records in the DC data, so gender of hospitalizations was used as a proxy. In Northern Virginia, males accounted for 58% of pedestrian hospitalizations. In DC and Central Maryland, about two-thirds (66% and 63%) of the pedestrian hospitalizations were males (Figure 14).

Figure 14: Pedestrian Injury Hospitalizations by Gender



3- Race

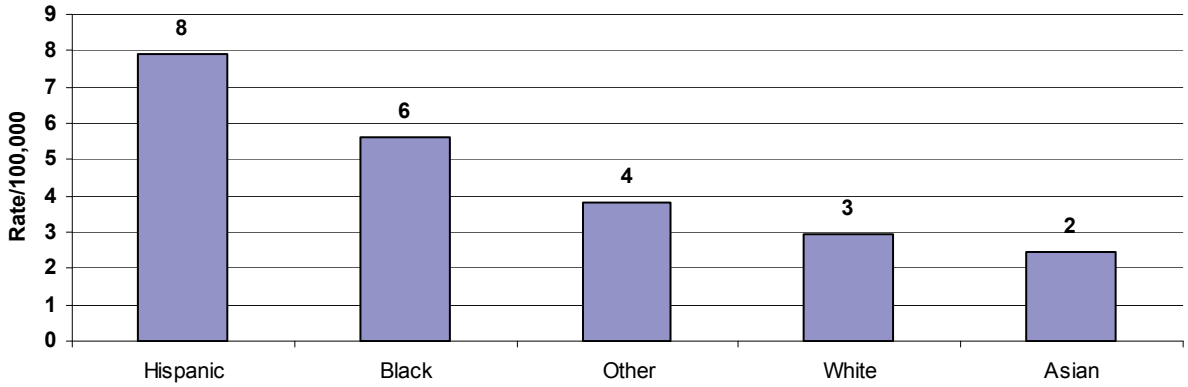
While traffic-related deaths and serious injuries continue to drop for the overall U.S. population, recent data analysis showed that it is not the case for many segments of the country's population (U. S. Census Bureau 2000). African-American and Latino populations are particularly at higher risk of traffic-related deaths and serious non-fatal injuries. Results of the current data analysis showed that these groups are also at higher risk of pedestrian injury in the DCMR. These statistics may be explained in part by socioeconomic status. Traffic safety efforts that reach members of the mainstream culture often fail to reach other groups because they do not cross language, geographic, cultural, or other barriers. Decreased access to cars as a means of transportation may also be a contributing factor.

Northern Virginia's population has become increasingly diverse. According to the U.S. Census Bureau, in 1980, slightly more than 14 % of the county's population defined themselves as belonging to an ethnic or racial group. Today, more than one third of the county's population is of Asian/Pacific Islander, Hispanic, African-American or "other" ethnic descent. The fastest-growing ethnic groups in Fairfax County are Hispanic and Asian/Pacific Islander. These population trends should be taken into consideration in interpreting these data.

Similarly, there are unique considerations for DC related to population density. As of the 2000 census, there are 572,059 people, 248,338 households, and 114,235 families residing in the District. The population density is 3,597.3/km² (9,316.4/mi²). There are 274,845 housing units at an average density of 1,728.3/km² (4,476.1/mi²). The racial makeup of the city is 60% Black or African American, 33% White, 3% Asian, 0.3% Native American and 2.4% from two or more races.

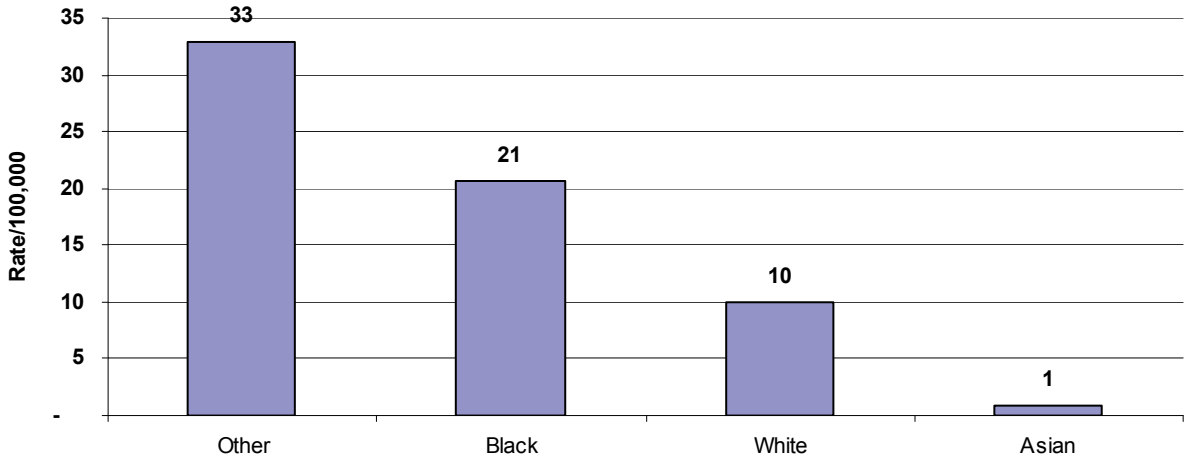
In Northern Virginia, Hispanics had the highest rate of pedestrian injuries at an average annual rate of 8/100,000. African Americans were the second most likely to be injured at an average annual rate of 6/100,000 population (Figure 15).

Figure 15: Pedestrian Injury Hospitalizations by Race
Northern Virginia 1999 to 2003



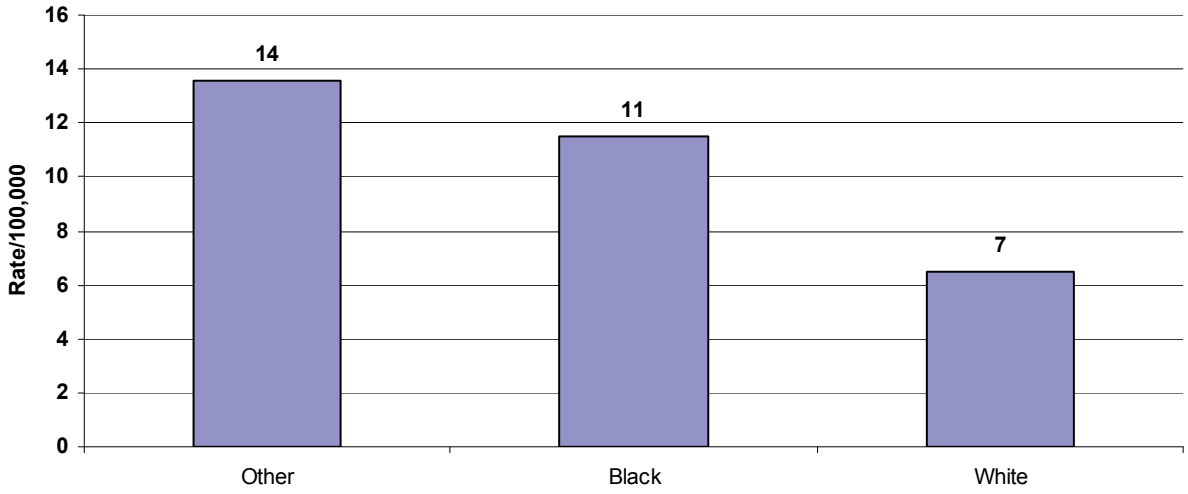
In DC, persons of other races had the highest rate of pedestrian injury hospitalizations at 33/100,000 population. African Americans were the second most likely to be hospitalized due to pedestrian injuries at a rate of 21/100,000 population (Figure 16).

Figure 16: Pedestrian Injury Hospitalizations by Race
DC Residents Only 2001 to 2002



In Central Maryland, persons of other races had the highest rate of pedestrian injuries at 14/100,000 population. Blacks (African Americans) were the second most likely to be injured in pedestrian crashes at a rate of 11/100,000 population (Figure 17).

Figure 17: Pedestrian Injury Hospitalizations by Race
Central Maryland 2000 - 2003



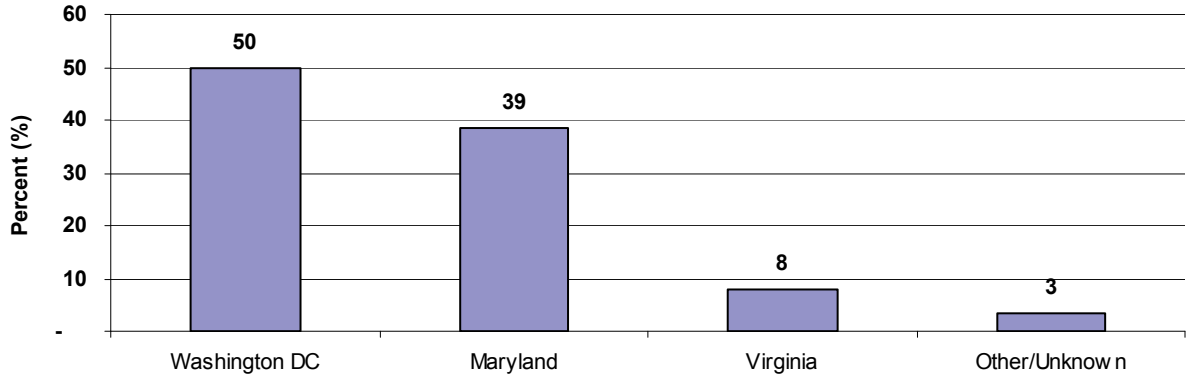
4- Geographic Distribution of Pedestrian Residence

Forty-eight percent of pedestrian crashes in Northern Virginia occurred among Fairfax county residents. Arlington county residents accounted for 22% of all pedestrian crashes in Northern Virginia (Figure 18).

Figure 18: Pedestrian Crash by City/County of Residence
Northern Virginia 1999 to 2003

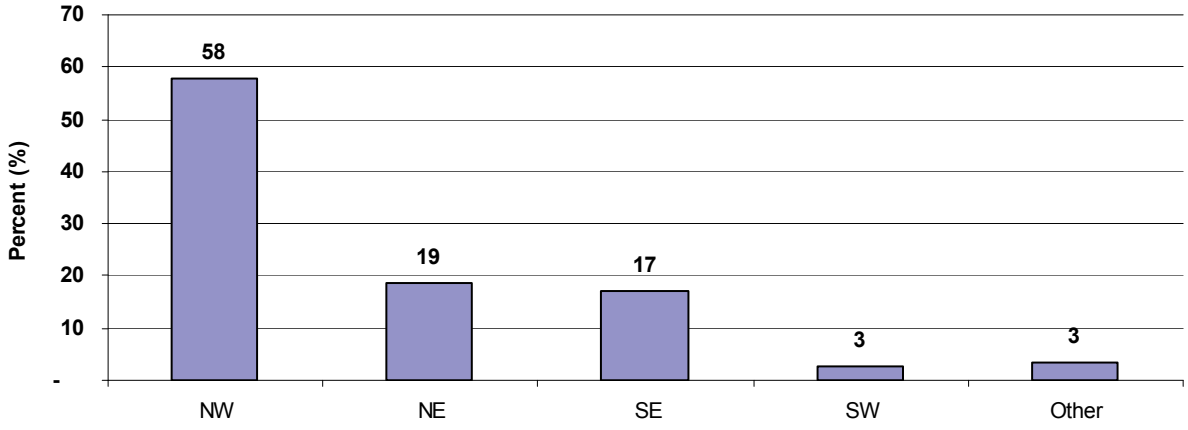
Pedestrians do not always reside in the same location where the crash occurs. Between 2001 and 2002, only 50% of pedestrians injured in DC were DC residents. Maryland residents accounted for 39% of pedestrians injured in DC followed by Virginia residents accounting for 8% (Figure 19). Geo-mapping of pedestrian injury deaths and hospitalizations by zip code of residence are provided in the geo-mapping section of the report (Page 40).

Figure 19: Pedestrian Injury Hospitalizations by State of Residence
DC 2001 - 2002



In DC, 58% of pedestrian crashes occurred in the Northwest quadrant followed by the Northeast quadrant of the city (Figure 20).

Figure 20: Pedestrian Crashes by City Quadrant
DC 2000 to 2004



In Central Maryland, 42% of pedestrian crashes occurred in Prince George's County. Anne Arundel County had the lowest pedestrian crashes among the three Maryland counties included in this report, accounting for only 20% of all pedestrian crashes (Figure 21).

Figure 21: Pedestrian Crashes by County
Central Maryland 2000 to 2003

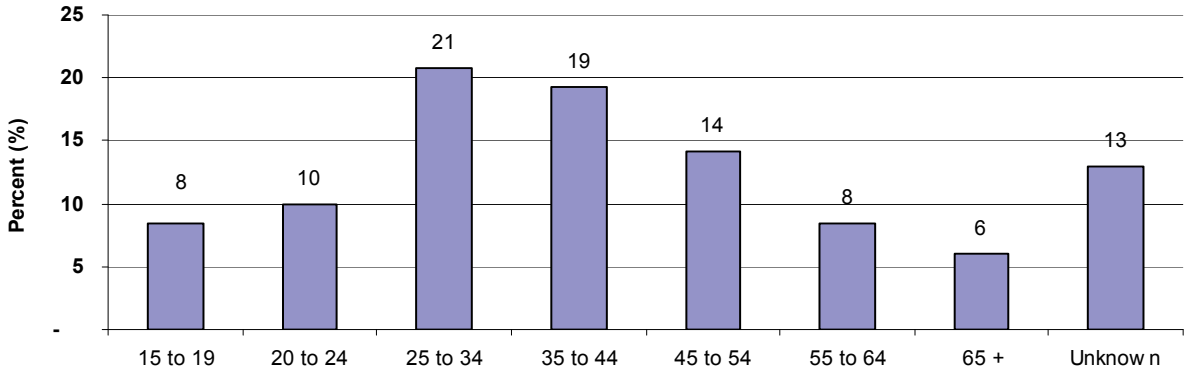
V- DRIVER PROFILE IN NORTHERN VIRGINIA

Data on driver profile are available only for Northern Virginia (1999 -2003). The information obtained from this data can be used with caution as an approximation of the driver profile in both DC and Central Maryland. The information in this section includes driver's age, gender and violations prior to pedestrian crash.

1- Age

Drivers aged 24 to 35 were involved in a higher percentage of pedestrian crashes. Young drivers aged 15 to 24 combined were the third highest age group to be involved in pedestrian crashes accounting for 18% (Figure 22).

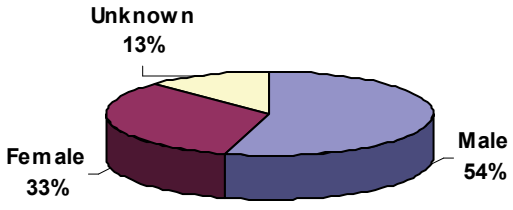
Figure 22: Age of Drivers
Northern Virginia 1999 to 2003



2- Gender

Male drivers were involved in 54% of pedestrian crashes, while female drivers were involved in only 33% (In 13% of the cases driver's gender was not available in the database) (Figure 23).

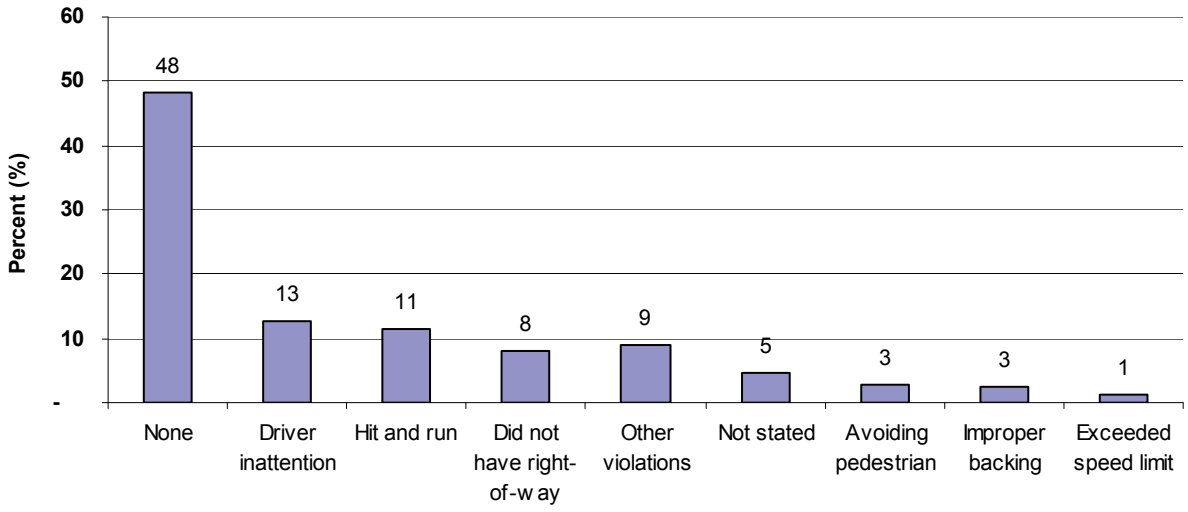
Figure 23: Gender of Drivers
Northern Virginia 1999 to 2003



3- Driver Violation

In 48% of the pedestrian crashes the drivers did not violate the traffic rules. The most common traffic violation associated with pedestrian crashes was driver inattention accounting for 13%. A considerable number (11%) of pedestrian crashes were reported as driver hit and run. Although Virginia law requires that the driver of any vehicle on a highway yield the right-of-way to any pedestrian crossing a highway, 8% of pedestrian crashes in Northern Virginia occurred when drivers did not yield right-of-way (Figure 24).

Figure 24: Drivers Violation Prior to Pedestrian Crash
Northern Virginia 1999 to 2003



VI- CRASH OUTCOME BY VEHICLE TYPE

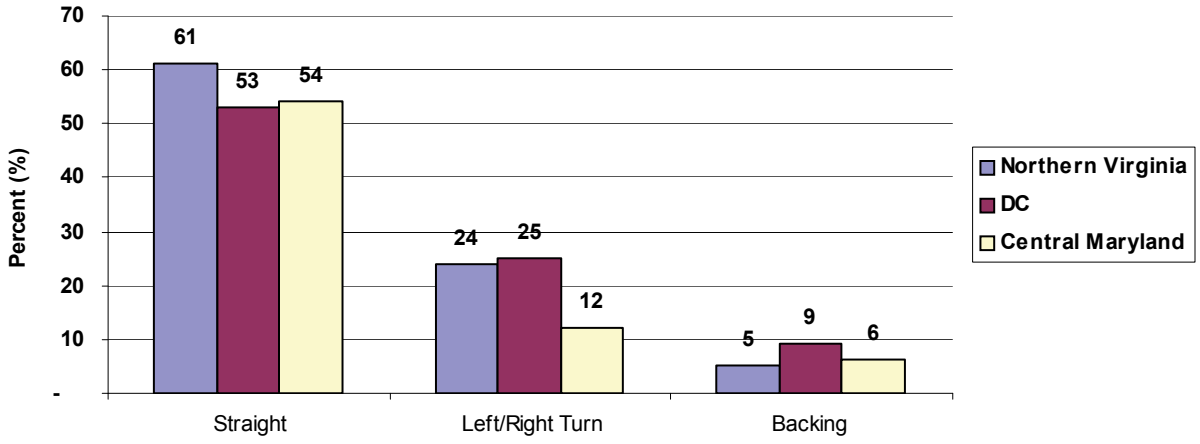
The overall DCMR pedestrian mortality between 1999 and 2003 was 5%. Crashes involving buses and trucks resulted in more fatalities (11%) than those involving passenger vehicles (4%). The majority of pedestrian fatalities occurred on the scene before the victims reached a hospital. *More details on outcomes of pedestrian crashes by vehicle type are shown in the appendix section pages 51-55.*

Pedestrian Crashes by Passenger Vehicles

1-Vehicle Maneuver

In all three areas, going straight ahead was the most common vehicle maneuver associated with pedestrian crashes with passenger vehicles. Making left or right turn was the second most common vehicle maneuver (Figure 25).

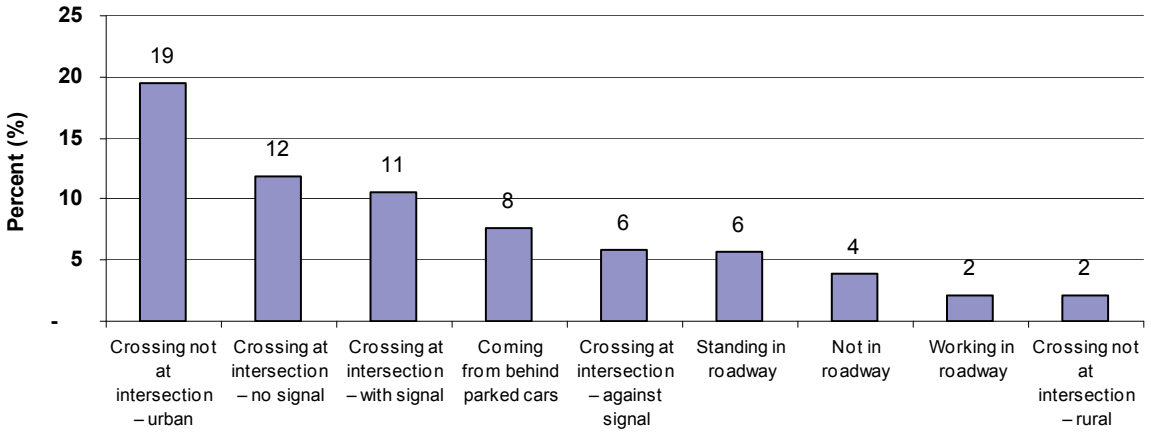
Figure 25: Pedestrian Crashes by Passenger Vehicle Maneuver



2– Pedestrian Action

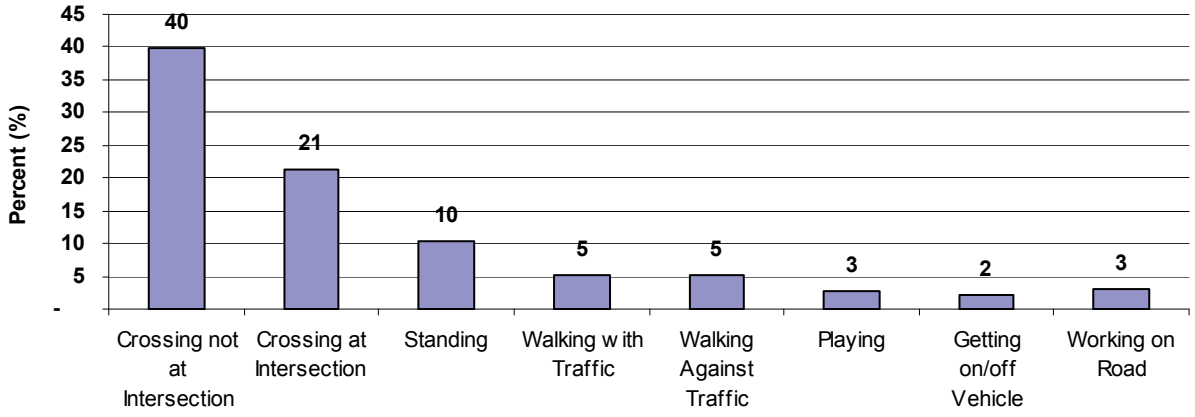
In Northern Virginia, 19% of pedestrian crashes involving passenger vehicles occurred while the pedestrian was crossing somewhere other than at an intersection. Crossing at an intersection with no signal accounted for 12% of pedestrian crashes with a passenger vehicle (Figure 26).

Figure 26 : Pedestrian Action Prior to Crash by Passenger Vehicles
Northern Virginia 1999 to 2003



In Central Maryland, 40% of pedestrian crashes involving passenger vehicles occurred while the pedestrian was crossing not at an intersection (Figure 27).

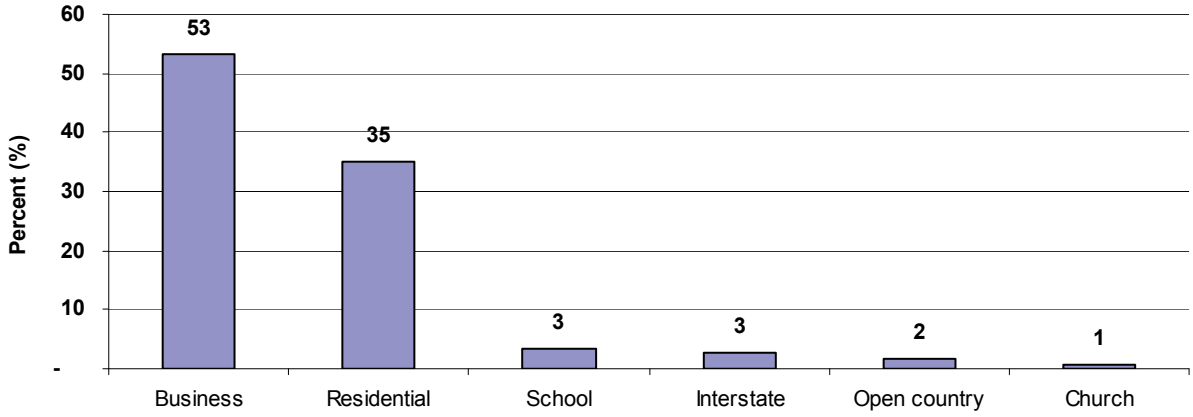
Figure 27: Pedestrian Action Prior to Crash by Passenger Vehicles
Central Maryland 2000 to 2003



3– Type of Locality

In Northern Virginia, pedestrian crashes involving passenger vehicles occurred mostly in business and residential areas. Crashes on open country roads or interstate highways occurred infrequently, accounting for only one and three percent respectively (Figure 28).

Figure 28: Pedestrian Crash by Type of Locality
Northern Virginia 1999 to 2003



In DC, 58% of pedestrian crashes occurred in the Northwest quadrant followed by the Northeast quadrant of the city (Figure 29).

Figure 29: Pedestrian Crashes Involving Passenger Vehicle by City Quadrant
DC 2000 to 2004

In Central Maryland, 42% of pedestrian crashes involved passenger vehicles occurred in Prince George's County, while only 20% of these crashes occurred in Anne Arundel County (Figure 30).

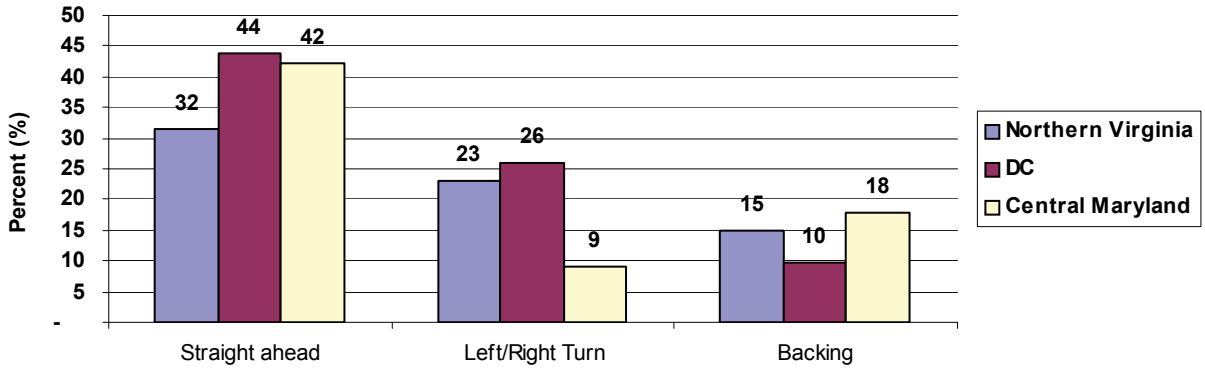
Figure 30: Pedestrian Crashes by County
Central Maryland 2000 to 2003

Pedestrian Crashes by Trucks

1– Vehicle Maneuver

In Northern Virginia 32% of pedestrian crashes involving trucks occurred while the drivers were going straight ahead. Crashes occurring while vehicles were making a left or right turn accounted for 23% of the total crashes. Fifteen percent of the pedestrians were hit by trucks while the vehicles were backing. In DC, 44% of pedestrian crashes involving trucks occurred while the drivers were going straight ahead. Making a left or right turn was the reported vehicle maneuver in 26% of the total crashes. Backing was the vehicle maneuver prior to pedestrian crashes in 9% of cases. In Central Maryland, 54% of pedestrian crashes occurred while the vehicle was going straight ahead. Only 12% of pedestrian crashes involving trucks occurred while the vehicle was making a left or right turn and 6% occurred while the vehicle was backing (Figure 31).

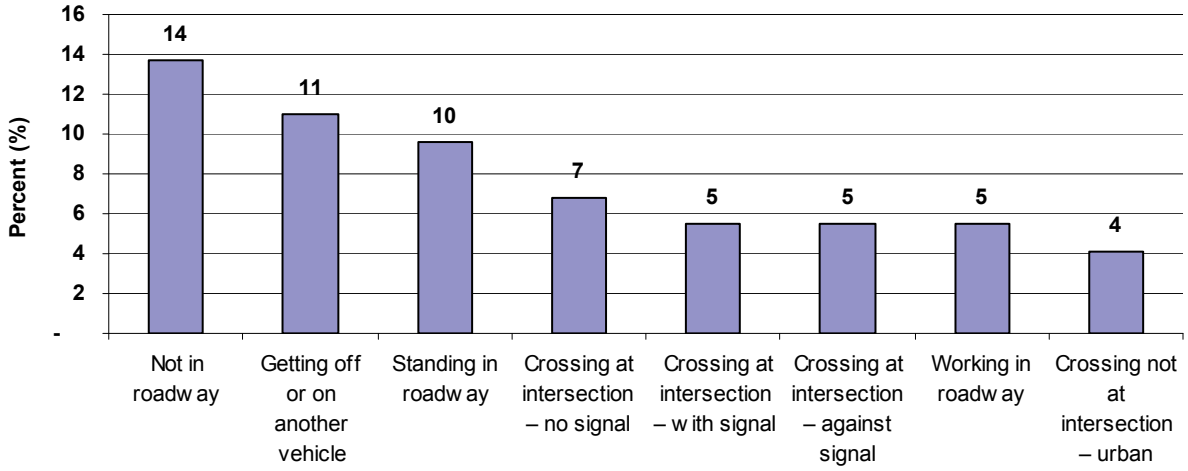
Figure 31: Pedestrian Crashes by Trucks Maneuver



2– Pedestrian Action

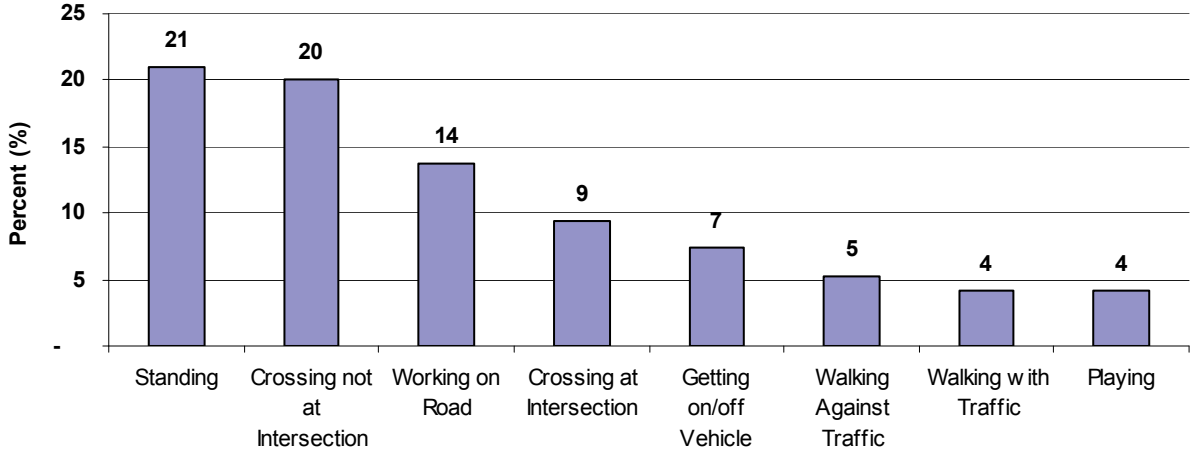
In Northern Virginia, 14% of pedestrian crashes occurred while pedestrians were not in a roadway. Eleven percent of the pedestrians were hit by trucks while they were getting off or on other vehicles. Five percent of the pedestrians were struck by trucks while working on a roadway (Figure 32).

Figure 32: Pedestrian Action Prior to Crashes Involving Trucks
Northern Virginia 1999 to 2003



In Central Maryland, 21% of pedestrian crashes involving trucks occurred while the pedestrian was standing on a roadway. "Crossing not at the intersection" was the second most common pedestrian action associated with pedestrian crashes involving trucks (Figure 33).

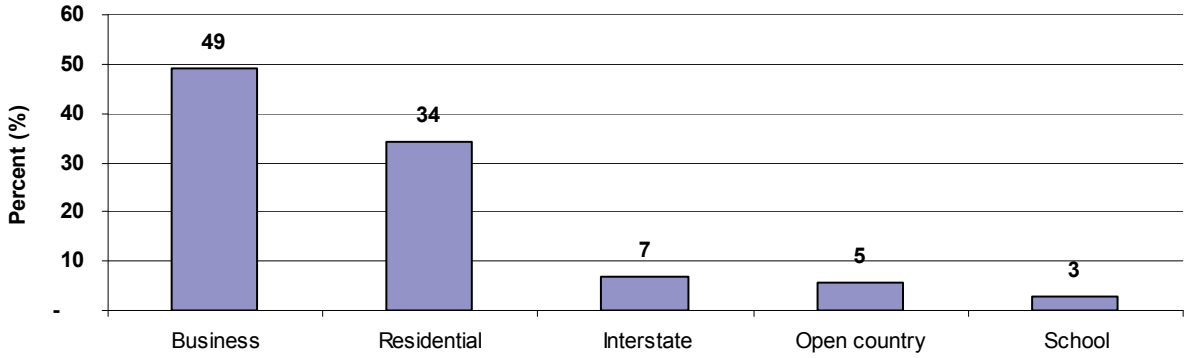
Figure 33: Pedestrian Action Prior to Crash by Trucks
Central Maryland 2000 to 2003



3– Type of Locality

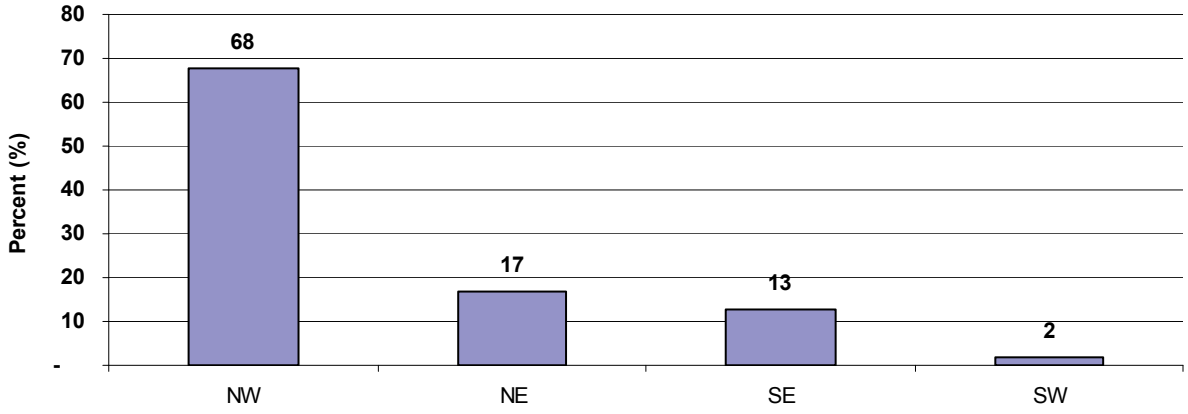
In Northern Virginia, 49% of pedestrian crashes involving trucks occurred in business areas. Thirty-four percent of the crashes occurred in residential areas. Interstate and open country roads were the location in 12 % of the pedestrian crashes involving trucks (Figure 34).

Figure 34: Pedestrian Crashes Involving Trucks by Type of Locality
Northern Virginia 1999 to 2003



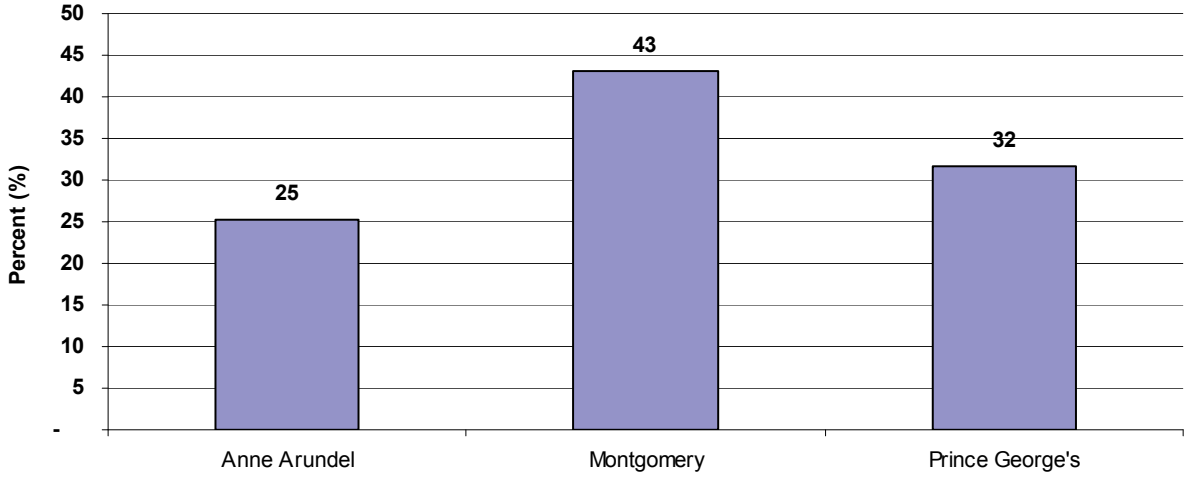
Sixty-eight percent of pedestrian crashes involving trucks occurred in the Northwest quadrant of DC. Northeast was the second most common area on pedestrian crashes accounting for 17% (Figure 35).

Figure 35: Pedestrian CrashesInvolving Trucks by City Quadrant
DC 2000 to 2004



In Central Maryland, 43% of pedestrian crashes involving trucks occurred in Montgomery County. Anne Arundel County had the lowest pedestrian crashes by trucks accounting for 25% (Figure 36).

Figure 36: Pedestrian Crash by Trucks by County
Maryland 2000 to 2003

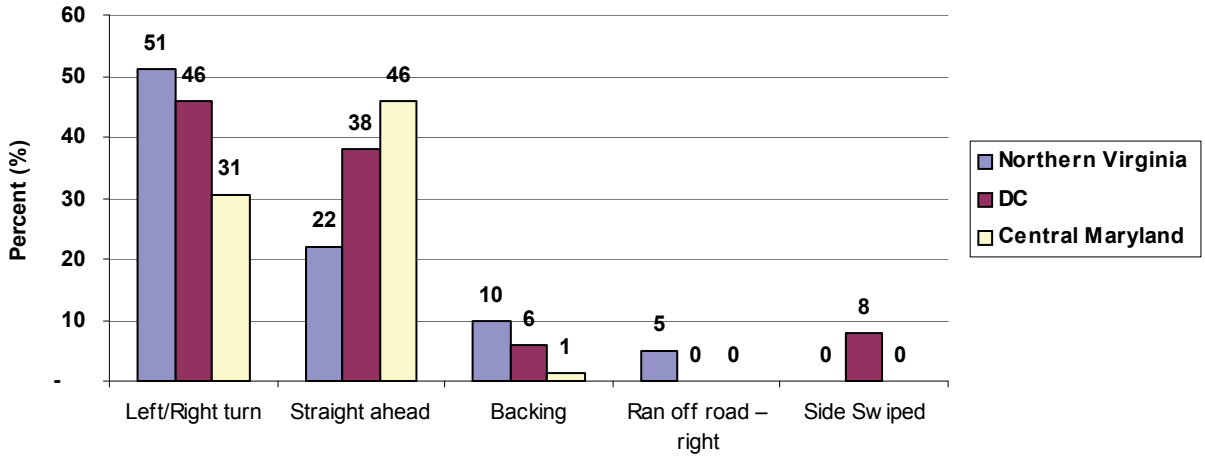


Pedestrian Crashes by Buses

1– Vehicle Maneuver

Making a left or right turn was the most common vehicle maneuver prior to pedestrian crashes by buses. In Northern Virginia, 51% of pedestrian crashes by buses occurred while the drivers were making a left or right turn. Going straight ahead was the second most common maneuver accounting for 22%. In DC, 46% of pedestrians were struck by buses while the drivers were making a left or right turn. Thirty-eight percent were struck while the bus was going straight ahead. In Central Maryland, 46% of pedestrian crashes occurred while the vehicle was going straight ahead (Figure 37).

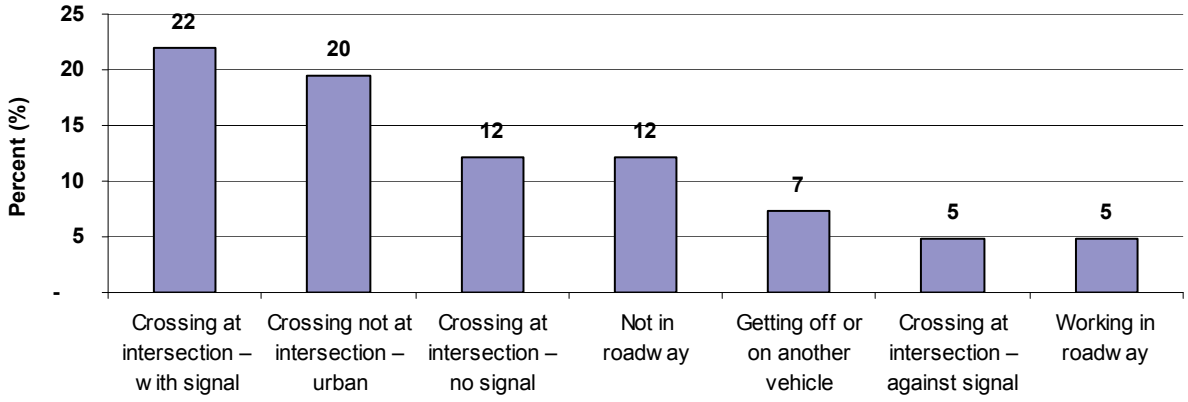
Figure 37: Pedestrian Crashes by Buses Maneuver



2– Pedestrian Action

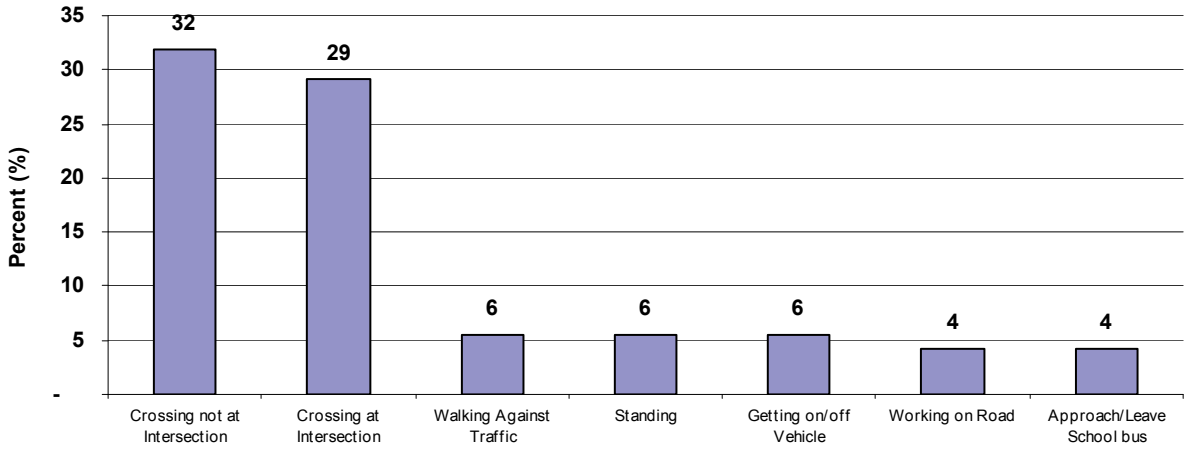
In Northern Virginia, 22% of pedestrian crashes by buses occurred while pedestrians were "crossing at an intersection with a traffic signal". Twenty percent of pedestrians were hit by buses while "crossing not at an intersection" (Figure 38).

Figure 38: Pedestrian Action Prior to Crash by Buses
Northern Virginia 1999 to 2003



In Central Maryland, most pedestrian crashes by buses occurred while pedestrians were "crossing not at an intersection" (Figure 39).

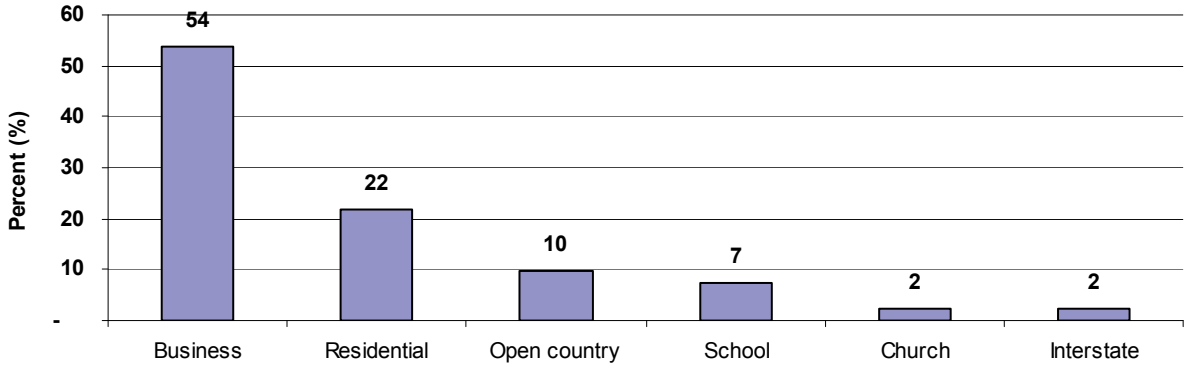
Figure 39: Pedestrian Action Prior to Crash by Bus
Central Maryland 2000 to 2003



3– Type of Locality

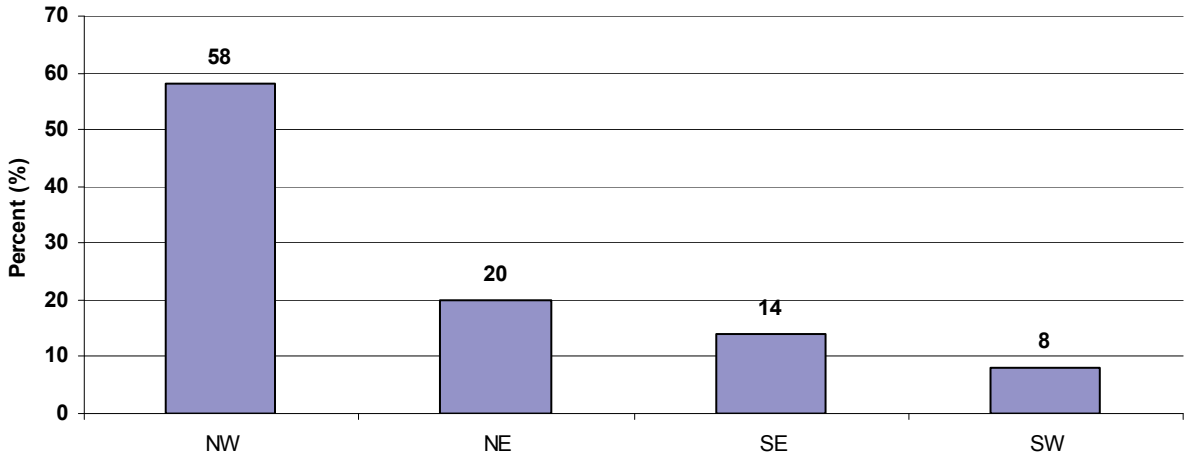
In Northern Virginia, 54% of pedestrian crashes by buses occurred in business areas, 22% in residential areas and 7% in school zones (Figure 40).

Figure 40: Type of Locality Where Pedestrian Crashes Occured by Buses
Northern Virginia 1999 to 2003



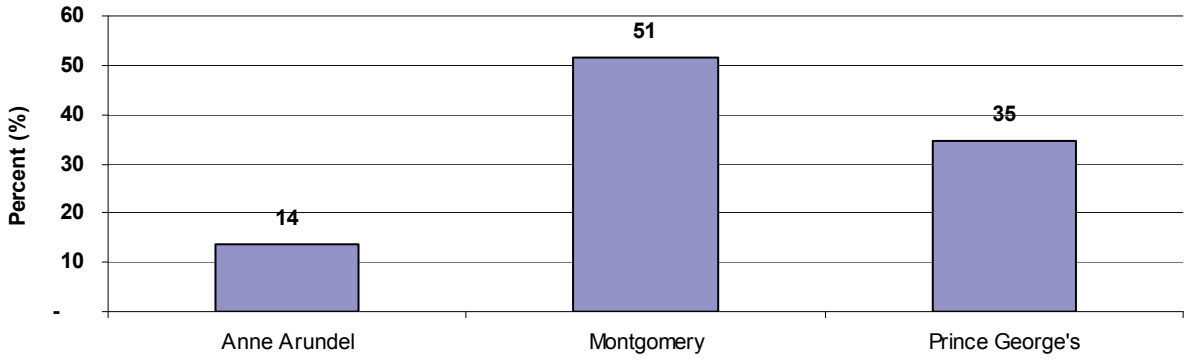
In DC, 58% of the crashes involving buses occurred in the Northwest quadrant and 20% in the Northeast quadrant of the city (Figure 41).

Figure 41: Pedestrian Crashes Caused by Buses by City Quadrant
DC 2000 to 2004



In Central Maryland, more than 50% of pedestrian crashes involving buses occurred in Montgomery County, 35% in Prince George's County and only 14% in Anne Arundel County (Figure 42).

Figure 42: Pedestrian Crashes by Buses by County
Central Maryland 2000 to 2003



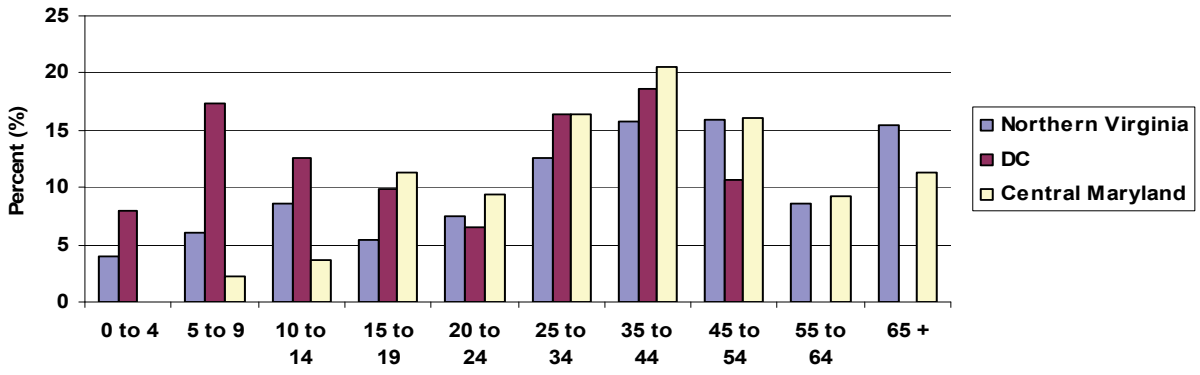
VII- IMPACT OF PEDESTRIAN CRASHES

Pedestrian injuries are the most serious traffic incidents. Lacking any protection, a pedestrian is completely vulnerable to serious injuries when struck by a moving vehicle. Even a relatively slow-moving vehicle can cause fractures and other major injuries to a pedestrian due to the significant momentum of the vehicle's mass and the hardness of the vehicle's exterior surfaces in comparison to the human body. This section provides information on the impact of these crashes on DCMR residents.

1-Pedestrian Injury Hospitalizations and Deaths by Age

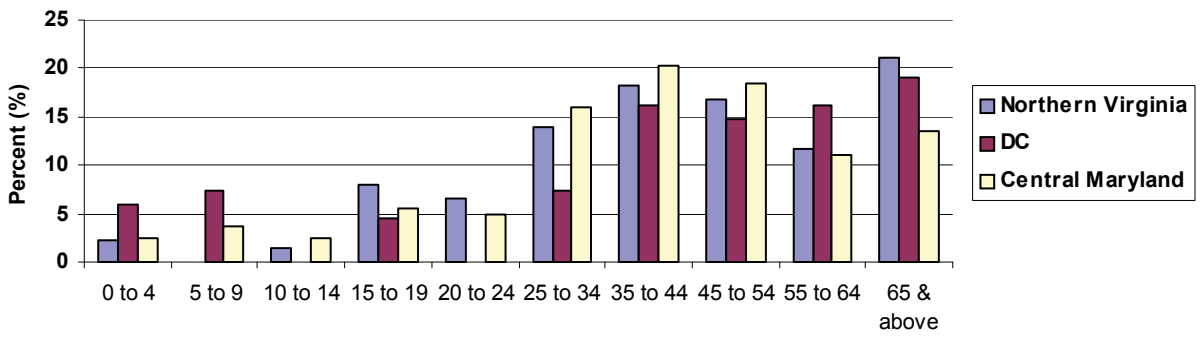
In the three areas included in this study, persons aged 25 to 34 and 35 to 44 had the highest percentage of pedestrian injury hospitalizations. In DC, children aged 5 to 9 accounted for 17% of all pedestrian injury hospitalizations (Figure 43 & Appendix Pages 48 to 50).

Figure 43: Pedestrian Injury Hospitalizations by Age



Approximately 80 pedestrians die in the DCMR each year. In both Northern Virginia and DC, seniors aged 65 and above had the highest percentage of pedestrian related deaths. In Central Maryland, persons aged 35 to 44 were the most likely to die in pedestrian related injuries (Figure 44).

Figure 44: Pedestrian Deaths by Age



2- Pedestrian Injury Deaths and Hospitalizations by Race

In Northern Virginia, Hispanics had the highest rates of pedestrian related injury hospitalizations and deaths at 8 and 4.3 per 100,000 population respectively. African Americans were the second most likely to be hospitalized for pedestrian related injuries at a rate of 6/100,000 population (Figures 45 & 46).

Figure 45: Pedestrian Injury Hospitalizations by Race
Northern Virginia 1999 to 2003

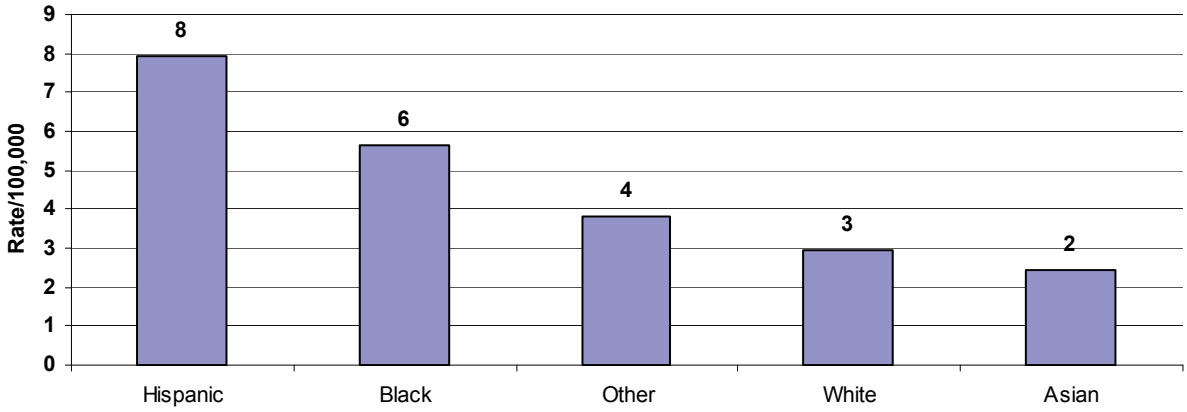
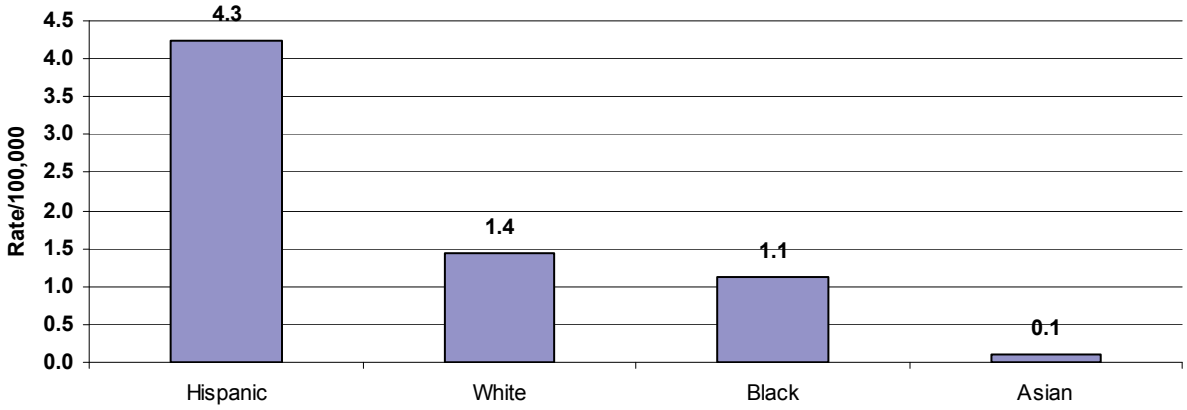


Figure 46: Pedestrian Injury Deaths by Race
Northern Virginia 1999 to 2003



In both DC and Central Maryland, persons of other races had the highest rate of pedestrian injury hospitalizations at 33/100,000 population and 14/100,000 population respectively. African Americans were the second racial group to be hospitalized due to pedestrian injuries at a rate of 21/100,000 in DC and 11/100,000 population in Central Maryland (Figures 47 & 48).

Figure 47: Pedestrian Injury Hospitalizations by Race
DC Residents Only 2001 to 2002

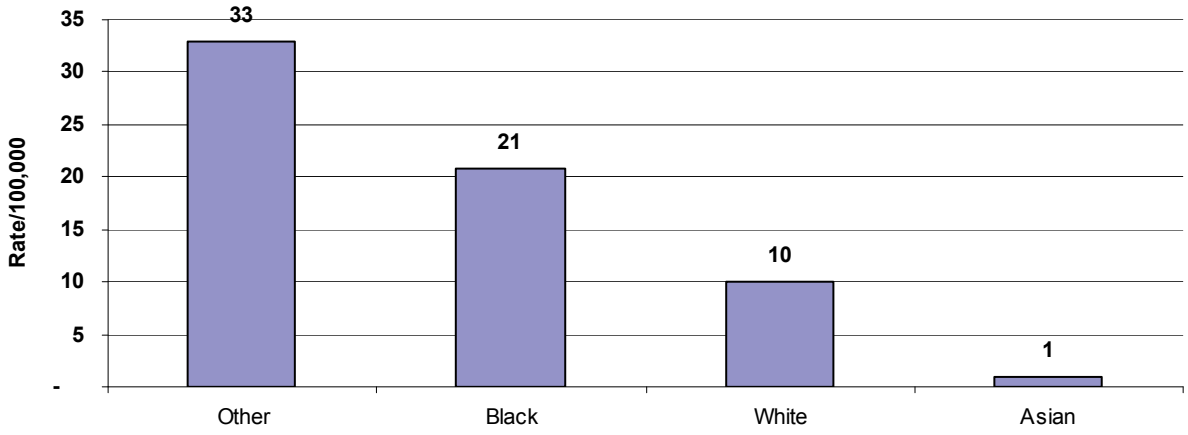
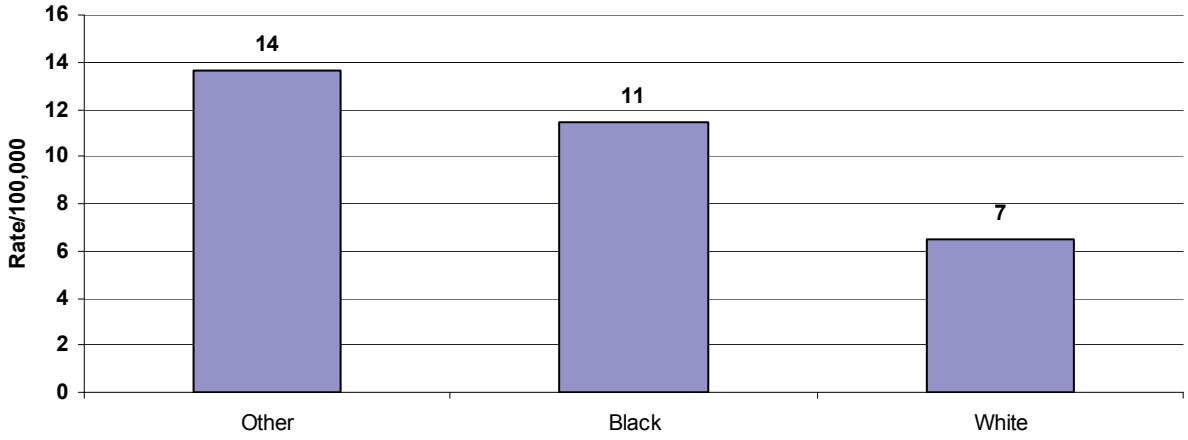


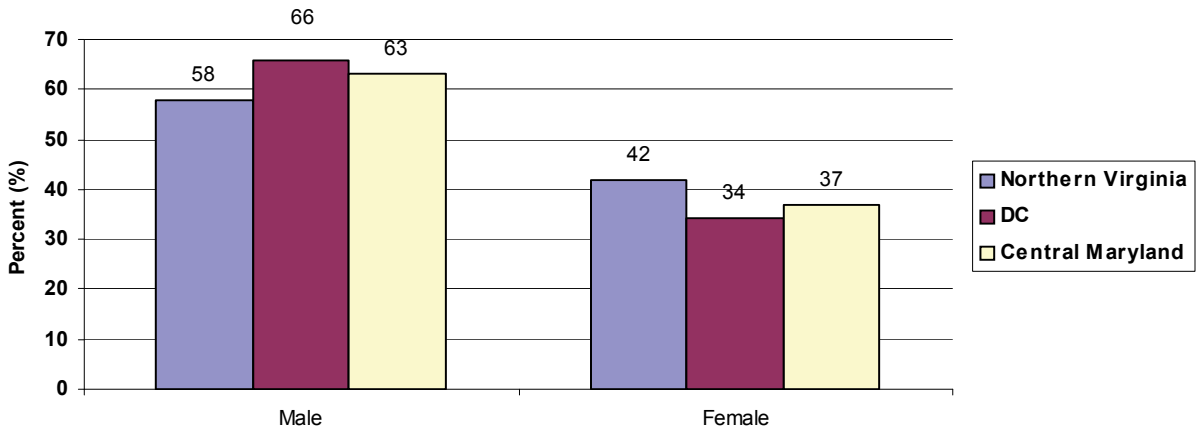
Figure 48: Pedestrian Injury Hospitalizations by Race
Central Maryland 2000 - 2003



3– Pedestrian Injury Hospitalizations by Gender

In Northern Virginia males accounted for 58% of pedestrian hospitalizations. In DC and Central Maryland, about two-thirds (66% and 63%) of the pedestrian hospitalizations were males (Figure 49).

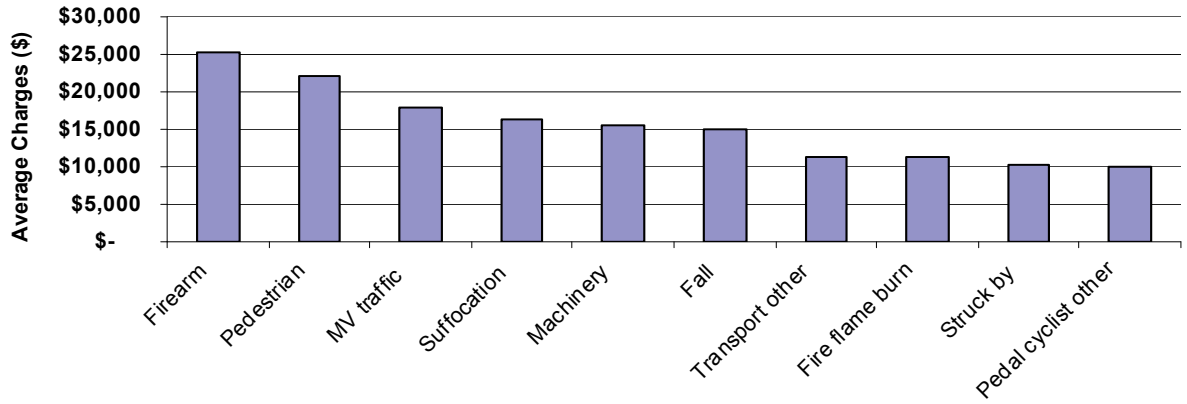
Figure 49: Pedestrian Injury Hospitalizations by Gender



4- Hospital Charges and Length of Stay

Approximately 3000 pedestrians are involved in crashes with motor vehicles every year in the DCMR. Of these, the vast majority (87-96%) sustain one or more injuries. A significant percentage of these (17%) require hospitalization for 24 hours or longer resulting in average hospital costs of $ 17,000 to $30,000 per patient. Hospital charges range from $654 to $259,094. In Northern Virginia, pedestrian injury hospitalizations were the second most costly injuries after firearm injuries (Figure 50).

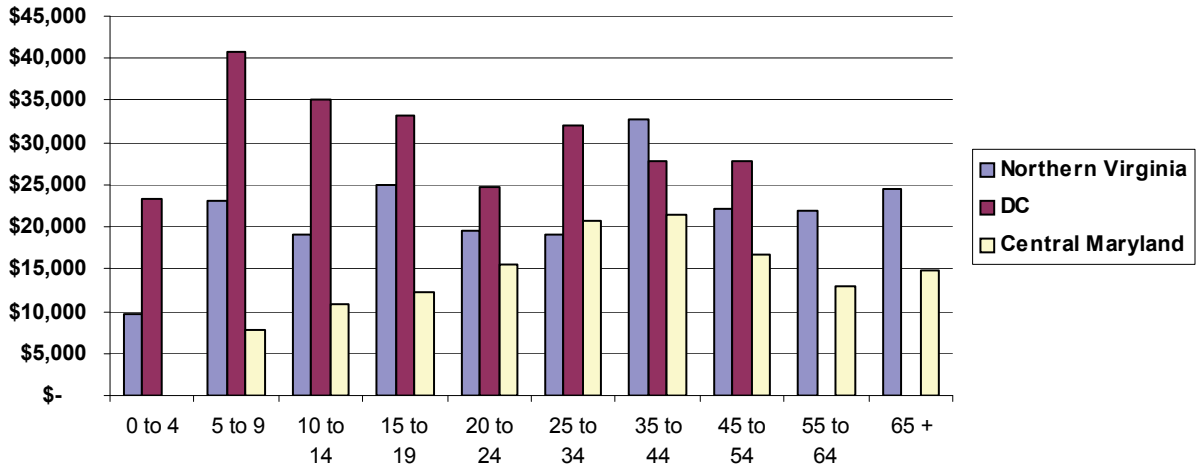
Figure 50: Average Hospital Charges for Different Types of Injuries Northern Virginia 1999 to 2003



In Northern Virginia total hospital charges were $10,981,697 for the five-year period between 1999 and 2003. In Central Maryland total hospital charges were $13,217,697 for the years 2000 -2003.

In Northern Virginia, persons aged 35 to 44 had the highest average hospital charges among all age groups. In DC, children aged 5 to 9 had the highest average hospital charges, followed by age group 10 to 14 years. In Central Maryland, persons aged 25 to 34 and 35 to 44 had the highest average hospital charges (Figure 51).

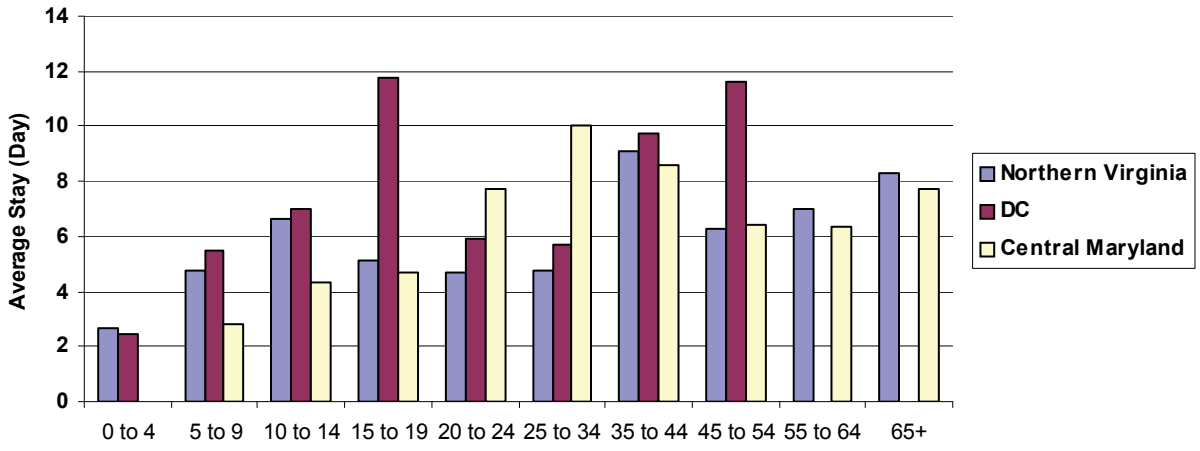
Figure 51: Average Hospital Charges by Age



Length of stay (LOS) in hospitals due to injuries is a strong indicator of lost productivity and possible lifetime disabilities. Pedestrian injuries required the second longest average hospital stay after burns. Average length of stay masks the extreme cases that are in the hospital for weeks or months. In addition, it does not account for the often lengthy recovery periods that are spent at home or in a rehabilitation hospital. Hospital stays for pedestrians ranged from 1 to 174 days.

In Northern Virginia, persons aged 35 to 44 had the highest average hospital stay. In DC, age groups 15 to 19 and 45 to 64 had the highest average hospital stay. In Central Maryland, persons aged 25 to 34 had the highest average hospital stay followed by age group 35 to 44 years (Figure 52).

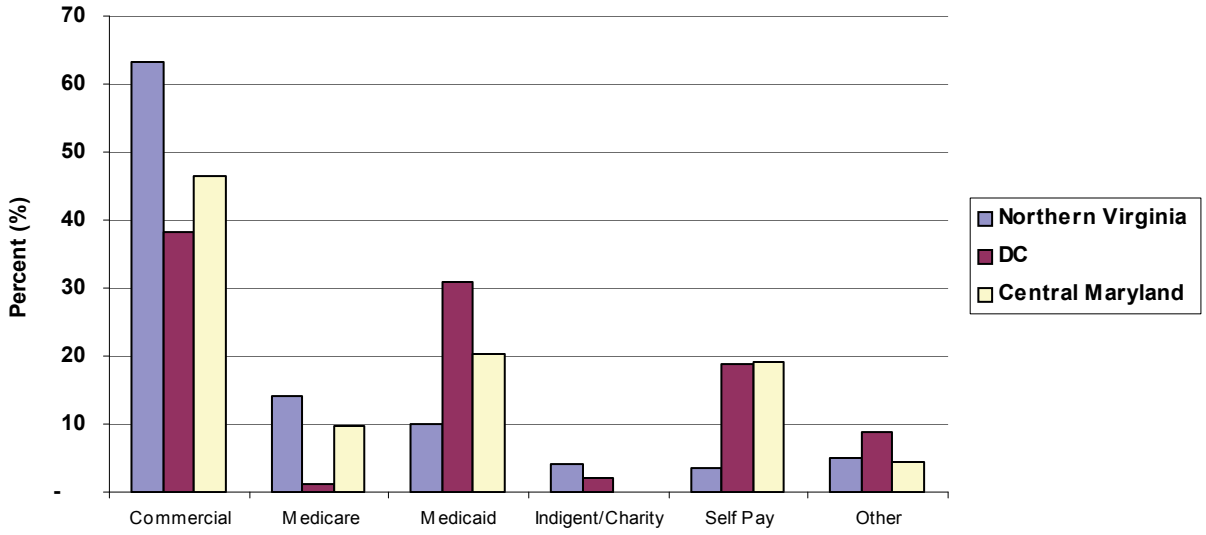
Figure 52: Average Hospital Stay for Pedestrian Injuries by Age



5- Financial Burden

Pedestrian injuries not only affect the injured persons and their families, but also the community in general. Society must often assume the enormous financial burden related to these injuries. In Northern Virginia, more than 60% of pedestrian hospital charges were paid by commercial insurance companies, compared to less than 40% in DC. In DC, 50% of pedestrian hospital charges were paid by Medicaid or self-pay. In Maryland, the payer is listed as Medicare, Medicaid or self pay in over 55% of the cases (Figure 53).

Figure 53: Payer for Pedestrian Hospital Charges

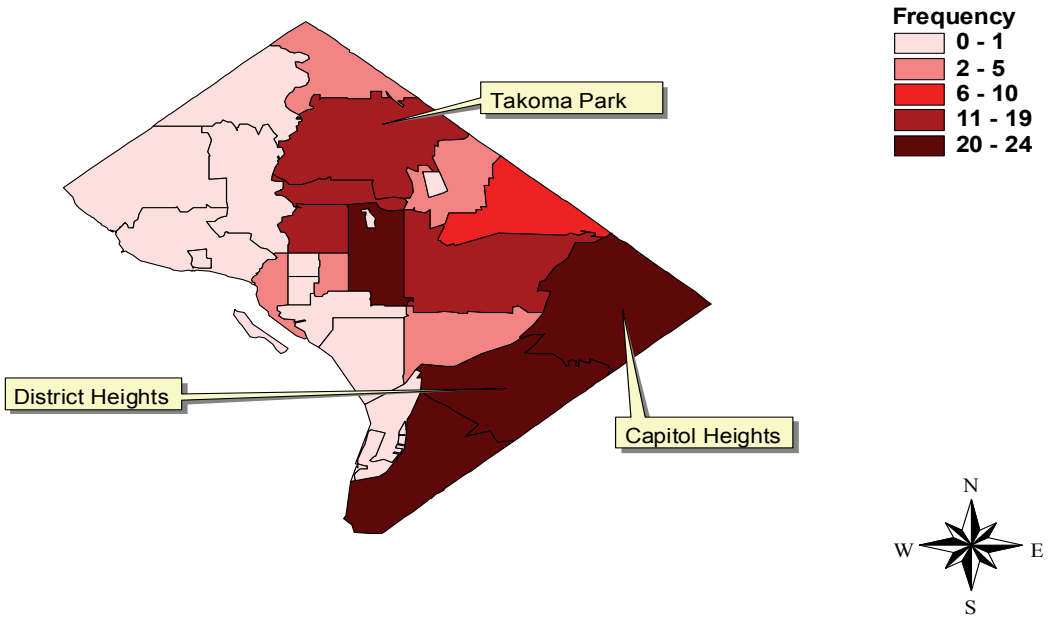


VIII- GEO-MAPPING

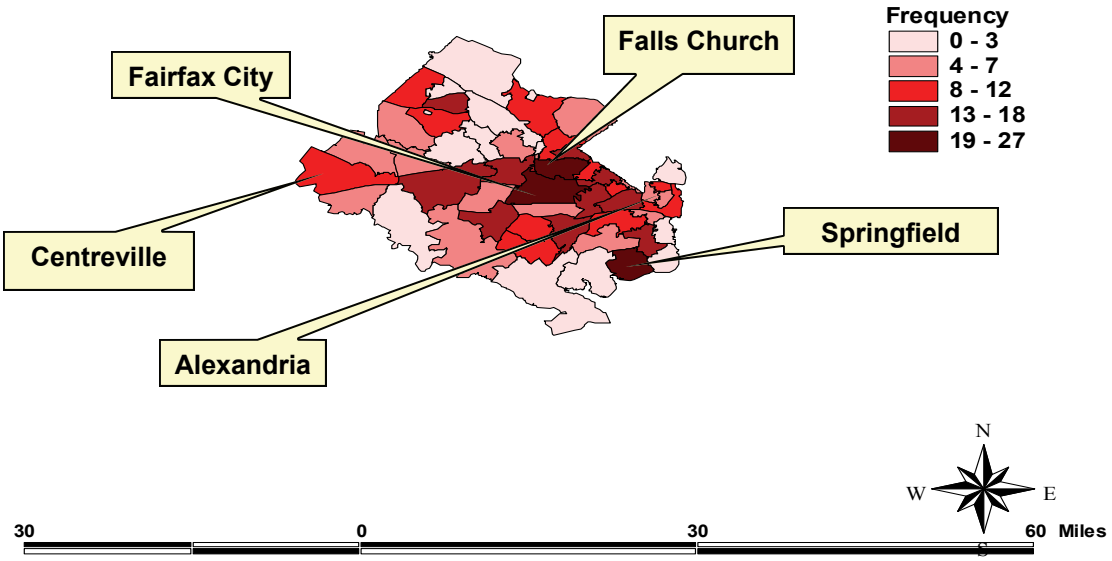
Injury maps are effective tools for public health officials to sort and analyze information when making important decisions about education and prevention.

Mapping injury rates can help identify the impact of injuries in a specific geographic area and compare the results with those of other areas. This mapping section provides the geographic distribution of pedestrian related deaths and hospitalizations that occurred in the DCMR. To assist public health officials in sorting and analyzing information when making decisions about education and prevention, the number of injuries in the period from 1999 to 2003 were combined so that the rates are based on a larger number of cases.

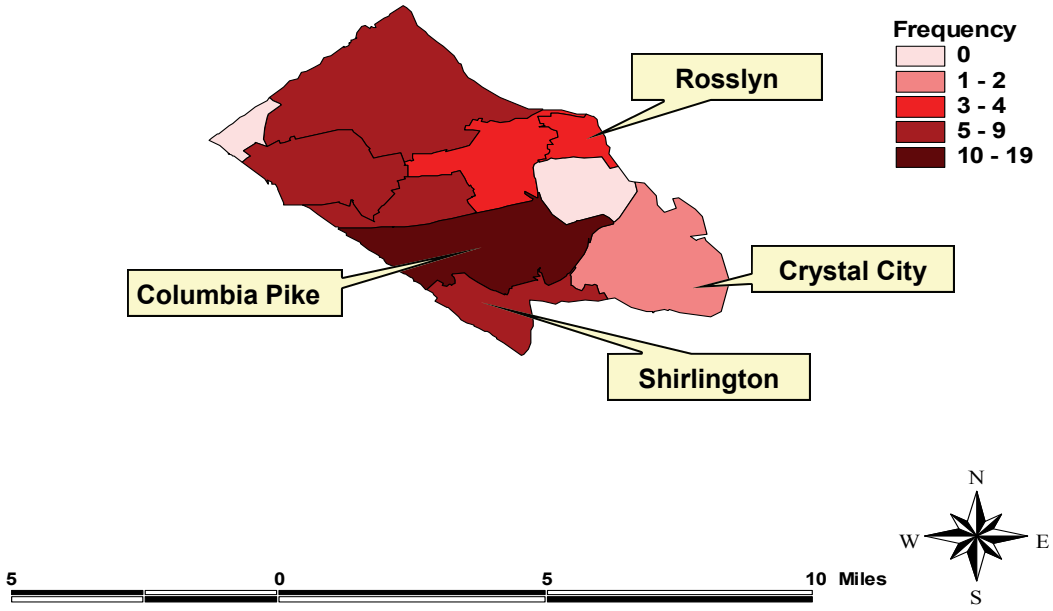
Map 1: Pedestrian Injury Hospitalizations by Zip Code of Residence, Washington DC 2001-2002



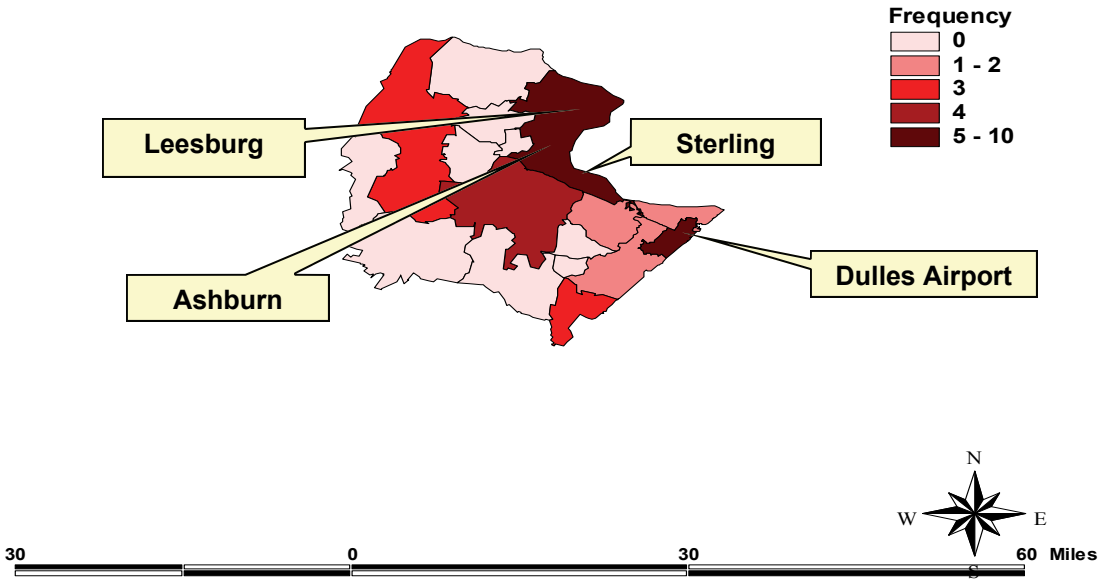
Map 2: Pedestrian Injury Deaths and Hospitalizations by Zip Code of Residence, Fairfax County Virginia 1999-2003



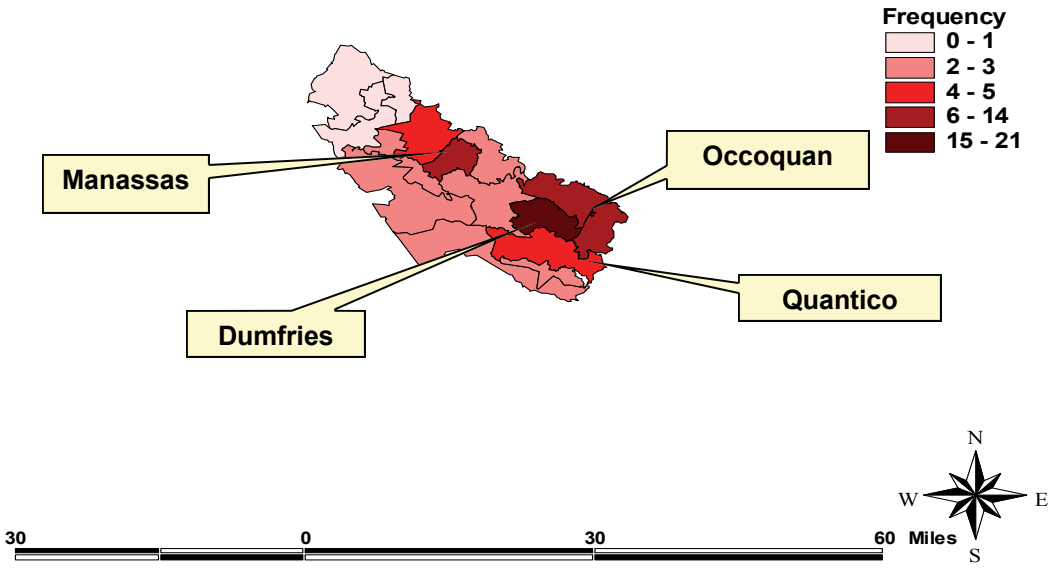
Map 3: Pedestrian Injury Deaths and Hospitalizations by Zip Code of Residence, Arlington County Virginia 1999-2003



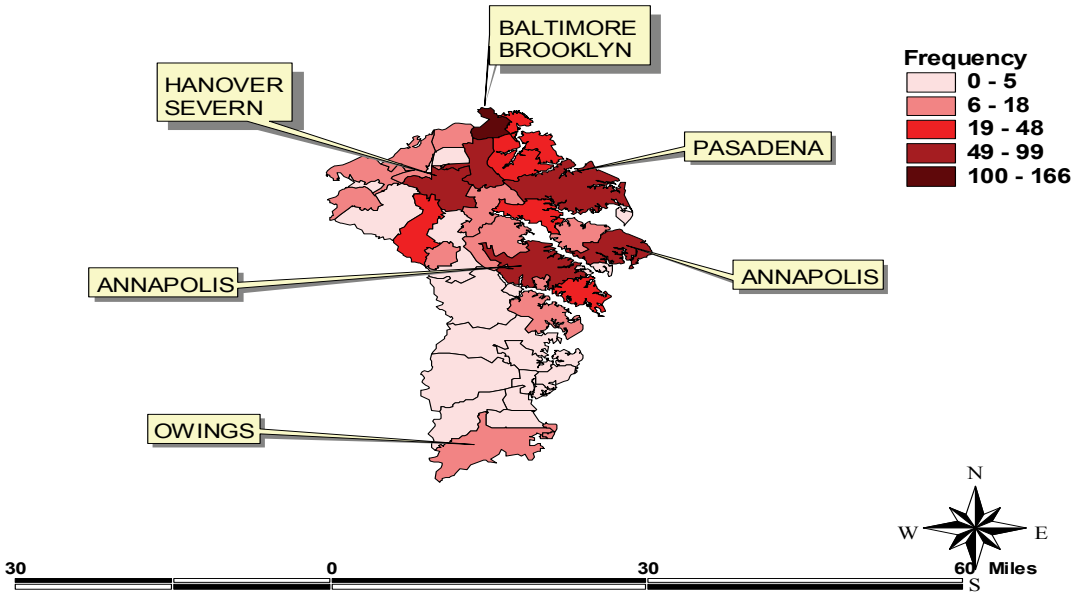
Map 4: Pedestrian Injury Deaths and Hospitalizations by Zip Code of Residence, Loudoun County Virginia 1999-2003



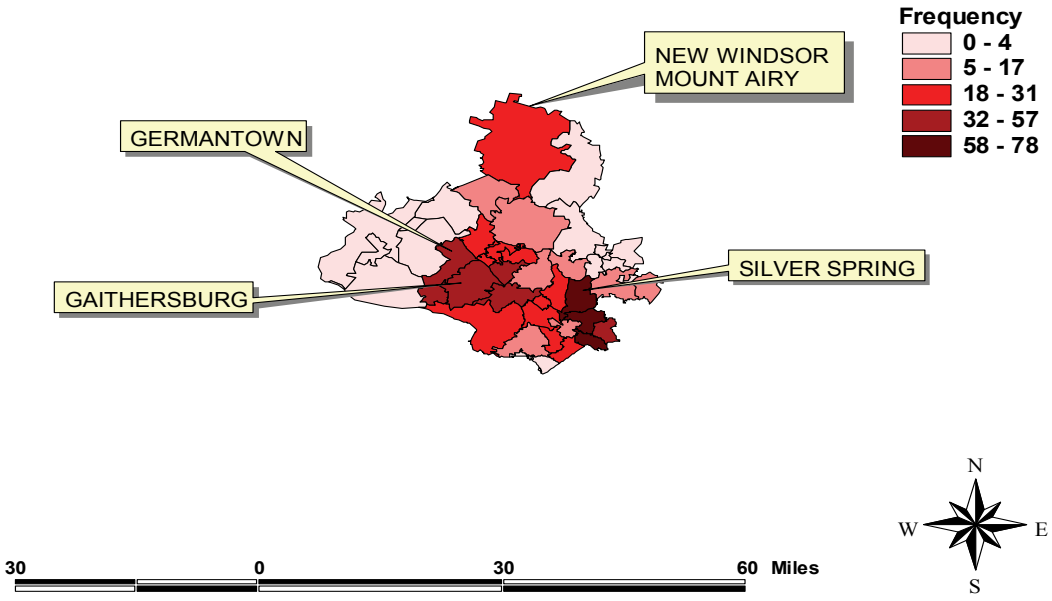
Map 5: Pedestrian Injury Deaths and Hospitalizations by Zip Code of Residence, Prince William County Virginia 1999-2003



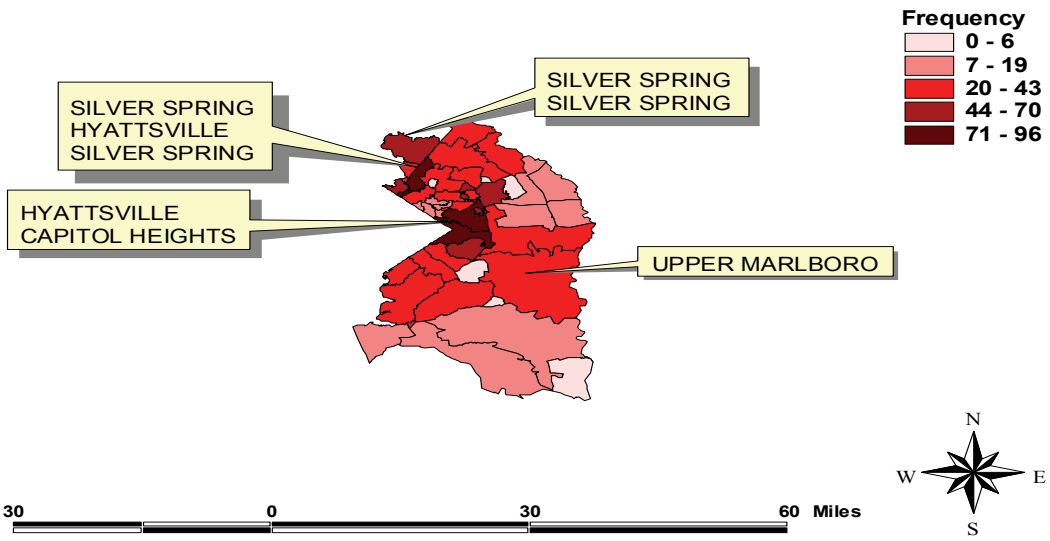
Map 6: Pedestrian Injury Hospitalizations by Zip Code of Residence, Anne Arundel County Maryland 2000-2003



Map 7: Pedestrian Injury Hospitalizations by Zip Code of Residence, Montgomery County Maryland 2000-2003



Map 8: Pedestrian Injury Hospitalizations by Zip Code of Residence, Prince George's County Maryland 2000-2003



IX- CONCLUSIONS

The surveillance data contained in this report provide comprehensive baseline information about pedestrian crashes to assist policy-makers, law enforcement personnel, researchers, city engineers, community leaders and the public in assessing the magnitude and impact of these injuries. In reviewing the data, some general conclusions are evident:

- Pedestrian injuries are a significant source of morbidity, mortality, and disability in the DCMR.
- The roots of this problem are diverse and no one simple solution presents itself upon examination of the facts. As a result, a multi-dimensional approach is required to adequately address the problem.
- Pedestrian crashes are more prevalent Monday through Friday during busy commuting hours. They occur more frequently in densely populated areas such as business districts.
- Underserved and minority populations are at higher risk for pedestrian injury. This includes seniors, school age children and new immigrants. Among the most remarkable statistics encountered in this study was the finding that in DC, persons of races other than Black or White had pedestrian injury hospitalization rates of 33/100,000 population, many times higher than other groups and other jurisdictions.
- Although most pedestrian crashes involve a passenger vehicle, pedestrians struck by buses or trucks are much more likely to suffer serious injury and/or death.
- The responsibility for the crashes appears to be shared almost equally between drivers and pedestrians. In 52% of the crashes in the DCMR the driver of the vehicle was cited for an infraction.
- Most pedestrian crashes occurred while pedestrians were crossing at a location different from an intersection.
- Locations of most frequent crashes by passenger vehicles in the DCMR were Fairfax County, Prince George's County and the NW quadrant of DC.

X- RECOMMENDATIONS

This report reviews data from multiple sources in the DCMR. In the absence of a formal injury surveillance system, policy makers and researchers are forced to collate data from many sources in order to obtain a comprehensive assessment of problems such as pedestrian injury. In order to develop effective strategies that reduce the burden of injury, communities and jurisdictions need reliable, easily accessible data sources that are available over long periods of time. Once such data are available, interventions directed at problems such as pedestrian injury can be developed and their effectiveness assessed over time. A uniform data collection strategy for all the jurisdictions in question would greatly simplify the effort. This report serves as a preliminary tool to guide planning, implementation, and evaluation of current and future prevention programs. A number of specific recommendations may be made based on these data:

1. Data collection, analysis and reporting are recommended on an ongoing basis.

2. Consistent data collection in the tri-state region would significantly improve the quality of data provided in the future.

3. Observational studies can provide in-depth information on pedestrian and driver behaviors associated with pedestrian crashes. These studies may be useful in clarifying the problem, shaping the interventions and evaluating the effectiveness of current prevention programs.

4. Individuals and groups from local and regional areas should be involved in developing comprehensive community-based interventions targeting drivers, pedestrians and engineers to decrease pedestrian crashes.

5. High-risk groups such as minority populations and the elderly should be targeted for interventions. In particular, certain populations in DC are in great need of interventions to reduce their exceptionally high rates of pedestrian injury and hospitalizations.

6. A highly publicized community-based campaign may serve as an appropriate venue for reaching the higher risk populations. This campaign would include culturally sensitive materials developed with the assistance of key leaders from the identified populations.

7. Interventions aimed at reducing pedestrian crashes involving buses and trucks are needed and have the potential to make a substantial impact on mortality.

8. Pedestrian safety programs may benefit from combining injury surveillance data with Geographic Information Systems (GIS) to better target the location and focus of injury prevention interventions. Several prevention programs have successfully utilized GIS mapping techniques to plot vehicle crash locations and identify high-risk areas for motorized vehicle crashes, which can be used in developing specific interventions.

In summary, pedestrian injury is a serious problem facing the entire DCMR. In order to minimize the burden of this injury on communities in the DCMR, well-organized data collection

efforts, broadly based observational studies and a variety of focused interventions will be necessary throughout the DCMR. Regional cooperation is vital to the success of these efforts.

XI- APPENDIX

Table A1: Pedestrian Injury Hospitalizations Northern Virginia 1999 to 2003

Age	Frequency	Percent
0 to 4	19	4
5 to 9	29	6
10 to 14	41	9
15 to 19	26	5
20 to 24	36	8
25 to 34	60	13
35 to 44	75	16
45 to 54	76	16
55 to 64	41	9
65 +	74	16
Total	**477**	**100**

Table A2: Pedestrian Injury Hospitalizations DC 2001 to 2002

Age	Frequency	Percent
0 to 4	23	6
5 to 9	62	17
10 to 14	42	12
15 to 19	34	9
20 to 24	38	10
25 to 34	56	15
35 to 44	69	19
45 to 54	40	11
Total	**364**	**100**

Table A3: Pedestrian Injury Hospitalizations Central Maryland 2000 to 2003

Age	Frequency	Percent
5 to 9	18	2
10 to 14	29	4
15 to 19	89	11
20 to 24	74	9
25 to 34	129	16
35 to 44	162	21
45 to 54	127	16
55 to 64	73	9
65 +	89	11
Total	**790**	**100**

Table A4: Pedestrian Injury Deaths Northern Virginia 1999 to 2003

Age	Frequency	Percent
0 to 4	3	2
10 to 14	2	1
15 to 19	11	8
20 to 24	9	7
25 to 34	19	14
35 to 44	25	18
45 to 54	23	17
55 to 64	16	12
65 +	29	21
Total	**137**	**100**

Table A5: Pedestrian Injury Deaths by Age, DC 2000 to 2004

Age	Frequency	Percent
0 to 4	4	6
5 to 9	5	7
15 to 19	3	4
25 to 34	5	7
35 to 44	11	16
45 to 54	10	15
55 to 64	11	16
65 +	13	19
Unknown	6	9
Total	**68**	**100**

Table A6: Pedestrian Injury Deaths by Age, Central Maryland 2000 to 2003

Age	Frequency	Percent
0 to 4	4	2
5 to 9	6	4
10 to 14	4	2
15 to 19	9	6
20 to 24	8	5
25 to 34	26	16
35 to 44	33	20
45 to 54	30	18
55 to 64	18	11
65 +	22	13
Unknown	3	2
Total	**163**	**100**

Table A7: Outcome of Pedestrian Crashes
Northern Virginia 1999

Vehicle Type	DOS	Injury	% Mortality
Passenger Vehicles	18	511	4
Trucks	3	14	21
Buses	1	9	11
Other/Unknown	0	58	0
Total	**22**	**592**	**4**

Table A8: Outcome of Pedestrian Crashes
Northern Virginia 2000

Vehicle Type	DOS	Injury	% Mortality
Passenger Vehicles	29	505	6
Trucks	0	16	0
Buses	0	2	0
Other/Unknown	2	65	3
Total	**31**	**588**	**5**

Table A9: Outcome of Pedestrian Crashes
Northern Virginia 2001

Vehicle Type	DOS	Injury	% Mortality
Passenger Vehicles	19	504	4
Trucks	1	11	9
Buses	1	14	7
Other/Unknown	4	128	3
Total	**25+ 8 DAA = 33**	**657**	**5**

Table A10: Outcome of Pedestrian Crashes
Northern Virginia 2002

Vehicle Type	DOS	Injury	% Mortality
Passenger Vehicles	21	493	4
Trucks	0	12	0
Buses	1	8	13
Other/Unknown	2	69	3
Total	**24 + 11 DAA = 35**	**582**	**6**

Table A11: Outcome of Pedestrian Crashes
Northern Virginia 2003

Vehicle Type	DOS	Injury	% Mortality
Passenger Vehicles	14	481	3
Trucks	3	13	23
Buses	1	4	25
Other/Unknown	1	80	1
Total	**19 + 5 DAA = 24**	**579**	**4**

Table A12: Outcome of Pedestrian Crashes
DC 2000

Vehicle Type	Death	Injury	% Mortality
Passenger Vehicles	10	323	3
Trucks	3	20	15
Buses	3	9	33
Other/Unknown	2	66	3
Total	**18**	**418**	**4**

Table A13: Outcome of Pedestrian Crashes
DC 2001

Vehicle Type	Death	Injury	% Mortality
Passenger Vehicles	10	401	2
Trucks	2	21	10
Buses	0	5	0
Other/Unknown	2	81	2
Total	**14**	**508**	**3**

Table A14: Outcome of Pedestrian Crashes
DC 2002

Vehicle Type	Death	Injury	% Mortality
Passenger Vehicles	5	304	2
Trucks	2	22	9
Buses	1	3	33
Other/Unknown	0	45	0
Total	**8**	**374**	**2**

Table A15: Outcome of Pedestrian Crashes
DC 2003

Vehicle Type	Death	Injury	% Mortality
Passenger Vehicles	11	296	4
Trucks	2	16	13
Buses	1	14	7
Other/Unknown	4	52	8
Total	**18**	**378**	**5**

Table A16: Outcome of Pedestrian Crashes
DC 2004

Vehicle Type	Death	Injury	% Mortality
Passenger Vehicles	7	380	2
Trucks	1	25	4
Buses	0	15	0
Other/Unknown	2	55	4
Total	**10**	**475**	**2**

Table A17: Outcome of Pedestrian Crashes Central Maryland 2000

Vehicle Type	Deaths	Injury	% Mortality
Passenger Vehicle	29	850	3
Trucks	0	23	0
Buses	1	12	8
Other/Unknown	3	28	11
Total	**33**	**913**	**4**

Table A18: Outcome of Pedestrian Crashes Central Maryland 2001

Vehicle Type	Deaths	Injury	% Mortality
Passenger Vehicle	34	865	4
Trucks	1	19	5
Buses	2	12	17
Other/Unknown	2	21	10
Total	**39**	**917**	**4**

Table A19: Outcome of Pedestrian Crashes Central Maryland 2002

Vehicle Type	Deaths	Injury	% Mortality
Passenger Vehicle	40	812	5
Trucks	0	18	0
Buses	1	14	7
Other/Unknown	3	21	14
Total	**44**	**865**	**5**

Table A20: Outcome of Pedestrian Crashes Central Maryland 2003

Vehicle Type	Deaths	Injury	% Mortality
Passenger Vehicle	43	921	5
Trucks	1	24	4
Buses	0	21	0
Other/Unknown	3	22	14
Total	**47**	**988**	**5**

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