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Older pedestrians hit by motor vehicles in the Australian Capital Territory

James Thompson

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make history.

Report documentation

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Older pedestrians hit by motor vehicles in the Australian Capital Territory

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Abstract

Older pedestrians are a growing and vulnerable road user group. They have an increased risk of serious or fatal injury if hit by a motor vehicle. Pedestrian safety is influenced by the design of the road system and available infrastructure. The capital city of Australia, Canberra, is a planned and walkable city. However, the road system may not be optimal for pedestrian safety. This report examined the number of older pedestrians (65 years and over) hit by motor vehicles in the Australian Capital Territory, with comparisons made to the number of younger adult pedestrians (18 to 64 years) hit by motor vehicles. Characteristics of the collisions, information related to the locations where they occurred, and the pedestrian injury outcomes were also examined to understand the crashes, in the context of the ACT and its infrastructure. Police-reported data for pedestrian-vehicle crashes in the ACT (2011 to 2020) were analysed. Fewer older pedestrians were hit by motor vehicles between 2011 and 2020 than younger adult pedestrians. However, they had similar rates of being hit per 10,000 population and older pedestrians had a higher overall rate of serious and fatal injury than younger adult pedestrians. Older pedestrians were more likely walking during daylight hours and on the footpath when hit compared to younger adult pedestrians, who were more likely walking at night when hit. Older pedestrians were more likely hit at uncontrolled road locations, while younger adult pedestrians were more likely hit at traffic lights and marked pedestrian crossings. GPS locations highlighted that pedestrians were commonly hit in the Canberra CBD. Police narratives and GPS locations were examined in detail for older pedestrians seriously or fatally injured from being hit to understand the crashes and determine whether the road design at the locations were adequate for pedestrian safety and what improvements could be made.

Keywords: older adults, pedestrians, crashes, injury, infrastructure

Summary

Older pedestrians are a growing and vulnerable road user group. Research indicates that they have an increased risk of serious or fatal injury if hit by a motor vehicle compared to younger aged pedestrians. Pedestrian safety is influenced by the design of the road system and the infrastructure available for pedestrians to use. The capital city of Australia, Canberra, is a planned city with an inner-city area that is inherently walkable, due to being a smaller city that is mostly flat. However, the road system and infrastructure in Canberra may not be optimal for pedestrian safety.

The present report examined the number of older pedestrians (65 years and over) hit by motor vehicles in the Australian Capital Territory, with comparisons made to the number of younger adult pedestrians (18 to 64 years) hit by motor vehicles. The characteristics of these collisions, information related to the locations where they occurred, and the pedestrian injury outcomes were also examined to understand the crashes, in the context of the ACT and its infrastructure. Police-reported data for all pedestrian versus motor vehicle crashes in the ACT between 2011 and 2020 were obtained from Road Safety and Transport Policy, Transport Canberra and City Services, ACT Government.

Fewer older pedestrians were hit by motor vehicles between 2011 and 2020 than younger adult pedestrians. However, the two groups had similar rates of being hit per 10,000 population and older pedestrians had a higher overall rate of serious and fatal injury than younger adult pedestrians. Older pedestrians were more likely to be walking during daylight hours (83 versus 65%) and on the footpath when hit (20 versus 8%). Younger adult pedestrians were more likely to be walking at night when hit (35 versus 17%). Two-thirds of the pedestrians from both age groups were hit at midblock locations, while a third were hit at intersections. Older pedestrians were more likely to be hit at uncontrolled road locations (80 versus 60%), while younger adult pedestrians were more likely to be hit at traffic lights (17 versus 10%) and marked pedestrian crossings (13 versus 3%). However, a lack of traffic control was most common overall for both pedestrian age groups (63%), which suggests that crash-involved pedestrians of all ages often choose road locations that are less safe to cross.

The Global Positioning System locations were the pedestrians were hit were plotted on spatial maps of the ACT. Ninety-eight percent of the pedestrians were hit in metropolitan or suburban areas, with many hit in the Canberra central business district. Also, police narratives and GPS locations were examined in detail for older pedestrians who were seriously or fatally injured from being hit. Fifty-nine percent of the older pedestrians were hit while attempting to cross a busy road in an area with a high level of pedestrian activity. Half of these older pedestrians were crossing without any protection or pedestrian-prioritised infrastructure, such as zebra crossings or pedestrian signals, at the location or anywhere in the near vicinity. These seriously and fatally injured older pedestrians highlighted that more pedestrian-protected crossings should be provided for pedestrians to use in the metropolitan and suburban areas of the ACT. Improvements in pedestrian safety can also be achieved through speed management (with speed limits in inner-metropolitan areas reduced to a survivable speed of 30 km/h) and associated enforcement, and improvements in the pedestrian protection afforded by the design of new vehicles. Pedestrian protection and a prioritising of the needs of pedestrians needs to be a fundamental component of the way that metropolitan and suburban spaces are designed and is vital to achieve a safe road system in the ACT.

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1. Introduction

Pedestrians are vulnerable road users. Walking exposes them to the possibility of being hit by a motor vehicle and they do not have the protection from injury that vehicles afford occupants in a crash. Research by Baldock, Thompson, Dutschke, Kloeden, Lindsay, and Woolley (2016) has found that pedestrians have the highest rates of fatalities from crashes compared to all other road users (e.g., car, bus, bicycle, motorcycle). A study by Elvik (2009) has also demonstrated that the risk of an injury when walking is about four times higher compared to when driving a car. Additionally, the proportion of the total road deaths that pedestrian deaths account for increased in Australia from 13% to 15% between 2010 and 2016, and similar increases have been noted in other western countries (World Health Organisation, 2015, 2018). Globally, pedestrian fatalities have increased by 12.9% between 2013 and 2016 compared to a 6.6% increase for other road users (Job, 2020; World Health Organisation, 2015, 2018). As a result, it has been suggested that the road transport system is failing pedestrians (Job, 2020).

Older pedestrians, however, are particularly vulnerable. It has been shown that pedestrians aged 65 and over are more than twice as likely to be killed when hit by a motor vehicle as those aged 16 to 64 (Martin, Hand, Trace, & O'Neill, 2010). Research in Australia by Baldock et al. (2016) found that the proportion of pedestrians who died from a crash was almost three times higher for those aged 75 and over compared to pedestrians aged under 60 (9% vs 3.2%). Also, Oxley (2009) demonstrated that pedestrians aged 70 years and older had the highest rate of deaths per 100,000 population compared to all other age groups. Other research by Langford and Koppel (2006) and the OECD (2001) has shown that older adults have a higher risk of being killed as pedestrians than as car drivers on a per trip basis. The increased risk of fatal injuries for older pedestrians is likely to be partly due to their fragility (Oxley, 2009; Uddin & Ahmed, 2018). The tolerance to injury of older adults is lower than that of younger adults (Evans, 2001, 1988; Viano, King, Melvin, & Weber, 1989)

It is not only the increased risk of fatal injury that they face, however, that makes older pedestrians so vulnerable. They may also have a higher risk of being involved in collisions compared to younger pedestrians, and this may be due to declines in their health or cognitive and functional abilities. A pedestrian negotiating the road environment needs to use a complex level of cognitive and perceptual processing. For example, crossing the road requires the ability to integrate the speed and distance of approaching vehicles. It is also crucial that pedestrians have an adequate level of physical ability. Age-related deteriorations in health or cognitive and functional abilities can make it considerably more difficult to negotiate the road environment safely as a pedestrian (Dommes & Cavallo, 2011; OECD, 2001; Oxley, Ihsen, Fildes, Charlton, & Day, 2005; Tournier, Dommes, & Cavallo, 2016). While normal ageing leads to some reduction in physical and cognitive functioning, some older adults have significant declines in these areas.

A number of studies (Carthy, Packham, Salter, & Silcock, 1995; Choi, Tay, Kim, & Jeong, 2019; Dommes, 2019; Dommes, Cavallo, Vienne, & Aillerie, 2012; Dommes, Cavallo, & Oxley, 2013; Lobjois & Cavallo, 2007, 2009; Oxley, 2000; Oxley, Fildes, Ihsen, Charlton, & Day, 1997, 1999; Oxley et al., 2005) have identified that older pedestrians experience the following difficulties when they cross the road:

- crossing in busy or fast-moving traffic;
- crossing at confusing intersections;
- crossing wide roads with numerous lanes;

- detecting an oncoming vehicle or correctly judging its speed; and
- selecting adequate gaps to accommodate their slower walking speed, particularly in complex two-direction traffic under time pressure.

Other studies (Amosun, Burgess, Groeneveldt, & Hodgson, 2007; Asher, Aresu, Falaschetti, & Mindell, 2012; Langlois, Keyl, Guralnik, Foley, Marottoli, & Wallace, 1997; Romero-Ortuno, Cogan, Cunningham, & Kenny, 2009) have highlighted that signalised pedestrian crossings have standard crossing times that are insufficient to accommodate the slower walking speed of older people. This indicates that the design and organisation of road systems may be partly responsible for the increased risk for older pedestrians.

In addition to being vulnerable road users, older pedestrians are also a growing road user group. Older adults are becoming increasingly healthier than those of previous generations and are undertaking more outside activities (BITRE, 2014; Burkhardt & McGavock, 1999; Hjorthol, Levin, & Siren, 2010; Hu, Jones, Reuscher, Schmoyer Jr., & Truett, 2000; Lyman, Ferguson, Braver, & Williams, 2002; OECD, 2001). Also, the baby boomer generation (born 1946 to 1964), which resulted from the increased birth rates after the end of the Second World War, has now moved into the older age bracket. It has been predicted that the proportion of people aged 65 years and older in the member countries of the Organisation for Economic Co-operation and Development (OECD) will double from 13% in the year 2000 to 25% in 2050 (OECD, 2001). Therefore, one in every four people in the developed world will be in this age range. In Australia, the number of people aged 65 years and older is expected to more than double between 2000 and 2031 (Booth & Tickle, 2003). This further emphasises the importance of, and need for, research which examines older pedestrian collisions with motor vehicles and attempts to find ways to improve their safety.

The present study involved a thorough exploration of the number of older pedestrians (65 years and over) hit by motor vehicles in the Australian Capital Territory, with comparisons made to the number of younger adult pedestrians (18 to 64 years) hit by motor vehicles. The characteristics of these collisions, information related to the locations where they occurred, and the injury outcomes for the pedestrians were also examined to understand the crashes, in the context of the ACT and its infrastructure. The capital city of Canberra is a planned city with an inner-city area that is inherently walkable, due to being a smaller city that is mostly flat. This makes walking in Canberra an attractive method of transportation. However, the road system and infrastructure that are available in Canberra for pedestrians to use may not be designed in a way that is optimal for their safety. As a result, it is beneficial to gain a greater understanding of the safety issues that face pedestrians in Canberra and the ACT, and particularly so for the most vulnerable pedestrians – those aged over 65. To undertake the present examinations, police-reported data for pedestrian versus motor vehicle crashes in the ACT between the years of 2011 and 2020 were analysed.

2. Method

2.1. Data

Police-reported data for all pedestrian versus motor vehicle crashes in the ACT for the most recent ten-year period available (2011 to 2020) were obtained from Road Safety and Transport Policy, Transport Canberra and City Services, ACT Government. The data included: details of the date and time of the crash, the location of the crash (suburb, road name(s), midblock/intersection, intersection type, GPS coordinates) of the crash, the traffic controls at the location (e.g., uncontrolled, traffic lights, marked pedestrian crossing, etc.), the weather (fine, light rain, heavy rain, cloudy/overcast/fog) and lighting (daylight, dark, semi-darkness) conditions at the time of the crash, the units involved (e.g., car, bus, truck, motorcycle, pedestrian, etc.), the directions (north, south, east, or west) and movement (e.g., continuing straight, turning left, backing out, crossing road, walking on footpath, etc.) of the units involved, details of the vehicle occupants or pedestrians involved (age, gender), a brief narrative/description of the crash, and the severity of any resulting injuries (no injury, received medical treatment, admitted to hospital, and fatality) to vehicle occupants or pedestrians.

Population data by age for the ACT were obtained from the Australian Bureau of Statistics (ABS) for 2011 to 2020. The total annual population by age was calculated from these data. This was then used to calculate the rates of pedestrians hit by motor vehicles per 10,000 head of population for each year of investigation.

2.2. Procedure

The data used for this study only included crashes in which a pedestrian was hit by a road-based motor vehicle. Pedestrian falls and collisions with bicycles, mobility scooters, wheelchairs, skateboards, trains, or trams were excluded. Injury severity was recorded as one of four levels: no injury, received medical treatment, admitted to hospital, and fatality. For the current investigation, a serious injury was defined as one requiring hospital admission.

To analyse the crash data in terms of the age group of the pedestrians involved, it was necessary to base the analysis on crash-involved pedestrians rather crashes. This means, however, that, for crashes involving several pedestrians, each pedestrian had a separate entry in the data. Consequently, a single crash that involved two pedestrians counted as two pedestrians in the data. Crashes involving several pedestrians were rare, however (15 of the 580 individual crashes in the sample (2.6%)).

The crash and population data were organised by age into two groups – 18 to 64 years and 65 years and older. Pedestrians were excluded from the analyses if their age was not recorded.

2.3. Analysis

The data were firstly examined in terms of the total number of pedestrians hit by motor vehicles in the ACT, as well as the rates of pedestrians hit per 10,000 population and the proportions of the pedestrians who were seriously or fatally injured, in each age group separately and for each year between 2011 and 2020. Next, the pedestrian sample was examined in terms of the male/female sex composition and the involvement of certain variables relating to the characteristics of the collisions they were involved in (day of week, time of day, speed limit, lighting conditions, and weather conditions, as well as the movement and position of the pedestrians at the time of the crash). Then the sample was examined in terms of information about the locations where they were hit (road segment, intersection type, and traffic control). Frequency counts and chi-square tests were used. For all chi-square analyses, an alpha level of 0.05 was used for statistical significance. The Global Positioning System locations where the pedestrians were hit were plotted on spatial maps of the ACT. The general purpose was to identify locations where they were commonly hit, particularly older pedestrians. Finally, the GPS locations and police narratives/descriptions were examined in detail for older pedestrians who were seriously or fatally injured to gain a greater understanding of where they were hit, what happened, the movement and positions of the pedestrians and vehicles, the roads and areas in which the collisions occurred (e.g., metropolitan, or suburban; nearby shops, restaurants, and schools; busy multi-lane or single lane roads; high or low pedestrian activity), and the pedestrian infrastructure that was available to the pedestrians (e.g., pedestrian traffic signals, centre of the road refuge, zebra crossing, etc.) in the near vicinity. The purpose was to determine whether the road design at the locations where the older pedestrians were hit and seriously or fatally injured was adequate for pedestrian safety and what improvements could be made to improve these locations.

3. Results

The data included a total of 595 pedestrians hit by motor vehicles over the ten years. The age of 497 (83.5%) was recorded, with 59 aged 65 years or older, 334 aged between 18 and 64 years and 104 aged under 18 years.

3.1. Overall crash involvement of pedestrians

The total numbers of pedestrians hit by motor vehicles in the ACT for each year from 2011 to 2020 are presented in Figure 3.1 for the two age groups separately (18 to 64 and 65 and over). The numbers were steady over the ten-year period for both age groups, although it should be noted that the numbers in each individual year were low for the older group (ranged from 1 to 8). The numbers were higher for the younger adult pedestrians in each year that was examined.

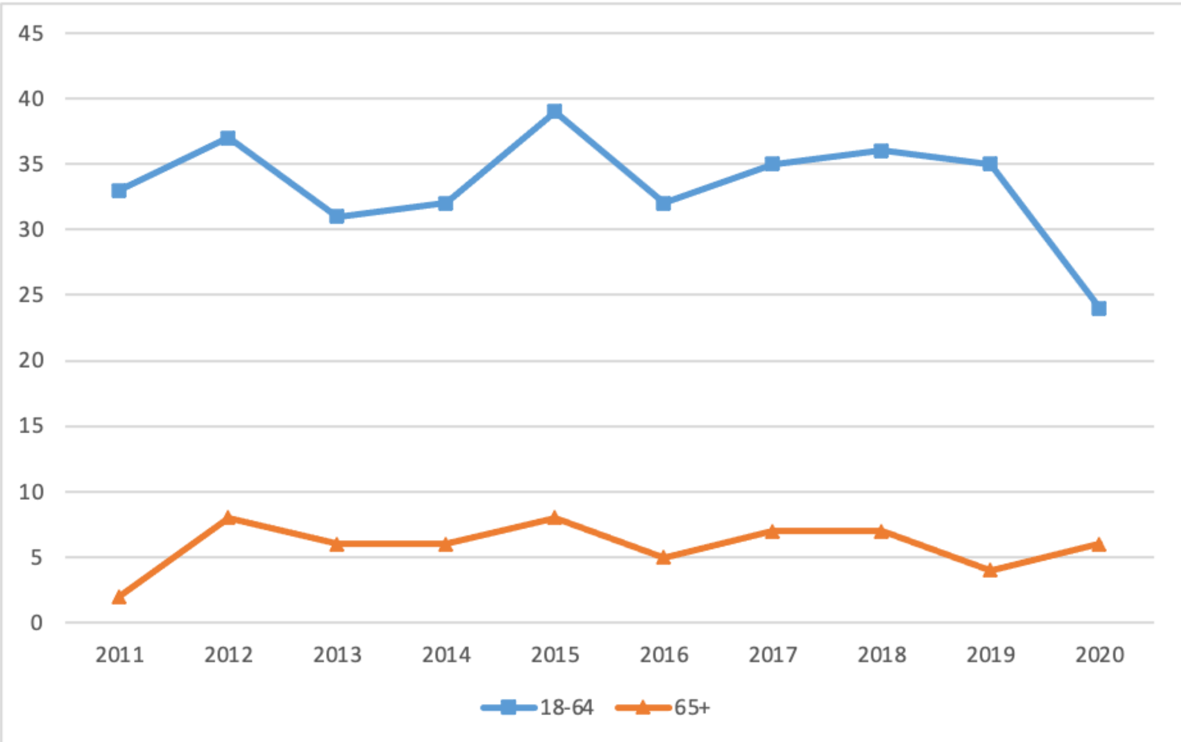

Figure 3.1
Pedestrians hit by motor vehicles in the ACT (2011 to 2020) by age group

Rates of pedestrians hit by motor vehicles per 10,000 population were calculated by age group for each year between 2011 and 2020 to account for differences between the groups in population. The rates (see Figure 3.2) remained relatively steady over the ten years and were similar overall for both age groups.

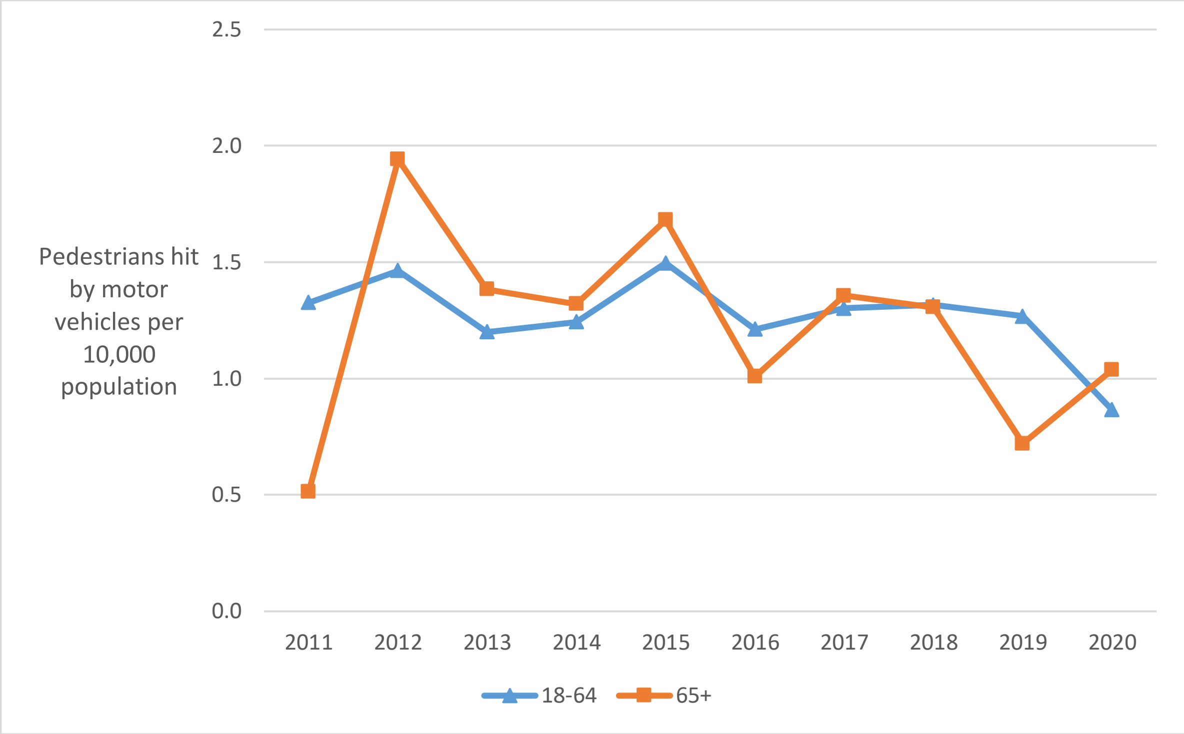

Figure 3.2
Pedestrians hit by motor vehicles per 10,000 population in the ACT (2011 to 2020) by age group

Proportions of the pedestrians who were seriously (classified as admitted to hospital) or fatally injured from being hit by vehicles were calculated for each year and are presented in Figure 3.3. There was considerable year to year variation in the data, particularly for the older group. Therefore, the proportions of the total pedestrians (across the ten years) from each age group who were seriously or fatally injured were examined instead. The overall proportion of older pedestrians (37.3%) was higher than that of younger adult pedestrians (26.9%), indicating that older pedestrians were more likely to be seriously or fatally injured.

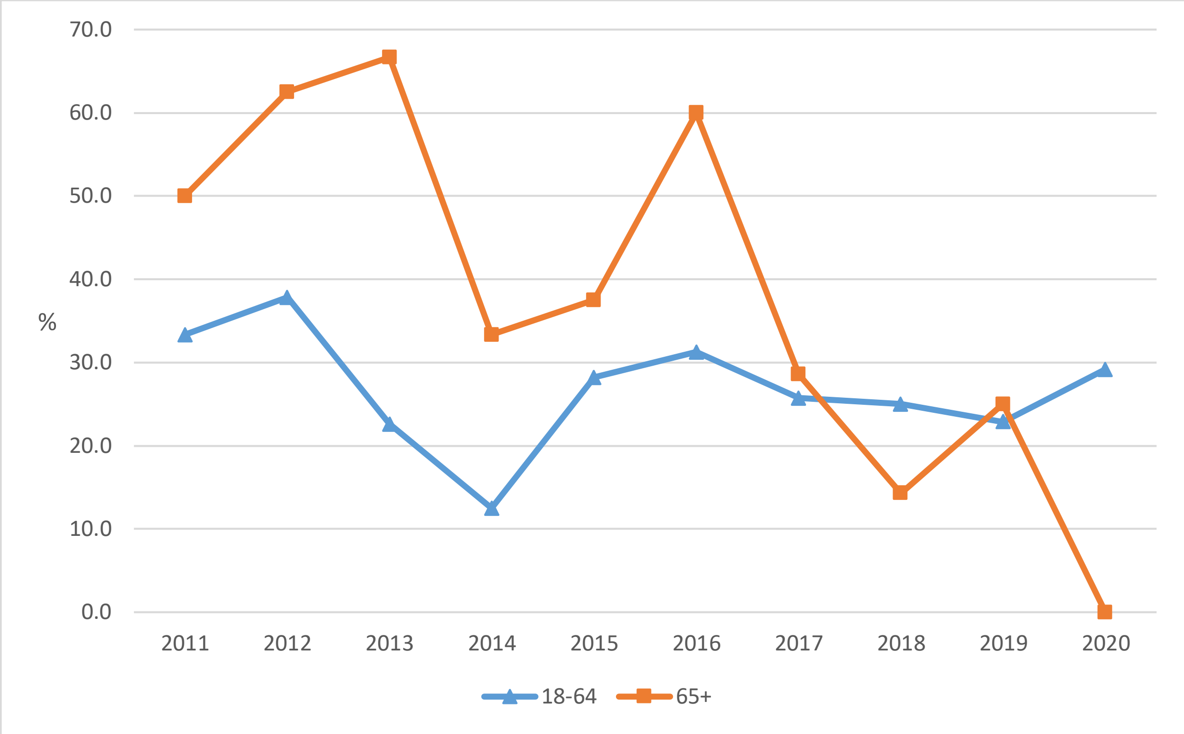

Figure 3.3
Proportions of pedestrians seriously or fatally injured in the ACT (2011 to 2020) by age group

3.2. Sex composition of the sample of pedestrians hit by vehicles

Of the 59 pedestrians aged 65 years or older who were hit by vehicles, 28 (47.5%) were female, 28 (47.5%) were male and sex was unknown for 3 (5.1%) pedestrians. Of the 334 who were under 65, 140 (41.9%) were female, 173 (51.8%) were male and sex was unknown for 21 (6.3%) pedestrians. The differences between the groups in the numbers of females and males were not statistically significant ($\chi^2(1) = 0.5$, $p = .466$). Therefore, the compositions of the two age groups were similar in terms of sex. For reference, the sex composition of the ACT population for these age groups between 2011 and 2020 was 50% females and 50% males for those aged 18 to 64, and 54% females and 46% males for those aged 65 or more.

3.3. Crash characteristics

This section compares older and younger adult pedestrians in terms of the characteristics of their collisions with vehicles. Table 3.1 summarises the results of Chi-square analyses comparing the two groups on several variables. Older pedestrians were statistically significantly more likely to be hit between the hours of 6 am and 6 pm than younger adult pedestrians (83.1 versus 65.3%), who were more likely to be hit between 6 pm and 6 am (34.7 versus 16.9%). This is also reflected in the results for the lighting conditions at the time the pedestrians were hit. Older pedestrians were statistically significantly more likely to be hit in daylight (81.4 versus 65.6%) than younger adult pedestrians, who were more likely to be hit in darkness (31.7 versus 13.6%). There were no statistically significant differences between the groups in terms of the day of the week in which they were hit or the weather conditions at the time.

Table 3.1
Older and younger adult pedestrians compared in terms of the characteristics of their crashes with vehicles

Variable	**65 and over**	**18 to 64**
Day of the week		
Sunday	10 (16.9%)	28 (8.4%)
Monday	9 (15.3%)	39 (11.7%)
Tuesday	6 (10.2%)	53 (15.9%)
Wednesday	10 (16.9%)	47 (14.1%)
Thursday	9 (15.3%)	58 (17.4%)
Friday	13 (22.0%)	58 (17.4%)
Saturday	2 (3.4%)	51 (15.3%)
Chi-square test		$\chi^2(6) = 11.7$, $p = .069$
Time of the day		
00:00 to 05:59	0 (0.0%)	26 (7.8%)
06:00 to 11:59	16 (27.1%)	83 (24.9%)
12:00 to 17:59	33 (55.9%)	135 (40.4%)
18:00 to 23:59	10 (16.9%)	90 (26.9%)
Chi-square test		$\chi^2(3) = 9.5$, $p = .023$*
Lighting conditions		
Daylight	48 (81.4%)	219 (65.6%)
Semi-darkness	3 (5.1%)	9 (2.7%)
Dark	8 (13.6%)	106 (31.7%)
Chi-square test		$\chi^2(2) = 8.5$, $p = .014$*
Weather conditions		
Fine	51 (86.4%)	300 (89.8%)
Light rain	6 (10.2%)	13 (3.9%)
Heavy rain	1 (1.7%)	12 (3.6%)
Cloudy/overcast/fog	1 (1.7%)	9 (2.7%)
Chi-square test		$\chi^2(3) = 4.9$, $p = .180$

* $p < .05$

The older and younger pedestrians were also compared in terms of their movement and position at the time they were hit. This information was drawn from the Road User Movement (RUM) code that was assigned to the crash by the attending police officer. Table 3.2 displays the pedestrians for each age group by the RUM code that was assigned to their crash. The differences between the groups in terms of their movement and position at the time they were hit were statistically significant. Older pedestrians were more likely than younger pedestrians to be hit while they were walking on the footpath (20.3 versus 8.1%), or to be hit while they were boarding or alighting from a vehicle, or by a runaway vehicle (6.8 versus 2.7%). In comparison, younger adult pedestrians were more likely than older pedestrians to have been hit when they had entered the road from the near side to the vehicle (31.4 versus 23.7%). Overall, the most common situation for both groups of pedestrians was that they had either just stepped onto the road or were already on the road when they were hit by a motor vehicle (84.5%), while those walking on the footpath when hit accounted for a small proportion (9.9%).

Table 3.2
Information about the movement and position of older and younger adult pedestrians at the time they were hit by vehicles

Road User Movement Group	65 and over	18 to 64
Pedestrian entered road from near side to the vehicle	14 (23.7%)	105 (31.4%)
Pedestrian emerged from behind parked vehicle on near side to vehicle	4 (6.8%)	21 (6.3%)
Pedestrian entered road from far side to the vehicle	13 (22.0%)	85 (25.4%)
Pedestrian walking, playing, working, lying, or standing on road	12 (20.3%)	78 (23.4%)
Pedestrian walking on footpath	12 (20.3%)	27 (8.1%)
Pedestrian struck while boarding or alighting, or by a run-away parked vehicle	4 (6.8%)	9 (2.7%)
Other	0 (0.0%)	9 (2.7%)
Chi-square test	$\chi^2(6) = 13.1$, p = .041*	

* p < .05

3.4. Locations where pedestrians were hit by motor vehicles

The section examines information relating to the locations where older and younger adult pedestrians were hit by motor vehicles. The results of Chi-square analyses comparing both groups are presented in Table 3.3. The differences between the groups in terms of road segment and intersection type were not statistically significant. Two-thirds of pedestrians from both age groups were hit at midblock locations, while the pedestrians in both groups were evenly divided between those who were hit at T-intersections and those who were hit at cross-intersections. The two pedestrian groups did statistically significantly differ, however, in terms of the type of traffic control present at the location where they were hit. Older pedestrians were more likely to be hit by a motor vehicle at uncontrolled locations compared to younger adult pedestrians (79.7 versus 59.9%), although uncontrolled locations were most common for both groups (62.8%). Younger adult pedestrians were more likely to be hit at traffic lights (16.8 versus 10.2%) and marked pedestrian crossings (12.9 versus 3.4%).

Table 3.3
Information about the locations where older and younger adult pedestrians were hit by vehicles

Variable	65 and over	18 to 64
Road segment		
Midblock	40 (67.8%)	215 (64.4%)
Intersection	19 (32.2%)	119 (35.6%)
Chi-square test		$\chi^2(1) = 0.3$, $p = .611$
Intersection type		
T-intersection	11 (57.9%)	55 (46.2%)
Cross intersection	8 (42.1%)	58 (48.7%)
Roundabout	0 (0.0%)	6 (5.0%)
Chi-square test		$\chi^2(2) = 1.6$, $p = .455$
Traffic control		
Uncontrolled	47 (79.7%)	200 (59.9%)
Traffic lights	6 (10.2%)	56 (16.8%)
Marked pedestrian crossing	2 (3.4%)	43 (12.9%)
Other	4 (6.8%)	35 (10.5%)
Chi-square test		$\chi^2(3) = 9.1$, $p = .028$*

* $p < .05$

3.5. Geospatial maps of where pedestrians were hit by motor vehicles

Figure 3.4 is a map of the ACT that shows the locations where all the pedestrians from both age groups were hit. Orange dots represent locations where older pedestrians were hit and either not injured or received medical treatment, and red dots represent locations where older pedestrians were hit and either seriously (admitted to hospital) or fatally injured. Locations where younger adult pedestrians were hit (all levels of severity) are represented by blue dots. Overall, the locations (for both age groups) were evenly spread across the metropolitan and suburban areas of the ACT, although several clusters of crashes are apparent. There was a cluster around the Belconnen and Macquarie districts, particularly around the Westfield Belconnen Shopping Centre. There was a cluster around the Gungahlin shopping district. There were also clusters around the Dickson shopping district; North Canberra; the city and the surrounding central business district; Kingston and the Manuka Oval; and Phillip and the Westfield Woden Shopping Centre. These clusters were likely due to the high level of pedestrian activity in these commercial and business areas.

Almost all pedestrians were hit in metropolitan or suburban areas of the ACT. There were eight pedestrians who were hit outside of these areas, however. One pedestrian was hit on the federal highway near the state border, one was hit on the Kings Highway near Sparrow Hill, one was hit on the Monaro Highway near the intersection with Isabella Drive, one was hit on Cotter Road near the intersection with the Tuggeranong Parkway, one was hit on the Tuggeranong Parkway near the National Zoo and Aquarium, one was hit on Caswell Drive near Black Mountain, one was hit at the intersection of Gungahlin Drive and Sandford Street near Mitchell, and one was hit on Barry Drive near the Inner North Dog Park. All eight pedestrians who were hit outside of metropolitan and suburban areas were younger adults (blue dots).

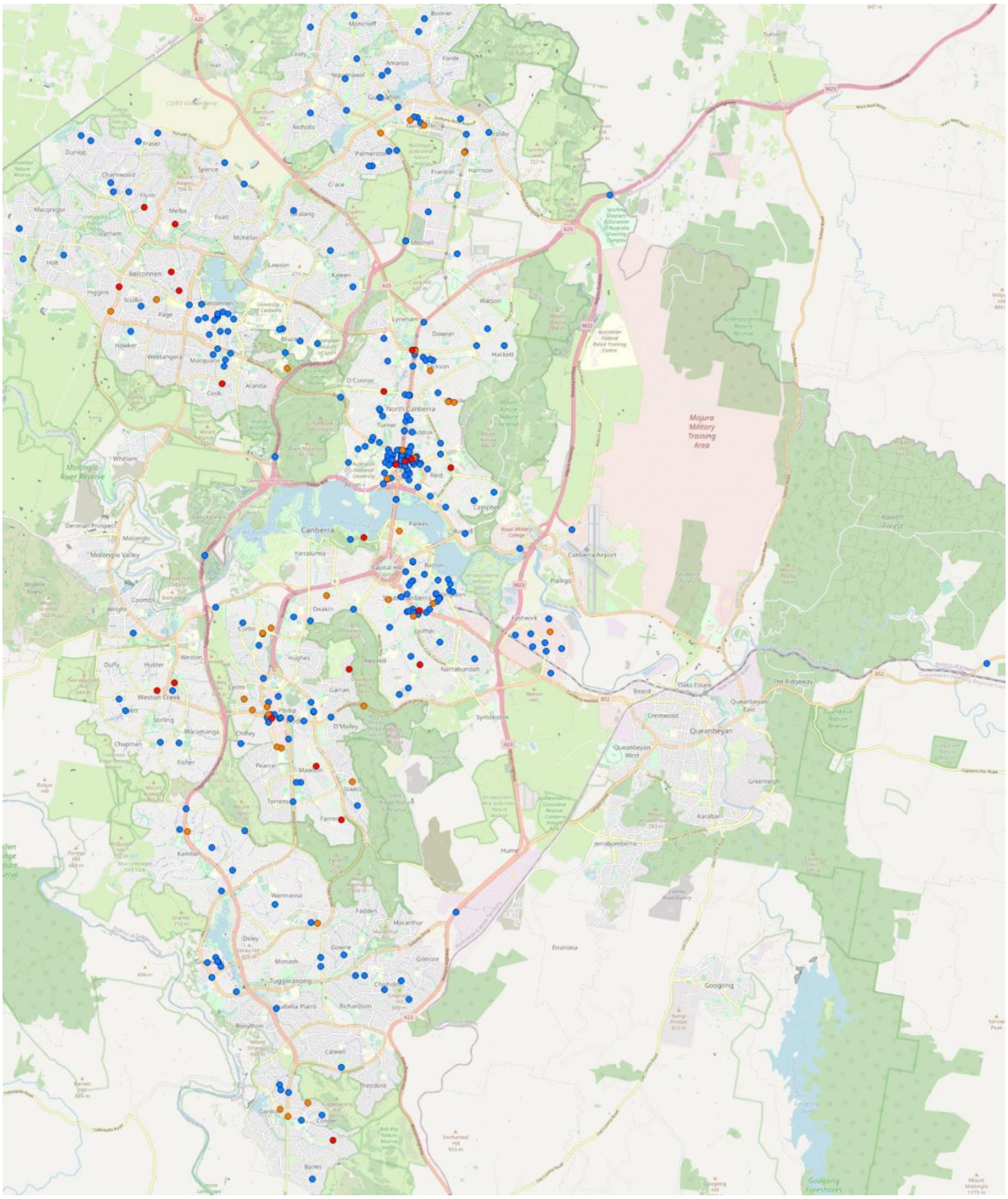

Figure 3.4
ACT locations where older (orange dots for non-injury or medically treated, red dots for seriously or fatally injured) and younger adult pedestrians (blue dots for all severity levels) were hit by vehicles

Figure 3.5 shows a closer view of the Canberra central business district and the locations where pedestrians were hit in Dickson, North Canberra, Canberra city, South Canberra, and Kingston. In Dickson, the locations clustered around the shopping district and the intersection of Northbourne Avenue and Antill Street. This is a busy, crossroad intersection but it does have dedicated pedestrian crossings that are signalised. In the Canberra CBD, the locations clustered around Barry Drive, Cooyong Street, Northbourne Avenue, Bunda Street, Scotts Crossing, Alinga Street, Mort Street, and East Row. These are all busy inner-metropolitan roads with high volumes of both vehicle traffic and pedestrian activity. Several pedestrians were also hit around Childers Street and the East side of London Circuit. In South Canberra, the locations clustered around Canberra Avenue in the vicinity of Manuka Oval and the Manuka Shopping Precinct.

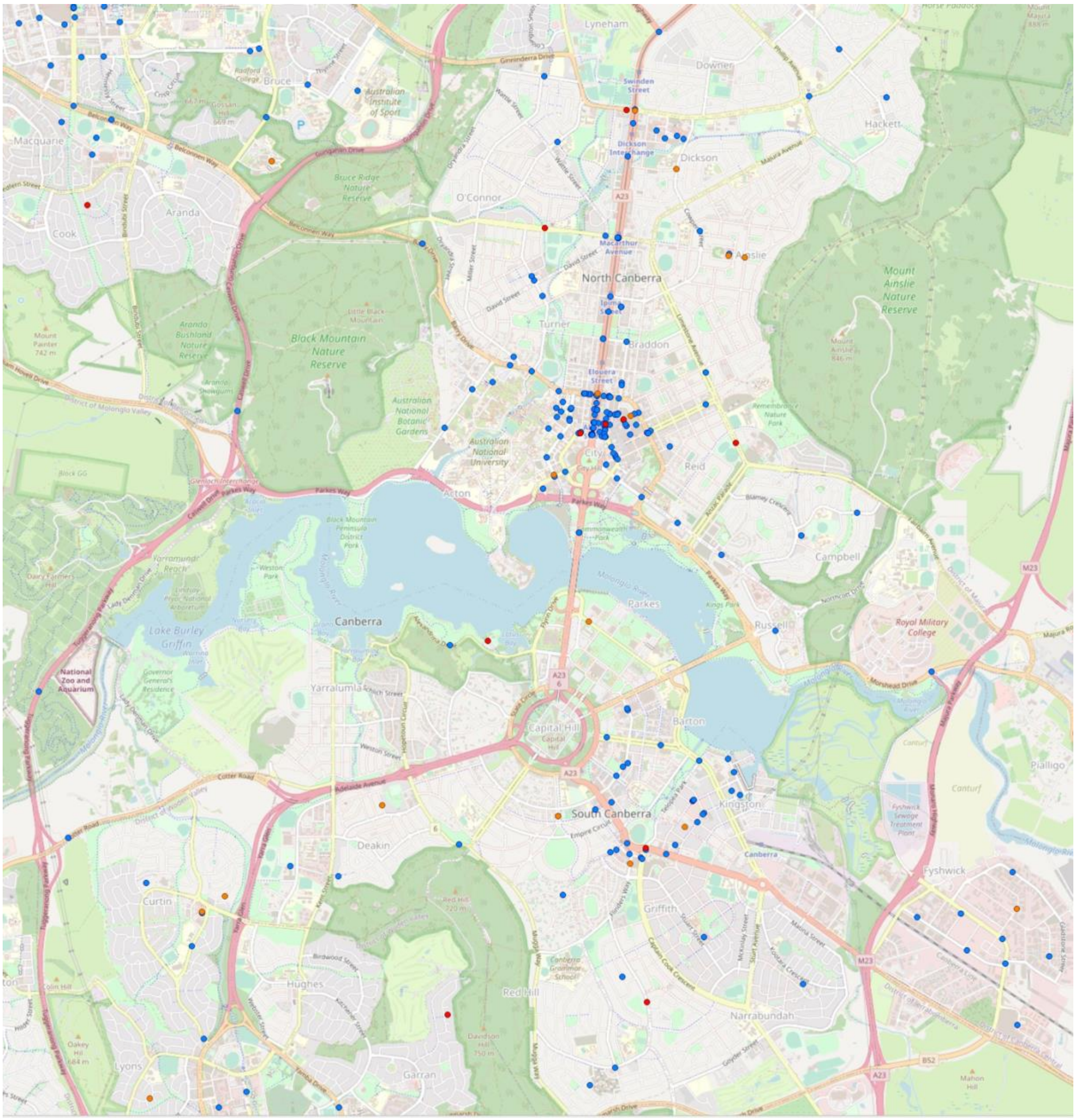

Figure 3.5
Canberra locations where older (orange dots for non-injury or medically treated, red dots for seriously or fatally injured) and younger adult pedestrians (blue dots for all severity levels) were hit by vehicles

Figure 3.6 displays a wider view of the ACT again, but only shows where older pedestrians were hit (orange for non-injury and medical treatment, red for serious or fatal injury). Like Figure 3.4, the most common areas were Belconnen, the Canberra CBD, South Canberra, and Phillip.

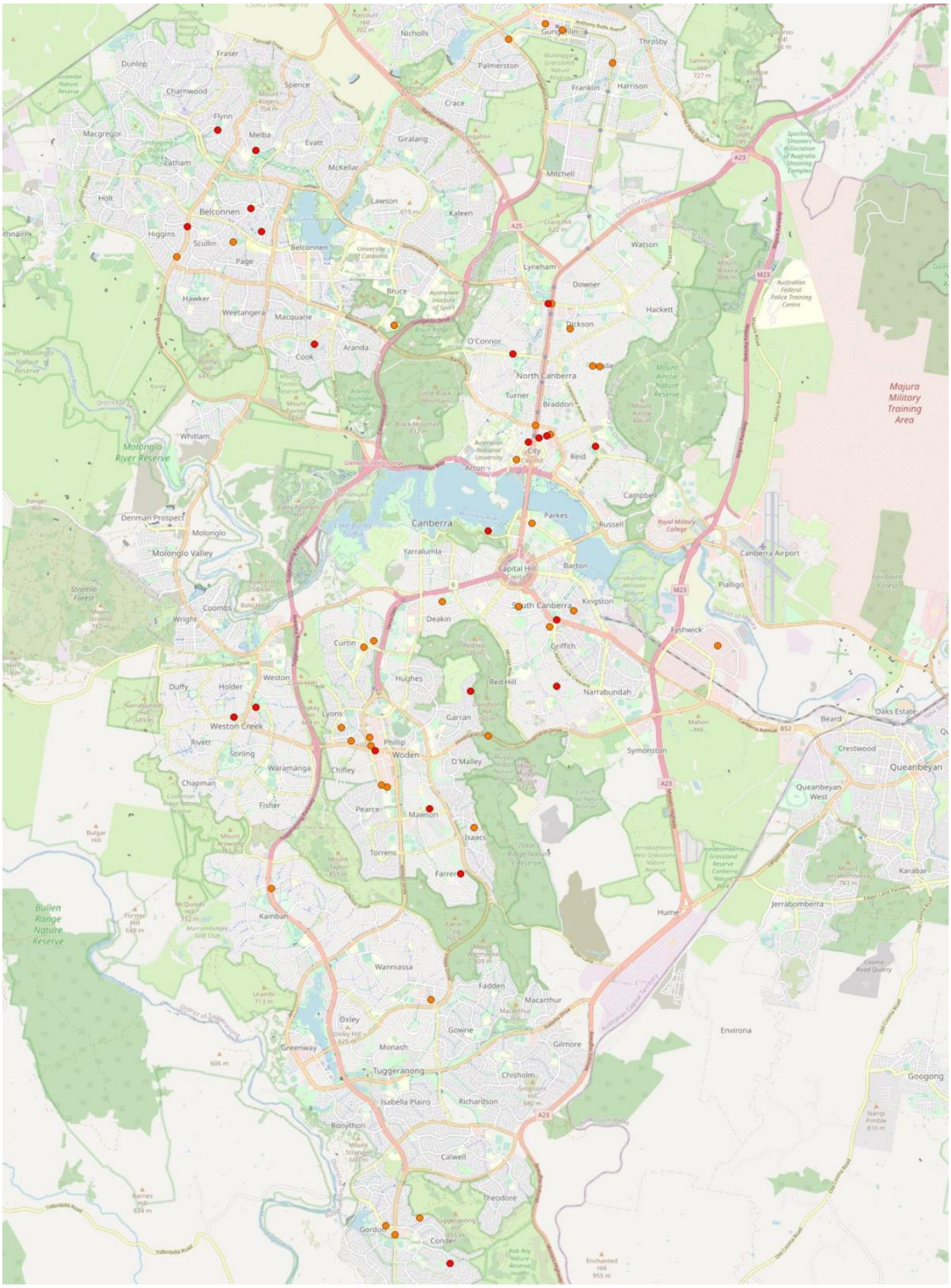

Figure 3.6
ACT locations where older pedestrians (orange dots for non-injury or medically treated, red dots for seriously or fatally injured) were hit by vehicles

Figure 3.7 shows where older pedestrians were hit and seriously or fatally injured (22 crashes). The police description (narrative) of each of these crashes was read by the authors to obtain as much information as possible about them. GPS locations of those that involved the older pedestrian attempting to cross the road were additionally viewed by the authors on Google Maps Street View to identify exactly where the crash occurred, the type of road the pedestrian was crossing, and the pedestrian infrastructure (e.g., signalised pedestrian crossing, pedestrian prioritised/zebra crossing) that was available to them in the near vicinity. The outcomes of these investigations are summarised in Section 3.6.

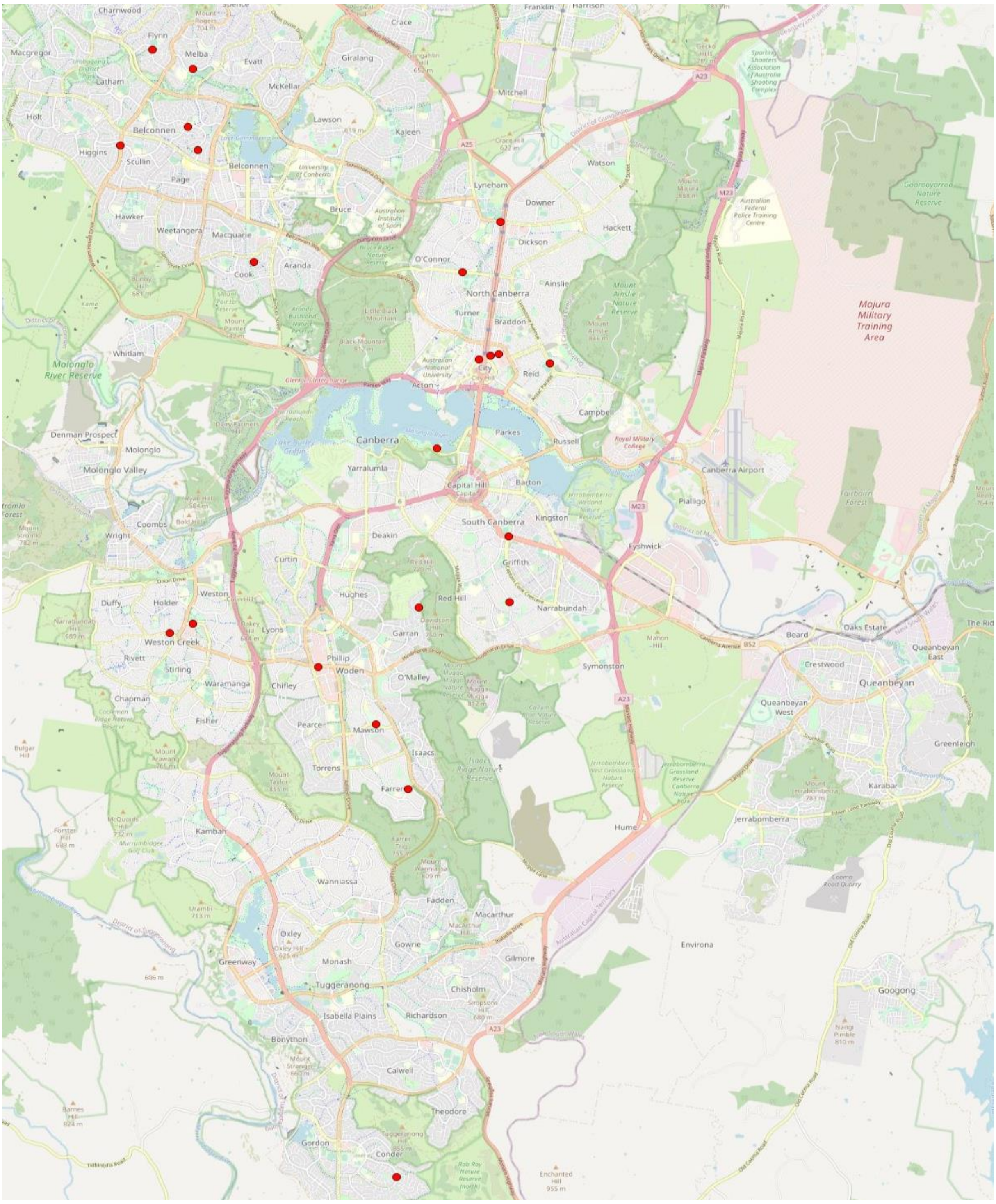

Figure 3.7
ACT locations where older pedestrians were hit by vehicles and seriously or fatally injured

3.6. Further examination of serious and fatal older pedestrian crashes

3.6.1. Canberra CBD crashes

Eight older pedestrians were hit and seriously or fatally injured in the general city area of Canberra. Seven were attempting to cross busy roads (the other involved a passenger in a vehicle who fell out and then was hit by the vehicle in a quiet car park). These roads likely all had a high level of pedestrian activity on and around the road due to nearby shops, restaurants, outdoor cafes, car parks, and schools. Many of these roads and the areas around them are spaces in which pedestrian activity would be encouraged for the success of the local commercial areas but were not designed in an optimal way for the safety of the pedestrians. Five pedestrians were crossing without any protection or pedestrian-prioritised infrastructure, such as zebra crossings or pedestrian signals, apart from a narrow pedestrian refuge median in the centre of the road at one location. They were crossing without protection because there was none available to them where they were crossing or nearby.

The issue of inner-metropolitan spaces that have a high level of pedestrian activity but are not designed in a way that prioritises the movement, needs, and safety of pedestrians (as opposed to prioritising vehicles) is demonstrated when a couple of the crashes are examined in detail. Figure 3.8 is a Google Maps screen shot of a location where an older pedestrian was hit by a vehicle and admitted to hospital as a result. It is the T-intersection of London Circuit and West Row, in the central business district of Canberra near hotels, restaurants and shops. The pedestrian was attempting to cross London Circuit (a busy road with three lanes in each direction) from north to south (heading towards the camera). Behind the camera (out of view of the screen shot) is a large car park and many pedestrians would cross at this location to access the car park. There is a zebra crossing across the neck of the T-intersection (to cross West Row) but there is no pedestrian-prioritised protection or infrastructure at this location, or in the near vicinity, for pedestrians to use to cross London Circuit. It can be seen in Figure 3.8 that there is a narrow pedestrian refuge built into the median but it has no protection (e.g., concrete bollards). Interestingly, written on the road at the refuge is the word “look” accompanied by an arrow, which instructs pedestrians to look in the appropriate direction for cars. The pedestrian in this case thought the road was clear, started crossing and could not understand how the driver of the vehicle did not see them. This location would benefit from redevelopment with the needs and safety of pedestrians as the priority. One option is to have a signalised intersection to provide pedestrian signals. If there is a wish to avoid having a signalised intersection here, another option is to provide a raised zebra crossing further east on London Circuit, so that it is not too close to West Row.

Figure 3.8
Location of a serious older pedestrian collision with a motor vehicle at the T-intersection of London Circuit and West Row.
Pedestrian was crossing London Circuit towards the camera through the narrow pedestrian refuge

Figure 3.9 is a screen shot of another Canberra CBD location where an older pedestrian was hit and admitted to hospital. It is the intersection of Bunda Street, Scotts Crossing and Garema Place, which has been designed as a shared zone for pedestrians and vehicles with a twenty kilometre per hour speed limit and related signage. The pedestrian was crossing Bunda Street (it is not clear which direction they were walking) and the vehicle that hit them was on Scotts Crossing (facing the same direction as the camera) turning right onto Bunda Street. There are restaurants, shops and outdoor cafes in this area and Garema place is a pedestrian only space, which means that many pedestrians would cross Bunda Street at this location. The driver stated that at no time did they see the pedestrian crossing the road and only became aware when the vehicle struck them. There is no pedestrian-prioritised protection or infrastructure at this location or in the near vicinity for pedestrians to use to cross Bunda Street. Interestingly, the driver estimated that the vehicle was only travelling around five to seven kilometres per hour when it struck the pedestrian. This demonstrates that even very slow vehicle speeds can cause serious injury to older pedestrians (in this case the pedestrian fell and hit their head on the road).

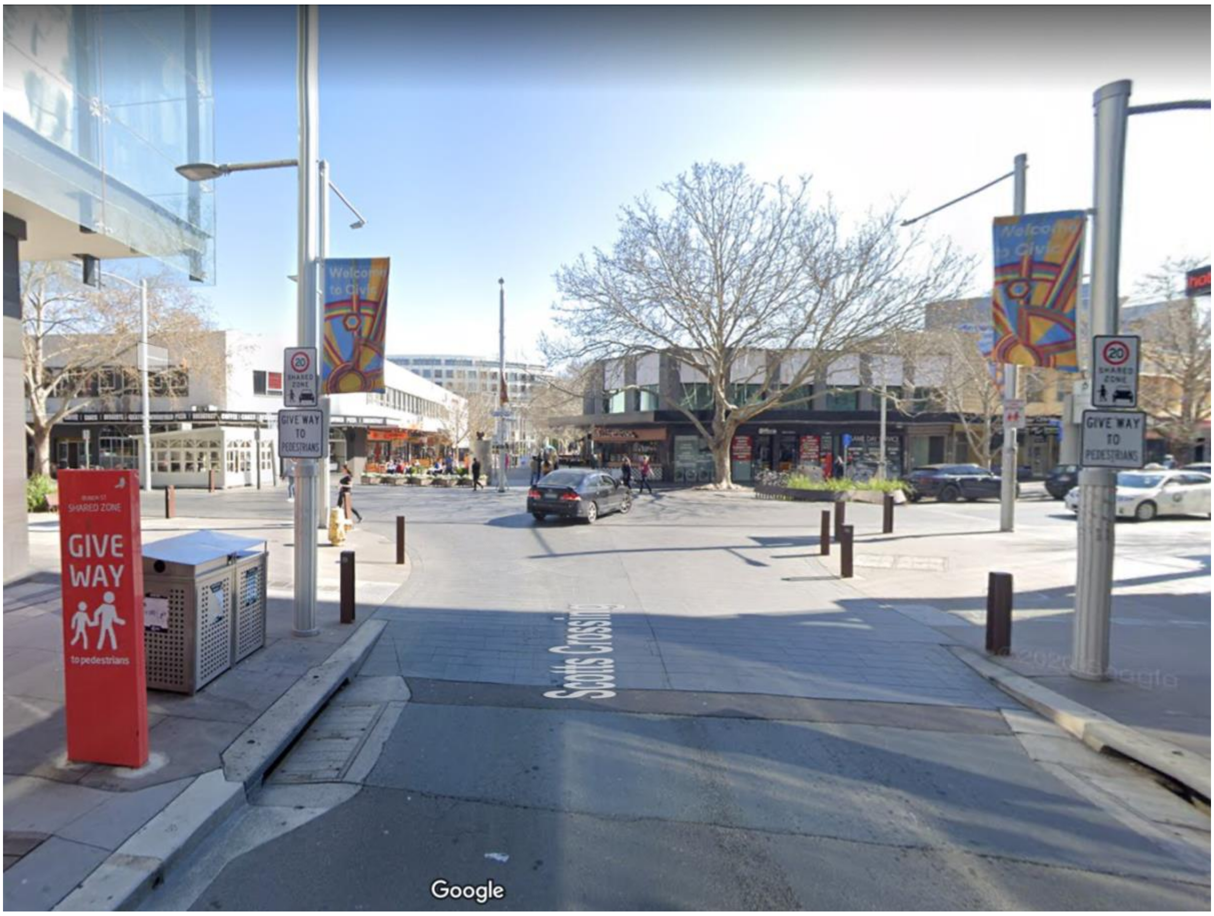

Figure 3.9
Location of a serious older pedestrian collision with a motor vehicle at the intersection of Bunda Street, Scotts Crossing and Garema Place. Pedestrian was crossing Bunda Street and vehicle was turning right out of Scotts Crossing

In another Canberra CBD crash, an older pedestrian was fatally injured when struck by a bus. The pedestrian was waiting at the signalised intersection of Manuka Circuit and Canberra Avenue to cross the east bound lanes of Canberra Avenue walking in a southerly direction. The bus had travelled south on Manuka Circuit and was intending to turn left at the traffic lights to travel east on Canberra Avenue. The screen shot in Figure 3.10 shows the intersection from the perspective of both the pedestrian and the bus. The traffic light and pedestrian signal turned green, and the pedestrian started walking. The bus had to give way to the pedestrian but was focussed on a bicyclist coming from the opposite direction and did not see the pedestrian. The bus turned left and hit the pedestrian. This demonstrates that pedestrian collisions can occur even when the pedestrian is using a signalised crossing if the crossing is not appropriately designed with the safety of the pedestrian in mind. The screen shot demonstrates that there are no left turning arrows for traffic from the direction of the bus. This collision may have been avoided if there had been a red arrow that required the bus to continue to wait while the pedestrian started walking.

Figure 3.10
Location of a fatal older pedestrian collision with a bus at the intersection of Manuka Circuit and Canberra Avenue. Pedestrian was walking straight ahead at the lights and the bus was turning left at the lights

3.6.2. Suburban ACT crashes

Fourteen older pedestrians were hit by vehicles and seriously or fatally injured in suburban areas of the ACT. Six were crossing the road (another two were likely crossing the road but it was not clear) and there was no pedestrian-prioritised protection or infrastructure at the location or anywhere in the near vicinity for pedestrians to use (apart from a centre median at three locations). Four pedestrians were crossing busy suburban roads (i.e., near primary schools, shops, and community areas), where crossing infrastructure should have been provided. Also of interest, in another crash the pedestrian was on the footpath and was hit by a car reversing out of a driveway, and in another the pedestrian was standing on the verge and was clipped by the side of a car. Two pedestrians were hit by runaway, unoccupied vehicles, with one pedestrian having alighted from the driver seat of their own car before it began moving and hit them.

It is useful to examine two of the suburban serious older pedestrian crashes in more detail as they demonstrate how the provision of a pedestrian crossing could have prevented the collision. Figure 3.11 shows the T-intersection of Namatjira Drive and Macnally Street in Weston. An older pedestrian was crossing Macnally Street (neck of the T-intersection) east towards the MacDonalds restaurant about 5 metres south of the Give Way line and was hit by a vehicle turning left off Namatjira Drive and fatally injured. Many pedestrians would cross at this location to access the MacDonalds restaurant. This location would benefit from either the intersection being signalised with pedestrian lights or a raised zebra crossing further south on Macnally Street.

Figure 3.11
Location of a fatal older pedestrian collision at the intersection of Namatjira Drive and Macnally Street, Weston. Pedestrian was crossing Macnally Street to the MacDonalds, and the vehicle turned left off Namatjira Drive onto Macnally Street

Similarly, an older pedestrian was admitted to hospital after they were hit by a vehicle at the intersection of Ratcliffe Crescent and Krefft Street in Florey (Figure 3.12). The pedestrian was crossing Krefft Street (the neck of the T-intersection), but it is not clear in which direction they were walking. The vehicle had turned right off Ratcliffe Crescent onto Krefft Street to travel north. Many children and parents/caregivers would cross Krefft Street at this location to access the Primary School on the corner, and their safety would be improved by either the intersection being signalised with pedestrian lights or raised zebra crossings further north on Krefft Street and further east on Ratcliffe Crescent.

Figure 3.12
Location of a serious older pedestrian collision at the intersection of Ratcliffe Crescent and Krefft Street, Florey. Pedestrian was crossing Krefft Street (neck of T-intersection), and the vehicle turned right off Ratcliffe Crescent onto Krefft Street

4. Discussion

This report examined the number of older pedestrians (65 years and over) hit by motor vehicles in the Australian Capital Territory, with comparisons made to the number of younger adult pedestrians (18 to 64 years) hit by motor vehicles. The characteristics of these collisions, information related to the locations where they occurred, and the pedestrian injury outcomes were also examined. The key findings are discussed in the following sections.

4.1. Overall crash involvement of older pedestrians in the ACT

Fewer older pedestrians were hit by motor vehicles in the ACT between 2011 and 2020 than younger adult pedestrians. However, the two groups were similar in their rates of being hit per 10,000 population over this period. Also, there was evidence to suggest that older pedestrians had a higher overall rate of serious or fatal injury, despite considerable variation in their year-to-year rates due to low numbers of serious or fatally injured older pedestrians in individual years.

Other studies (Oxley, 2009; Martin et al., 2010; Baldock et al., 2016) have also shown that older pedestrians have an increased risk of serious or fatal injury. This is most likely related to fragility, as their tolerance to injury is lower (Evans, 2001, 1988; Viano, King, Melvin, & Weber, 1989). The similar rates between the two groups in terms of being hit per 10,000 population does not support the hypothesis that older pedestrians have an increased risk of crash involvement due to health, cognitive and functional decline. However, the health and cognitive and functional ability of the sample of crash-involved older pedestrians in this study could not assessed, as this information was not available in the data. Further research is required.

4.2. Characteristics of older pedestrian crashes in the ACT

Older pedestrians were more likely to be walking during daylight hours (with optimal pedestrian visibility conditions) when hit by a motor vehicle. This would likely reflect the times at which pedestrians of different ages choose to walk. This corresponds with a study in Melbourne, Australia, by Pour, Moridpour, Tay and Rajabifard (2018), which found that pedestrians aged over 65 were more likely to be hit by vehicles during daytime off-peak traffic periods (10 am to 3 pm).

The collisions between older pedestrians and motor vehicles were also more likely to be ‘accidental’ in nature; they were more likely to be hit while boarding or alighting from a vehicle, be hit by a runaway vehicle, or be hit while walking on the footpath (due to vehicles leaving driveways or departing the road and mounting the footpath) than younger adult pedestrians. This could relate to their reduced mobility, and therefore their ability to avoid reversing or runaway vehicles, or safely board or alight a vehicle. It could also be due to the ability of their, often elderly, acquaintances to safely manoeuvre their vehicle, for example due to unintended acceleration events from pedal misapplication (Freund, Colgrove, Petrakos, & McLeod, 2008; Sharpe, Brinkerhoff, Crump, & Young, 2017) or physical difficulties such as turning their head to adequately see behind them (Herriots, 2005). Hitting something while reversing is a common driving error made by older drivers (Assailly, Bonin-Guillaume, Mohr, Parola, Grandjean, & Frances, 2006; Sullivan, Smith, Horswill, & Lurie-Beck, 2011). However, the most common situation for both age groups of pedestrians was that they had either just stepped onto the road or were already on the road when they were hit by a motor vehicle (85%).

4.3. Locations where older pedestrians were hit by vehicles in the ACT

Two-thirds of the pedestrians from both age groups were hit at midblock locations, while a third were hit at intersections. Also, older pedestrians were more likely to be hit where traffic was uncontrolled, while younger adult pedestrians were more likely to be hit at traffic lights and marked pedestrian crossings. Given their increased vulnerability to injury and potentially slower walking speed, older pedestrians would benefit the most by using controlled road crossings. However, it could also be the case that they do often use pedestrian controls when crossing the road, but that those who were hit were more likely to not be using them, or it could be the case that when they do not use protected crossings, their reduced mobility and slower walking speed makes a collision more likely. Research on pedestrian exposure would be needed to examine this. However, a lack of traffic control was most common overall for both pedestrian age groups (63%). This, in combination with the finding that the majority were crossing at midblock locations when they were hit, suggests that pedestrians of all ages often choose locations that are less safe to cross the road.

Almost all (98%) of the pedestrians from both age groups were hit in metropolitan or suburban areas of the ACT, which is logical as this is where most pedestrian activity occurs. Similarly, research on pedestrian-vehicle crashes in New Zealand by Hirsch, Mackie and McAuley (2021) found that 80% occurred in urban environments. Overall, this report demonstrated that the locations where the pedestrians were hit were evenly spread across the metropolitan and suburban areas of the ACT, although there were areas where multiple crashes occurred, these were:

- The Belconnen and Macquarie districts, particularly around the Westfield Belconnen Shopping Centre.
- The Gungahlin shopping district.
- The Dickson shopping district.
- Canberra and the surrounding central business district.
- North Canberra
- South Canberra, Kingston, and the Manuka Oval.
- Phillip and the Westfield Woden Shopping Centre.

4.4. Creating a safe road system for pedestrians in the ACT

A safe system is a traffic system that is adapted to the physical limitations of its users (OECD, 2018). Such a system must accommodate unavoidable human error without resulting in serious or fatal injury. Therefore, the road system must be designed with consideration of the forces a human body can tolerate and still survive. Pedestrians are vulnerable road users, and the present study, along with past research (Oxley, 2009; Martin et al., 2010; Baldock et al., 2016), suggests that older pedestrians are even more vulnerable to serious and fatal injury. Also, while they may avoid some risky walking behaviours (less likely to be hit while walking at night, they are more likely than younger adult pedestrians to be hit while crossing the road without protection such as traffic lights or marked pedestrian crossings. Therefore, it is important to identify ways to improve their safety, through both preventing these crashes and reducing the likelihood that they will be seriously or fatally injured. This aligns with the first key goal of the ACT Road Safety

Strategy (2020 to 2025) to reduce serious and fatal crashes. Such improvements in safety would benefit pedestrians of all ages.

The present study closely examined crashes in the ACT that resulted in the older pedestrian being seriously or fatally injured. The locations were examined in Google Maps Street View and the police narratives/descriptions of the crashes were read. Thirteen (59%) older pedestrians were hit and seriously or fatally injured while they were attempting to cross the road, and eleven (50%) of them were crossing without any protection or pedestrian-prioritised infrastructure, such as zebra crossings or pedestrian signals, as there was none available either at the location or anywhere in the near vicinity. The roads that they were trying to cross were at locations where high pedestrian activity would be expected and encouraged for the success of the local commercial or community areas. Several crashes were discussed in detail, as they demonstrated common road and infrastructural limitations for pedestrian safety, for which potential countermeasures are available. These potential road infrastructure improvements would not only benefit these specific locations but could be considered by ACT road authorities for implementation at appropriate locations across the ACT road network.

To reduce pedestrian-vehicle collisions, a better balance between the needs of pedestrians and those of vehicles should be realised in the design and implementation of road infrastructure and the built environment in the metropolitan area of Canberra and many of the suburban commercial areas of the greater ACT. Arguably, the balance in many inner metropolitan areas currently favours vehicle movement (Gårder, 2004). More pedestrian-protected crossings, such as signalised or zebra crossings, would ideally be provided for pedestrians to use. As identified in Section 3.6.1, there are many locations in metropolitan Canberra that have a high-level of pedestrian activity but do not have protected crossings. There are also locations that have been designed as shared spaces (see Figure 3.9) but still do not have protected crossings. Additionally, fencing on the sides of roads that are difficult for pedestrians to cross (i.e., large traffic volume and multiple lanes) would encourage pedestrians to use designated crossings. This is important given the present finding that older pedestrians were not using such crossings when hit. Alternative barriers, such as trees, hedges, raised gardens and outdoor seating, produce the same effect but are more subtle and blend into the roadside aesthetics (Oxley, Corben, Fildes, & Charlton, 2004).

Research in New Zealand by Hirsch et al. (2021) demonstrated that drivers still failed to stop at signalised crossings and flat zebra crossings in 13% of serious injury and 12% of fatal pedestrian crashes. Consequently, raised zebra crossings (i.e., vertical deflection) with advanced warning signage would be most effective as they slow motorists. This would mitigate the injury severity of a pedestrian-vehicle collision as previous studies have shown that the higher the vehicle speed on impact, the more severe the outcome for the pedestrian (Anderson, McLean, Farmer, Lee, & Brooks, 1997; Desapriya, Sones, Ramanzin, Weinstein, Scime, & Pike, 2011; Jurewicz, Sobhani, Chau, Woolley, & Brodie, 2017; Kröyer, 2015; Zeeger & Bushell, 2012).

It is important to control vehicle speeds to a survivable level for pedestrians, particularly in metropolitan areas with high pedestrian activity. This can be achieved through reduced speed limits and associated enforcement. Hirsch et al. (2021) noted that pedestrians are less likely to survive impacts over 30 km/h. Also, a report on speed and crash risk by the OECD (2018) assessed the road environments of ten countries, including Australia, and found that speed limits in built-up environments where pedestrians, bike riders and motor vehicles mix should be set at 30 km/h. The OECD report suggested that a pedestrian struck by a vehicle travelling at 30 km/h has a strong chance of surviving. However, the probability of a pedestrian being killed is around 4-5 times higher at 50 km/h compared to the same type of collisions at 30 km/h (Kröyer, Jonsson, & Varhelyi, 2014; OECD, 2018). This research should be considered by road authorities when setting speed limits in the ACT. Slower speed limits (and, therefore, slower vehicle speeds) also reduce the risk of a collision (OECD, 2018; Oxley, Corben, Fildes, & Charlton, 2004) because they improve the predictability of vehicles for pedestrians crossing the road and the control, manoeuvrability, and reaction and braking distance for drivers. This report also highlighted, however, that older pedestrians can be seriously injured even when hit by a vehicle travelling at a very low speed (see Section 3.6.1), particularly when they hit their head on the road or footpath.

Zebra crossings are preferable to signalised crossings (where practical) because they allow older pedestrians to cross at their own pace, without the constraints and pressure of designated crossing times. Pedestrian over/under passes protect pedestrians by removing them from the road environment but are expensive and often difficult for older persons (walking up/down stairs or ramps). Vehicle over/under passes are also expensive but at least eliminate any additional difficulty for pedestrians. Wider footpaths with good visibility for both drivers and pedestrians may reduce the risk to older pedestrians on footpaths. Finally, vehicle-free zones, such as Garema Place in Canberra, prioritise pedestrian movement and effectively remove the risk of vehicular collision but must be accompanied by protected crossings so that pedestrians can safely reach these spaces.

4.5. Vehicle-based countermeasures

Pedestrian injury outcomes can also be improved by the design of vehicles (Keall, Watson, Rampollard, & Newstead, 2022; Strandroth, Rizzi, Sternlund, Lie, & Tingvall, 2011). Energy-absorbing components located on the bonnet and front of vehicles can minimise injury severity (Crandall, Bhalla, & Madelely, 2002). Improvements in vehicle design have been encouraged by the testing of the pedestrian protection provided by vehicles and incorporating the results into overall vehicle safety ratings (Ponte, van den Berg, Anderson, & Linke, 2013). However, testing that is tailored to account for the fragility of older adults rather than a one-size-fits-all standard would likely lead to even greater improvements in the protection of older pedestrians. The implementation of certain technologies in vehicles is also important for pedestrian safety, including Autonomous Emergency Braking, reversing cameras, rear collision warnings, pedestrian frontal collision warnings and intelligent speed assistance, all of which will become more common as the vehicle fleet is upgraded. However, Anderson, van den Berg, Ponte, Streeter and McLean (2006) showed that metal bull bars increase the risk of severe injury or death to a pedestrian in a crash, which demonstrates that some vehicle modifications can have adverse safety effects.

4.6. Study limitations

It should be acknowledged that non-injury crashes and near-misses would not be included (Hirsch et al., 2021) in the police-reported crash data that were used in this study. This would bias the results towards a greater representation of crashes that resulted in injury.

It was hoped that additional information relating to pedestrian collisions with motor vehicles could have been examined. Specifically, whether the older pedestrians were found by the attending police officers to have been at-fault in the crashes, what their blood alcohol concentration was, what errors they made in causing the crashes, and the speed limit of the road at the crash location, with comparisons made to younger adult pedestrians and their collisions with motor vehicles. However, this information was not consistently available in the police-reported data. There were also no pedestrian exposure data available, which would be important to include in any examinations related to risk (e.g., of serious or fatal injury).

4.7. Conclusions

The overall intention of this report was to highlight the road safety issues for older pedestrians and identify what could be done to address them, with an eventual aim to assist the ACT to progress towards its vision of zero road fatalities by creating a safe system for a vulnerable group of road users. This report found, firstly, that older pedestrians have an increased vulnerability to serious and fatal injury when they are hit by a motor vehicle. It also found that many older pedestrians are hit by motor vehicles and seriously or fatally injured when they cross busy roads with no protected crossings available for them to use. Overall, this study has highlighted that such protection (in combination with speed management and improvements in vehicle design) needs to be a fundamental component of the way that metropolitan and suburban spaces are designed and is vital to achieve a safe road system in the ACT.

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