Title: Fatal road transport crashes among Australian Residential Aged Care Facility residents

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MeSH key words: Nursing home, death, transport crash

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Abstract

Objectives To examine fatal road transport crashes of Residential Aged Care Facility (RACF) residents to determine crash characteristics and risk factors.

Methods A cross-sectional study of a retrospective national cohort of RACF resident deaths notified to Australian coroners. Inclusion criteria: death occurred between 1-Jul-2000 and 30-Jun-2013; mechanism classified as 'transport injury event'; and completed coronial investigation. Descriptive statistical analyses were conducted on crash characteristics and risk factors.

Results Thirty-eight deaths met the inclusion criteria. Median age of deceased RACF residents was 84 years and sex was equally distributed. Men were most frequently pedestrians (n = 14, 37%) and women were most frequently motor vehicle passengers (n = 14, 37%). Road user factors contributed to two-thirds of crashes (n = 25, 66%), with 'failure to yield' (n = 17, 45%) most frequent.

Conclusions Reducing fatal crashes of RACF residents requires effective road safety strategies and public awareness of risks for this increasing and vulnerable population.

MeSH key words: Nursing home, death, transport crash

Impact statement:

This is the first academic literature reviewing and discussing how residents of aged care facilities die from road trauma. The findings in this article will inform future policy to optimize safe mobility options for aged care facility residents.

Introduction

Older people (≥ 65 years) are over-represented in fatal transport crash statistics (1), due in part to their age-related declines in sensory, cognitive and physical abilities (2), increased frailty, and increased susceptibility to injury (3). Residential Aged Care Facility (RACF) residents are a particularly vulnerable group with increased comorbidities, osteosarcopenia and frailty (4). Mobility in the community contributes to older adults' independence and self-worth and facilitates maintenance of good health, quality of life and social engagement, through enabling access to essential services and social activities (5-11). Internationally, while older road users are being encouraged to maintain their mobility for as long as possible, their safety is also a serious community concern (12-14).

Road safety principles incorporate recognition of the limits of human performance; humans make mistakes and the transport system must accommodate these so far as is possible (15). Australia has adopted this philosophy with the Safe System approach, derived from road safety best practice in Sweden (Vision Zero) and the Netherlands (Sustainable Safety) (3). The Safe System approach consists of four pillars: safer road user behaviour; safer roads and roadsides; safer vehicles, and; safer speeds.

Given that the proportion of older Australian adults (≥ 65 years) is projected to reach 22% by 2061 (16), it is imperative that the transport system accommodates this group. A recent systematic review of the published literature yielded no studies examining fatal crashes of RACF residents (17). Given this knowledge gap, this study examined fatal crashes among Australian RACF residents in accordance with the four pillars of the Safe System approach.

Methods**Research Design**

This research design comprised a cross-sectional study of a retrospective national cohort of RACF resident deaths notified to Australian coroners. The detailed method is published elsewhere (18).

Data Source

The primary data source was the National Coronial Information System (NCIS), an electronic data storage and retrieval system of deaths reported to Australian coroners since July 2000 (January 2001 for Queensland) (19).

Definitions

RACFs were defined as: licensed businesses that provide accommodation and assistance with day-to-day living for frail and aged persons accredited by the Australian Aged Care Quality Agency Ltd (AACQA). Residents were defined as a person who resided in a RACF temporarily or permanently. Fatal crashes were defined as incidents directly caused by motor vehicles, which included motor vehicles, motorcycles, trucks and buses and excluded railway trains or trams, motorised wheelchairs and electric mobility scooters. Counterparts were defined as the other party involved in the crash (e.g., motor vehicles, fixed or stationary objects).

Case identification and inclusion criteria

Cases were identified by one author (LB) using the NCIS query design function. The search strategy comprised: deaths where the person's usual place of residence was classified as a RACF; case type was classified as resulting from external causes; and the mechanism of injury was classified as a transport injury event. One author (LB) reviewed the results against the following inclusion criteria: incident occurred between 1-Jul-2000 and 30-Jun-2013; the coronial investigation was completed on or before 31-Dec-2014; and the deceased's usual place of residence was confirmed as a facility accredited by AACQA.

Data Collection

Information collected included: socio-demographic characteristics of the deceased RACF resident; cause of death using International Classification of Diseases 10th Revision (ICD-10); RACF location; RACF funding type; and details of the crash including: date, day, road design, road user type, and the counterpart. Full text reports attached to each included case were examined by one author (HCL) to extract data relating to Safe System approach pillars.

Two authors (MJ, SK) reconstructed crash events from report documents and assigned crash codes (Victorian Definitions for Classifying Accidents (DCA)) (20). Latitude and longitude coordinates for RACFs and crashes were mapped using Google Maps (21) and the integrated ruler was used to determine distance between the RACF and the crash site.

Data analysis

SPSS (V23) was used to analyse the: frequency of crashes involving RACF residents; socio-demographic characteristics of the deceased RACF resident and counterparts (where applicable); crash characteristics; and Safe System approach factors.

Ethics

Ethics approvals were granted by the Justice Human Research Ethics Committee of the Victorian Department of Justice and Regulation (cf/13/8187), and the Coronial Ethics Committee of State Coroner Western Australia (EC12/13).

Results

Deaths of 38 RACF residents resulting from 38 separate crashes met the inclusion criteria (Table 1a).

Characteristics of deceased RACF residents

The median age of deceased RACF residents was 84 years for women and 86 years for men (Interquartile Range: 80-90 years for both sexes) and 50% were women. Where reported ($n = 29$, 76%), the majority ($n = 28$, 97%) of RACF residents had a medical condition (e.g., arthritis, ischaemic heart disease, etc.). Toxicology tests were conducted in 21 cases (55%), and prescription medication was detected in the majority (86%). Alcohol was detected in two cases; a deceased pedestrian (Blood Alcohol Content [BAC] = 0.09 g/100ml); a deceased passenger (BAC = 0.01 g/100ml).

Crash characteristics for deceased RACF residents

Most deceased RACF residents were either pedestrians ($n = 19$, 50%) or motor vehicle passengers ($n = 18$, 47%). In two cases, road user type was not specified. No cases involved the RACF residents as a motor vehicle driver. Most deceased men were pedestrians ($n = 14$ / 19, 37% of all deaths) and most women were passengers ($n = 14$ / 19, 37% of all deaths).

Of the passenger fatalities (n = 18), the driver's sex was specified in nine crashes (50%). Six drivers were men, including five who were the husband of the deceased. Other drivers included children or friends of the deceased.

Residential location was available for all cases. However, specific crash location data (i.e. longitude and latitude coordinates) were available for only 13 cases. Of those cases, half of the crashes occurred within 2km of the deceased person's residence (n = 7, 53.8%) (Figure 1).

Time of the crash was available for 25 cases (36%). Most occurred between 10am and 4pm (n = 20, 80%). The remaining 20% (n = 5) occurred during dusk or night-time. Atmospheric information was available for nine crashes (24%) and most (n = 7, 78%) occurred during dry/clear conditions.

The most common type of crash was *pedestrian on foot hit by a motor vehicle* (n = 7, 18%). Other crash types included: *vehicles from adjacent, opposing directions, off path on straight or curve*. Posted speed was reported for seven crashes, five of which occurred in speed zones below 60 km/h.

Thirty crashes involved a counterpart and more than half were motor vehicles (n = 19, 50%) (Table 1a). Other counterparts included heavy vehicles (n = 7, 18%), or fixed/stationary objects (n = 4, 11%). Counterpart gender (where applicable) was available for 12 crashes (31%). Most counterparts were men drivers (n = 10, 27%).

Safe System factors

Across the 38 crashes, road user factors were attributed to two-thirds (n = 25, 66%). Further examination of these crashes identified 34 road user factors. The most frequent factor was *failed to yield* (n = 17). Among these cases, the party that failed to yield was a driver (counterpart, n = 7; driver of deceased passenger, n = 6) or pedestrian (n = 4).

Road factors were attributed to six (16%) crashes; four of these may have been prevented if the stop or give way sign had been more visible. Vehicle factors were attributed to four (11%) crashes; three deaths may have been prevented if the motor vehicle had been fitted with an audible seatbelt warning. Speed was an attributed factor in two (5%) crashes.

Discussion

This study identified 38 fatal road transport crashes involving Australian RACF residents over a 13-year period and highlights the vulnerability of this growing proportion of the

population. In Australia, the total number of fatal crashes is decreasing, yet fatal crashes involving older road users are increasing (22).

Deceased RACF residents were most frequently travelling as pedestrians or motor vehicle passengers. In addition, road user behaviour was the most common risk factor. Findings confirm that it is rare for RACF residents be involved in fatal crashes as drivers, likely because few RACF residents drive themselves given their age-related declines (2). However, their physical frailty makes RACF residents vulnerable as road users when accessing their community.

It is important to note that most crashes occurred in close proximity to the RACF. This highlights the importance of ensuring roads and roadsides provide safe access for RACF residents. For example, pedestrian crossings signal times near a RACF should consider the slower walking speed of RACF residents (23). Further, lower speed zones and traffic calming measures, similar to those that protect children around schools, are needed to protect pedestrian zones around RACFs (24).

Study limitations

This is the first study to examine fatal crashes of RACF residents. Ideally, a larger study including non-fatal injuries would provide greater insights. Finally, missing data, especially the details of crash circumstances (e.g. speed), limited the ability to examine the presence and contribution of all Safe System factors systematically.

Implications

Road user behaviour was the leading contributing factor identified in this study. This highlights the importance of public awareness and education regarding road safety. Older road users are increasingly being reported as a higher risk of injury and or death than younger road users across different travel modes (e.g., pedestrians, pedal cyclists, and users of mobility scooters)(25-27).

As there is likely to be a steady growth in the number of older road users as the population ages, their safe mobility will become a major issue (26). RACFs are in a unique position to educate residents and family/friends. To help RACF residents maintain safe access to their community as they age, it is vital that the environment surrounding RACFs accommodates their needs. Greater action is need to reduce speed and increase traffic calming measures by state and local governments in partnership with RACFs.

Future Studies

To optimise safe mobility options for RACF residents, more comprehensive data are needed. Further research using datasets that link healthcare, police and transport data, including non-fatal crashes, would guide future policy and implementation to reduce preventable deaths and serious injuries on our roads.

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Table 1a: Crash characteristics

	Deceased Road User Group			
	Passenger	Pedestrian	Not Stated	Total
	n (%)	n (%)	n (%)	n (%)
Deceased Sex				
Female	14 (37)	5 (13)	- (-)	19 (50)
Male	4 (11)	14 (37)	1 (3)	19 (50)
Total	18 (47)	19 (50)	1 (3)	38 (100)
Deceased Age Group				
<65	1 (3)	2 (5)	1 (3)	4 (11)
65-74	1 (3)	1 (3)	- (-)	2 (5)
75-84	8 (21)	6 (16)	- (-)	14 (37)
85-94	7 (18)	9 (24)	- (-)	16 (42)
95+	1 (3)	1 (3)	- (-)	2 (5)
Total	18 (47)	19 (50)	1 (3)	38 (100)
Counterpart				
Counterpart, Mode				
Car	6 (16)	13 (34)	- (-)	19 (50)
Heavy Vehicle	1 (3)	6 (16)	- (-)	7 (18)
Fixed or Stationary Object	4 (11)	- (-)	- (-)	4 (11)
Not Stated	7 (18)	- (-)	1 (3)	8 (21)
Total	18 (47)	19 (50)	1 (3)	38 (100)
Counterpart, Sex				
Male	1 (3)	9 (24)	- (-)	10 (26)
Female	1 (3)	1 (3)	- (-)	2 (5)
Not Applicable	4 (11)	- (-)	- (-)	4 (11)
Not Stated	12 (32)	9 (24)	1 (3)	22 (58)
Total	18 (47)	19 (50)	1 (3)	38 (100)
Safe System factors				
Safe System				
Road User Factors	11 (29)	14 (37)	- (-)	25 (66)
Speed	1 (3)	1 (3)	- (-)	2 (5)
Roads and roadsides	2 (5)	4 (11)	- (-)	6 (16)
Vehicles	3 (8)	1 (3)	- (-)	4 (11)
Total	17 (45)	20 (53)	- (-)	37 (97)

Table 1b: Road user factors (25 crashes identified)

Passenger (Driver	Pedestrian	Counterpart driver	All Crashes n = 38
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	behaviour)		behaviour	
	n (%)	n (%)	n (%)	n (%)
Failed to yield	6 (16)	4 (11)	7 (18)	17 (45)
Prescription Meds contributing	1 (3)	- (-)	- (-)	1 (3)
Fatigue	- (-)	- (-)	1 (3)	1 (3)
Distracted	- (-)	- (-)	2 (5)	2 (5)
Onto the path of the counterpart vehicle	- (-)	2 (5)	- (-)	2 (5)
Failed to navigate bend	1 (3)	NA NA	- (-)	1 (3)
Drove to the oncoming traffic	1 (3)	NA NA	- (-)	1 (3)
Lost Control	1 (3)	NA NA	- (-)	1 (3)
Careless driving	1 (3)	NA NA	- (-)	1 (3)
Parked facing wrong side of the road	- (-)	NA NA	1 (3)	1 (3)
Failed to wear seatbelt	3 (8)	NA NA	- (-)	3 (8)
Failed to follow Pedestrian control light	- (-)	1 (3)	NA NA	1 (3)
Did not use Pedestrian crossing	NA NA	1 (3)	NA NA	1 (3)
Wandered out of RACF	NA NA	1 (3)	NA NA	1 (3)
Total	14 (37)	9 (24)	11 (29)	34 (89)

*

Radial distance and bearing of distances from residence to crash location for fatal transport crashes involving nursing home residents in Australia (crashes that occurred within 2km of nursing home, n=7)

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