THE EFFECTS OF AGE ON ROAD CRASH PATTERNS IN SOUTH AUSTRALIA FROM 1994 TO 1998

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ABSTRACT

The crashes of older drivers (aged over 65) were compared with those of drivers in younger age groups for all road crashes reported to South Australia Police for the years 1994 to 1998. Comparisons were made for the number of crashes, the types of crashes, and the conditions in which the crashes occurred. It was found that older drivers were involved in relatively few crashes, and their crash involvement rates were relatively low except when adjusted for kilometres driven. With regard to crash types, the crashes of older drivers were more likely than those of younger drivers to have resulted in severe injury and to have involved some form of turning movement, especially right turns. Older drivers were more likely to have been deemed responsible for the crash in which they were involved but were less likely to have been driving at excessive speed or with an illegal blood alcohol concentration when the crash occurred. Older drivers were less likely to have crashed in adverse driving conditions, such as peak hour traffic times, night time or in periods of wet weather. The fact that older drivers were less likely to crash in adverse driving conditions suggests that they may have been deliberately limiting their exposure to such conditions. This analysis is being used as the background to a subsequent exploratory study of the self regulatory behaviour of older drivers that will seek to determine both the extent and nature of the self regulation practised by older drivers.

INTRODUCTION

A number of consistent findings have been reported in the literature concerning the crash involvement patterns of older drivers (aged over 65). These findings relate to the number of crashes involving older drivers, the types of crashes in which they tend to be involved, and the conditions in which these crashes tend to occur.

With respect to crash numbers, older drivers have been found to have fewer crashes than younger drivers, even when crash involvement rates are adjusted for differences in the population of different age groups. However, their crash involvement rates are higher than those of younger drivers when adjusted for differences across age groups in the number of licences held and annual kilometres driven (Hakamies-Blomqvist, 1998; OECD, 2001; Ryan, Legge, & Rosman, 1998).

In terms of crash types, older drivers tend to be involved in more severe crashes than younger drivers, with a greater likelihood of a fatality or serious injury (OECD, 2001). Older drivers are also more likely to be involved in a crash at an intersection (Stamatiadis, Taylor, & McKelvey, 1991), to be turning prior to the crash, and to fail to give way (Preusser, Williams, Ferguson, Ulmer, & Weinstein, 1998). In addition, older drivers are more likely to be deemed responsible for the crashes in which they are involved (Hakamies-Blomqvist, 1993, 1994a, 1994b) but are less likely to have been driving at excessive speed or with an illegal blood alcohol concentration (BAC) at the time of the crash (Fildes, 1997; Hakamies-Blomqvist, 1994b).

With regard to the conditions in which crashes occur, older drivers are reported to be less likely than younger drivers to crash at night, during peak hour, or during rain (Eberhard, 1996).

This study sought to assess whether the crash patterns of older drivers in South Australia resembled those previously reported in the literature. More specifically, it examined the crash involvement of older drivers in terms of number of crashes (total number, number per head of age group population, number per licensed driver and number per kilometre driven), types of crashes (crash severity, driver injury severity, intersection involvement, crash type, vehicle movement prior to the crash, driver error, driver responsibility, involvement of excessive speed, alcohol involvement), and the conditions in which crashes occur (time of day, ambient illumination, presence of rain).

This analysis was undertaken to check that the population of drivers (South Australian older drivers) from which a sample was drawn for a subsequent study on older drivers' driving habits was typical of older driver populations. If the South Australian older driver population exhibited crash patterns comparable to other older

driver populations reported in the literature, then the results of the subsequent study on older drivers' driving habits are more likely to be generalisable to older drivers elsewhere.

METHOD

The study was based on an analysis of data recorded in the Traffic Accident Reporting System (TARS) database maintained by the Safety Strategy Section of Transport SA. The TARS includes records of all road crashes in South Australia that are reported to the police. Crash participants are required to report their crash to the police if the crash results in a person being injured or if it causes property damage in excess of $1,000. The most recent year for which complete data were available was 1998. A period of five years was chosen to provide an adequate time frame in which to obtain a representative sample of crash data.

In order to analyse the data in terms of the age group of drivers involved in the crashes, it was necessary to base the analysis on crash-involved drivers rather than crashes. This means that for crashes in which there was more than one driver/vehicle, the details of the crash would be represented more than once in the data extracted from TARS for analysis. Crash-involved drivers were chosen for inclusion in the analysis only if they were driving a car or car derivative (station wagon, panel van, utility).

Estimates of the South Australian population for the different age groups in June of each year from 1994 to 1998 were obtained from Australian Bureau of Statistics publications (Australian Bureau of Statistics, 1997, 1998a, 1999). These data were used to determine an estimate of the average annual population over the five years for each age group.

Driver licensing data were obtained from the Registration and Licensing section of Transport SA. Requests were made to Registration and Licensing for the number of driver licences held in South Australia, broken down by age group, for each year from 1994 to 1998 inclusive. These data, however, were only available for December 1998. Although determining crash rates per licensed driver using licensing data from the very end of the time period being studied is not ideal, it is assumed that any biases introduced by the use only of the 1998 data would be small and would not have a significant effect on the results. Deceased drivers are also removed from the database.

Driving exposure data, in terms of kilometres driven by South Australian drivers, were obtained from the Australian Bureau of Statistics. The data were derived, on request, from the Australian Bureau of Statistics Survey of Motor Vehicle Use for the 12 months ending 31st June, 1998 (Australian Bureau of Statistics, 1998b). The Surveys of Motor Vehicle Use conducted by the Australian Bureau of Statistics are vehicle-based rather than driver-based surveys. That is, the data refer to the average number of kilometres driven by drivers in a particular sampled vehicle. The data do not take into account the possibility that drivers may drive multiple vehicles, and may, therefore, underestimate the number of kilometres driven by the drivers in the sample. For the purposes of this study, in which only relative comparisons across driver groups are of importance, rather than absolute figures, it is assumed that drivers of different age groups do not systematically differ from each other in terms of the extent to which they spread their driving between different vehicles. The information requested from the Australian Bureau of Statistics was for passenger vehicles only. This subset of vehicles matched closely those chosen from the TARS database for inclusion in the analysis. Relative standard errors for the estimates (standard errors divided by the estimates for each age group) were of an acceptable size, ranging between 9 and 27 percent.

Due to the very large size of the crash sample used in this study, the normal method of analysing frequency data, χ^2 analyses, would be likely to assign statistically significance even to differences that are too small to be of practical interest. Instead of tests of significance based on χ^2 analyses, point estimates for crash characteristics were expressed in terms of 99 per cent confidence intervals, and statistical significance at the $p<.01$ level was determined by inspection of the presence or absence of overlap in the confidence intervals. This method of determining statistical significance has the advantage of allowing for multiple pairwise comparisons between different age groups.

RESULTS

Number of Crashes

In the years 1994 to 1998 in South Australia, there were 331,590 drivers of cars or car derivatives who were involved in crashes reported to the police. The age of the driver was recorded by the police in 260,361 cases (78.5%). The number of crash-involved drivers in each age group is shown in Table 1, which reveals that with increasing age (excluding those under the age of 16, who were too young to be licensed), there was a decrease in the number of drivers involved in crashes.

Table 1: Age of Crash-Involved Drivers in South Australia 1994 to 1998.

AGE GROUP (years)	CRASHES	
	Number	Percent of known
<16	209	0.1
16-24	73,645	28.3
25-34	58,062	22.3
35-44	49,600	19.1
45-54	35,658	13.7
55-64	19,833	7.6
65-74	15,142	5.8
75-84	7,275	2.8
85+	937	0.4
Unknown	71,229	-
Total	**331,590**	**100.0**

The percentages of drivers per head of population in each age group who were involved in a crash between 1994 and 1998 are presented in Figure 1. Due to the way in which data were recorded in the TARS database, two crashes involving the same driver were counted as two separate crash-involved drivers. This would result in a slight overestimate of the percentage of the population who had experienced a crash in the study period. The rates of crash involvement adjusted for the population in each age group again show that younger drivers were over-represented in crashes compared to middle-aged and older drivers. The lowest rates of crash involvement were for the oldest age groups.

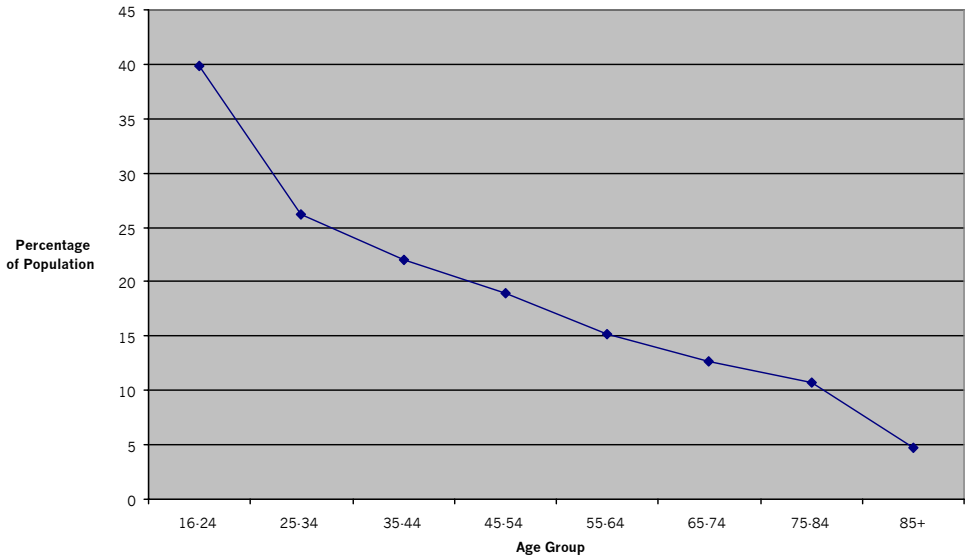

Figure 1: Crash-Involved Drivers per Head of Population in Each Age Group in South Australia 1994 to 1998

Figure 2 displays the crash rates from 1994 to 1998 per licensed driver for each age group. In contrast to when the crash rates had been adjusted for head of population, older drivers no longer had the lowest crash rates. Drivers over the age of 74 had higher crash rates than those in late middle age (45-64).

The crash rates per million kilometres driven for different age groups are shown in Figure 3. The crash rates for drivers aged over 84 are not shown because the average number of kilometres driven each year by drivers in this age group was reported by the Australian Bureau of Statistics to be zero. This made it impossible to calculate a crash rate in terms of crashes per kilometres driven for this group. As can be seen in Figure 3, those drivers with the highest crash rates per distance driven were young drivers, aged under 25. The second highest crash rates were those of older drivers, aged over 74. All other groups of drivers, aged between 25 and 74, exhibited crash rates that were approximately equivalent. Drivers aged over 84 were also likely to have had higher crash rates per kilometres driven than the young drivers, given the very low amount of driving done by this group and their higher rate of crash involvement per licensed driver compared with the 75 to 84 age group (refer to Figure 2).

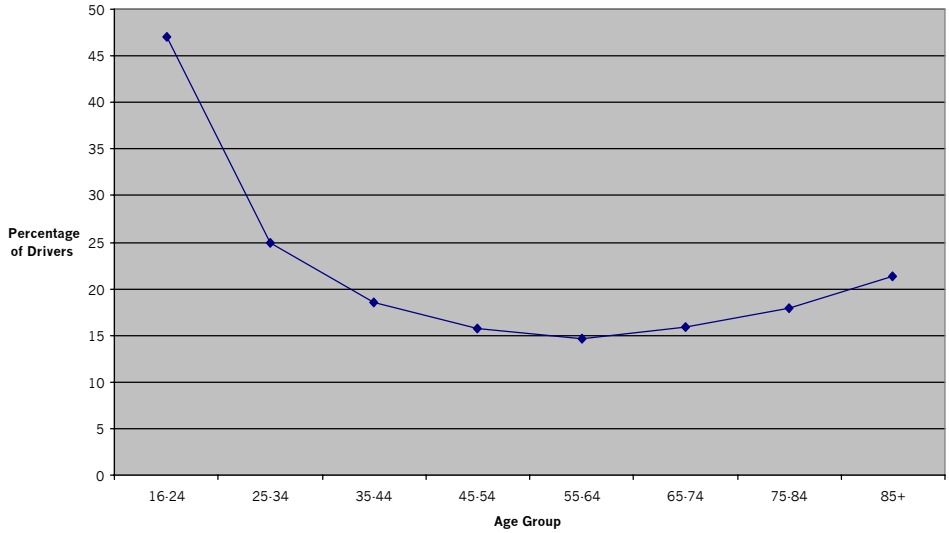

Figure 2: Crash-Involved Drivers per Licensed Driver in South Australia 1994 to 1998, by Age Group

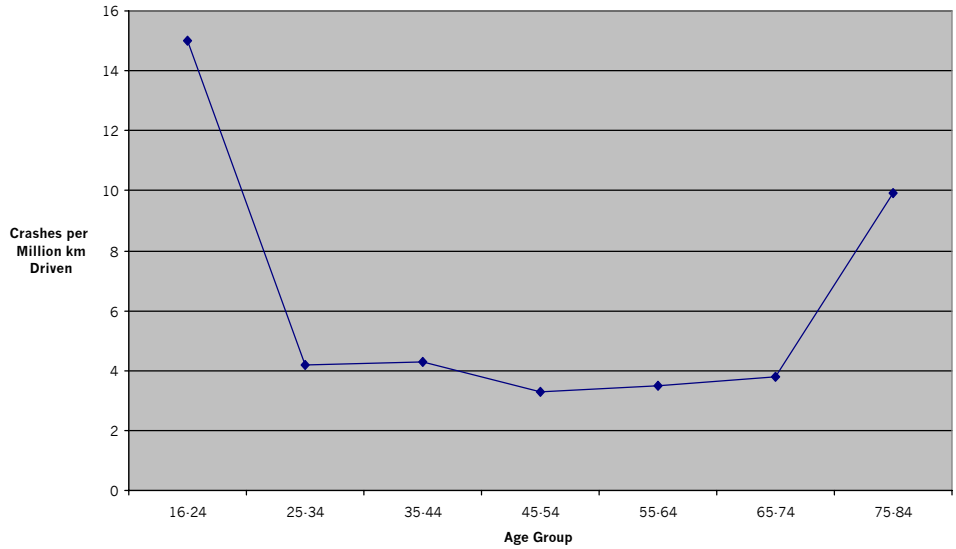

Figure 3: Crashes per Estimated Million Kilometres Driven, South Australia 1994 to 1998, by Age Group

Type of Crash and Conditions in which the Crashes Occurred

The crash variables which were analysed with respect to age of driver were crash severity, driver injury severity, intersection type, crash type, vehicle movement prior to the crash, driver error, driver responsibility for the crash, excessive speed, driver blood alcohol concentration, time of day, ambient illumination, and presence of rain. For each of these variables, older drivers were compared to drivers in other age groups to determine if there were any significant differences in crash type patterns that were consistent with previous findings. The comparisons were made using 99 per cent confidence intervals, with the lack of any overlap of intervals indicating a statistically significant difference ($p<.01$). Pairwise comparisons were made between each older driver age group (65-74, 75-84, and 85+) and the age group 45 to 54. The age group 45 to 54 was chosen as a baseline for comparison because it was the group with the lowest crash rate per kilometre driven, a standard used previously by Ryan et al. (1998). These comparisons are shown in Table 2.

Table 2: Comparison of Older Drivers and Drivers Aged 45 to 54 for Various Crash Type Characteristics, Using 99 Percent Confidence Intervals

CRASH CHARACTERISTICS	AGE GROUPS			
	45-54	**65-74**	**75-84**	**85+**
Percentage hospital admission or fatality resulting from the crash	2.2-2.6[1]	2.7-3.5	3.4-4.6	3.3-7.1
Percentage hospital admission or fatal injury to the driver	1.0-1.2	1.4-2.0	2.0-3.0	2.2-5.4
Percentage crashes at intersections	53.9-55.3	53.4-55.4	54.1-57.1	51.0-59.4
Percentage right turn crashes	5.6-6.2	6.5-7.5	7.3-8.9	7.3-12.3
Percentage turning prior to the crash	10.2-11.0	16.0-17.6	20.5-22.9	22.7-30.1
Percentage disobey traffic signal, stop sign or give way sign	2.7-3.1	5.5-6.5	7.8-9.4	8.7-14.1
Percentage responsible for the crash	40.5-41.9	54.8-56.8	66.2-69.0	77.6-84.2
Percentage excessive speed	0.1-0.3	0.0-0.2	0.1-0.3	0.0-0.6
Percentage illegal blood alcohol concentration[2]	7.7-8.5	3.0-3.8	1.6-2.4	0.0-0.0
Percentage during peak hour traffic	28.3-29.5	16.2-17.8	12.4-14.4	9.1-14.5
Percentage during daylight hours	87.0-88.4	92.7-94.5	93.7-95.9	94.3-99.7
Percentage during rain	8.8-9.6	6.8-7.8	6.0-7.6	2.9-6.5

[1] *The percentage data presented in the table are in the form of 99 percent confidence intervals.*

[2] *NB: There were differences across age groups in the likelihood of a crash-involved driver being tested for alcohol but these differences disappeared after controlling for differences in crash severity. That is, drivers were more likely to be tested for alcohol following severe crashes, and young (under 25) and old (over 64) drivers were more likely to be involved in severe crashes. This would not introduce any biases into the BAC data reported here.*

Table 2 shows that older drivers, compared to those aged between 45 and 54, were more likely to be involved in crashes resulting in a fatality or hospital admission, to be seriously injured themselves, to be involved in right turn crashes, to be turning prior to the crash (right turn, left turn or U-turn), to disobey traffic signals, Give Way signs or Stop signs prior to the crash, to be deemed to be responsible for the crash, and to crash in daylight hours. Older drivers were less likely than those aged 45 to 54 to be driving with an illegal blood alcohol concentration, to crash during peak hour traffic, or to crash in the rain. No statistically significant differences were found for crashing at intersections or for driving at excessive speed prior to the crash.

Most of the significant differences remained when older drivers were compared on these variables with every age group under 65, except that older drivers were not more likely than *every* other age group to be involved in crashes producing serious injuries or to be involved in right turn crashes. Specifically, young drivers (aged under 25) were as likely as old drivers to be involved in serious injury and right turn crashes.

DISCUSSION

In terms of the number of crashes, drivers aged over 64 were found to have relatively few crashes in total and per head of age group population. However, drivers aged over 74 had higher crash rates compared to middle aged drivers when adjustments were made for the number of licensed drivers each age group, and the estimated distance driven by drivers in each age group, respectively. The findings of increased crash risk per licensed driver and per distance driven among older drivers is consistent with previous findings (Hakamies-Blomqvist, 1998; OECD, 2001; Ryan et al., 1998).

When crash types were examined, it was found that older drivers were more likely to be severely injured in a crash, to be involved in right turn crashes, to be turning prior to the crash, to disobey traffic signals, Give Way signs or Stop signs and to be deemed responsible for the crash. These findings are all consistent with the literature (Hakamies-Blomqvist, 1993, 1994a, 1994b; OECD, 2001; Preusser et al., 1998), as is the finding of a lower likelihood of older drivers having an illegal blood alcohol concentration at the time of the crash (Fildes, 1997; Hakamies-Blomqvist, 1994b). The failure to find differences between age groups for crashes at intersections is likely to be due to this category of crashes including a large number of rear end collisions, which are not related to the types of errors at intersections (eg gap judgements, simultaneous processing of multiple stimulus sources) that are thought to be more prominent among older drivers (Preusser et al., 1998; Staplin, Gish, Decina, Lococo, & McKnight, 1998). Thus, the problems at intersections experienced by older drivers could have been 'masked' by the presence of rear end collisions that are common in all age groups. Also inconsistent with the literature was the lack of significant differences between age groups for crashes involving excessive speed. This is likely to be due partly to the fact that very few crashes in any age group (0.6% overall) were deemed to involve excessive speed, making it difficult to show a lower percentage of older drivers speeding prior to crashes than drivers in other age groups. This extremely low overall percentage assigned to

'excessive speed' is almost certainly a reflection of incomplete reporting rather than an accurate indication of the role of speeding in crashes.

With regard to conditions at the time of the crash, older drivers tended *not* to crash during peak hour traffic, outside daylight hours, or during rain. These findings are consistent with previous reports and are thought to be due to self regulatory practices limiting exposure to these more difficult driving conditions and also to the opportunity for older drivers no longer in the workforce to choose when they drive (Eberhard, 1996).
In conclusion, this sample of older drivers in South Australia appears to exhibit crash patterns similar to those previously reported in the literature. It is therefore likely that any future research examining South Australian drivers will be generalisable to drivers in other locations.

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