Analysis of trends over time for motorcycle crashes in South Australia

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An increasing number of people are choosing to ride motorcycles for recreation, pleasure and for commuting. Furthermore, motorcycles have great environmental advantages over cars. However, there are also serious safety concerns.

Aims: The aim of this study is to provide a general descriptive account of trends over time from 1990 to 2009 for motorcycle crashes in South Australia. This is achieved through a comparison of age groups for total motorcycle crashes, single and multiple vehicles crashes, metropolitan and non-metropolitan high and low speed area crashes, and gender of the motorcyclist.

Databases: Police-reported crash data (Traffic Accident Reporting System TARS) allowed a general exploratory account of motorcycle crashes in South Australia from 1990 to 2009.

Results: Crash frequencies are tabulated with particular reference to (a) different ages of motorcyclist, (b) the metropolitan versus non-metropolitan distinction, (c) single and multiple vehicle crashes, and (d) gender of motorcyclist. Each analysis showed a similar trend in crash frequency for age groups, with younger riders (16-29yrs) declining in crash frequency, the intermediate age group (30-39yrs) consistent in frequency over time, and the older age group (40yrs and above) increasing in crash frequency per year, particularly in recent years.

Conclusions: Changes in the trends between age groups for crash frequency over time suggest that there is a shift in motorcycle use for the older and younger age groups in recent years. Further research needs to be directed to economic, social and motivational differences between the various age groups of motorcyclists.

Keywords: Motorcycle crashes, time trends, age groups, geo-location, gender

The use of motorcycles has been increasing steadily throughout Australia and internationally over recent years. In Australia, motorcycle registrations and sales have increased substantially, with a 56.5% increase in the numbers of motorcycles in the vehicle fleet over the last five years, greater than for any other vehicle type (ABS, 2010). However this increase in motorcycle registrations has not been uniform for each state. Although there were increases in every state, the five year changes ranged from 77% in Western Australia down to 45% in Victoria (ABS, 2010).

There are many benefits to the use of motorcycles as opposed to other forms of transport but it has been well established that crash risk and injury severity are much greater for motorcyclists than for any other road user type. Per distance travelled, the Australian rate of motorcyclist deaths is approximately 30 times the rate for car occupants, while the serious injury rate for motorcyclists is 41 times the rate for car occupants (Department of Infrastructure, Transport, Regional Development and Local Government, 2008).

Given the vulnerability of motorcyclists on the road, they pose a particular challenge for the Safe System approach to road safety. The Safe System approach to road

safety requires alert and compliant road users operating in a system that does not allow physical impacts beyond the limits of human tolerance. Motorcycle safety research is not as advanced as research into other road users or other areas of road safety and much still needs to be learned about the nature of motorcycle crashes.

Recent research indicates that there are considerable differences between certain age groups in the frequency of motorcycle crashes. In Australia there has been a general decline in crash frequency for the younger age groups over the last decade, while in the same time there has been a significant increase in motorcycle crashes for the older age groups (ATSB, 2008). This trend is also seen in the US with the average age of the motorcyclist changing from 24 in 1980 to nearer 40 in 2000, with a change of the mean age involved in fatal crashes increasing from 29 years in 1990 to 36 years in 2001 (US DOT, 2000). A similar trend is seen in the UK with motorcycle casualties in the younger age group falling, and the casualty crash involvement of the group aged from 25-59 increasing steadily since 1992 (Department for Transport, 2007). It is speculated that a majority of these cases consist of 'returning riders', who may be returning to recreational use of motorcycles after a period of time away from riding (Jamson & Chorlton, 2009).

This paper will examine trends in police reported motorcycle crashes in South Australia over the last 20 years. The data will be examined to see if there have been any changes in the total number of crashes involving motorcycles, the age distribution of crash-involved motorcyclists, the distribution of age of crash-involved riders in rural and metropolitan areas, and trends in the gender of crash-involved motorcyclists.

The primary data source was the Traffic Accident Reporting System (TARS), the database of all crashes reported to the police in South Australia, using data from 1990 to 2009. The aim was to use identification of changes in crash frequency and type for differing age groups over the last 20 years to guide the focus of future research.

Methods

Data

The Traffic Accident Reporting System (TARS) database contains information on all crashes reported to police in South Australia. Data for all crashes involving at least one motorcycle from 1990 to 2009 were extracted, providing a total of 15,370 motorcycle crashes.

Age groups

To examine the different age groups, categories were created for young (16-29yrs), intermediate (30-39yrs) and older (40yrs and above). Preliminary analyses suggested these groupings to be most appropriate as further disaggregation of the young group revealed no difference between young rider sub-groups, with similar findings for the older group. This classification excluded crashes with an unknown age of the motorcyclist and those under the age of 16yrs. This reduced the total number of crashes to 15,059.

Data analysis

Trends for motorcycle crashes in South Australia from 1990 to 2009 were examined by age group comparisons. Total crash frequencies per year by age group were examined in relation to single and multiple vehicle crashes, location and speed limit, and gender of the motorcyclist.

Results

Total crashes involving a motorcyclist in South Australia from 1990-2009

The analysis of age group trends over time for motorcycle crashes begins with a look at the distribution of total numbers of crash-involved riders between 1990 and 2009. This includes all property damage crashes as well as injury and fatal crashes for all age groups. Figure 1 shows the number of police-reported motorcycle crashes per year. It can be seen that the total number of crashes has declined markedly since 1990. The number of crashes in 2009 was 51.5% of the number in 1990. The decline, however, has not been a gradual one, with a drop of 51.2% from 1990 to 1993. From 1993 to 2009, there has been little change (+0.6%).

To further explore this shift in frequency of motorcycle crashes over time, an analysis of the crash frequencies for different age groups was conducted. The following section details the comparison of age groups in regards to: total motorcycle crashes, number of vehicles involved, geographic location, and gender of the motorcyclist.

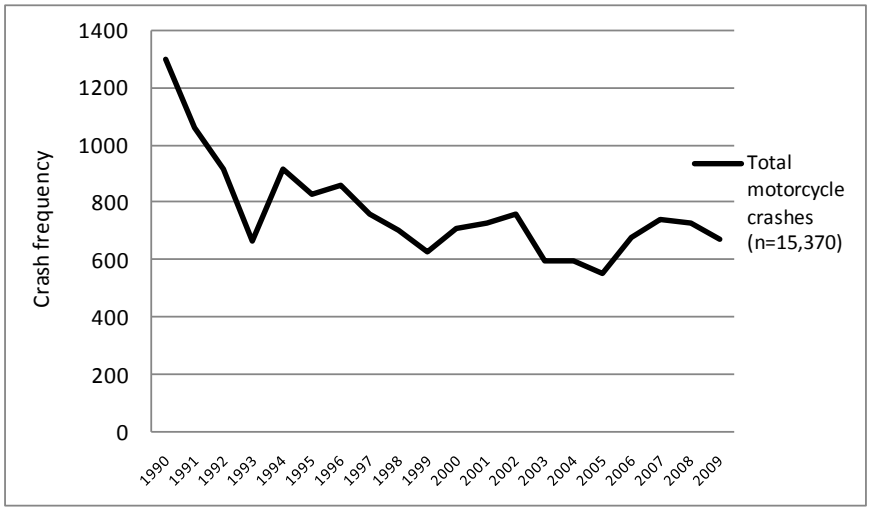

Figure 1: Frequency of police reported motorcycle crashes in South Australia per year 1990-2009

Age groups of motorcyclist involved in crashes over time

Age groups were created which combined the younger groups (16-29yrs), combined the older age groups (40yrs and above), and maintained an intermediate age group (30-39yrs). Figure 2 shows the differences in age group trends for total motorcycle crashes per year. Exponential trendlines have been used to highlight the changes for each age group. It can be seen that the younger age group has gradually declined over the years in motorcycle crash frequency, the intermediate age group has remained relatively constant over the years, and the older age group has continued to increase in motorcycle crash frequency, particularly in recent years.

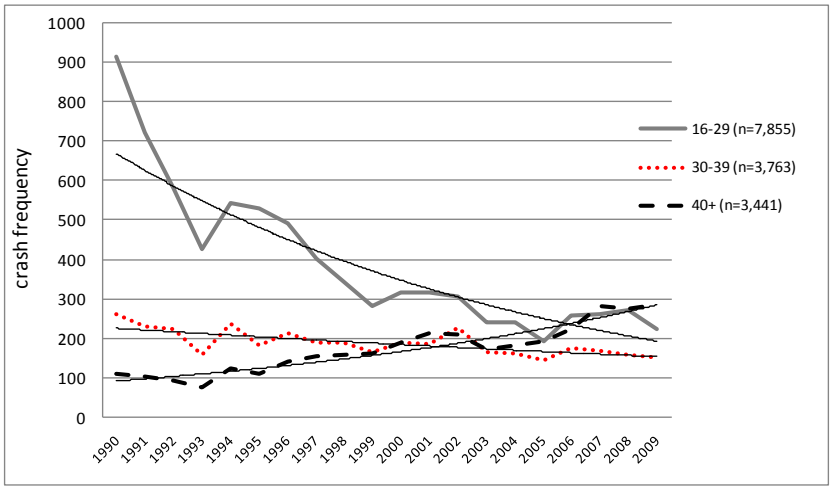

Figure 2: Distribution of total motorcycle crashes over time by age groups

Table 1: Percentage of change for age groups from 1990 total for motorcycle crashes in South Australia

Age group	1990 total crashes	1995 % change from 1990	2000 % change from 1990	2005 % change from 1990	2009 % change from 1990
Younger	**915**	-43.3%	-65.6%	-78.9%	-75.2%
Intermediate	**261**	-30.7%	-27.2%	-44.4%	-42.9%
Older	**108**	+1.9%	+73.1%	+77.8%	+163.0%

Comparison of crashes with motorcycle only and multiple vehicles involved

To further explore the trends in characteristics of motorcycle crashes it was necessary to separate single vehicle crashes (motorcycle only) from multiple vehicle crashes. For the purpose of the analysis, crashes with a pedestrian or a cyclist were excluded from single vehicle crashes, and collisions with parked cars were excluded from multiple vehicles crashes. This allowed a total data set of 14,511 motorcycle crashes. This comparison looked at the frequency per year from 1990 to 2009 of crashes involving a single motorcycle with the frequency of crashes involving multiple vehicles. The results are shown in Figure 3 which indicates a declining trend for multiple vehicle crashes, while single vehicle crashes have remained relatively stable over the years, with a slight increase since 2005.

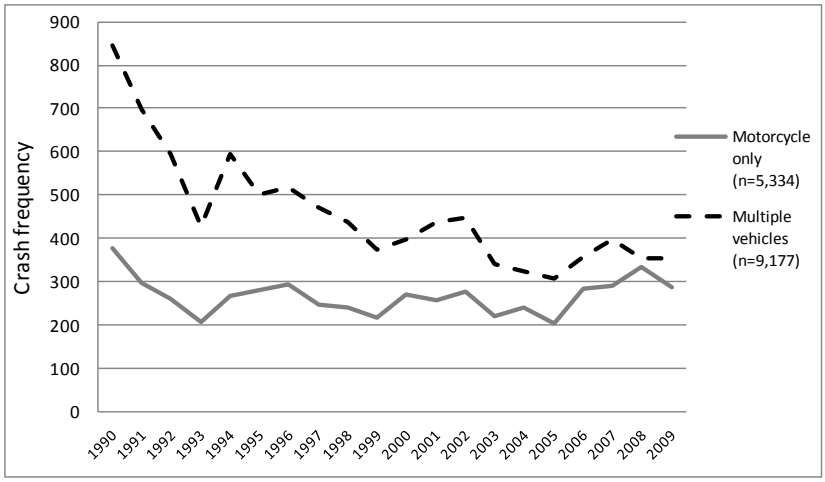

Figure 3: Comparison of crashes with motorcycle only and multiple vehicles involved

Comparison of age groups for motorcycle only and multiple vehicle crashes over time

The following analysis looks at the trends for each age group (younger, intermediate and older motorcyclists), in single vehicle and multiple vehicle crashes from 1990 to 2009 in South Australia. Figure 4 shows the crashes per year for younger riders in single vehicle and multiple vehicle crashes, Figure 5 shows the results for the intermediate age group and Figure 6 shows results for the older age group.

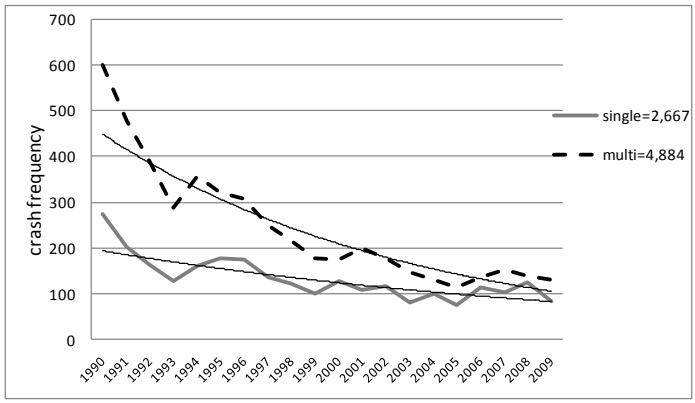

Figure 4: Comparison of single motorcycle and multiple vehicle crash frequency per year for young age group (16-29yrs) from 1990 to 2009 in South Australia

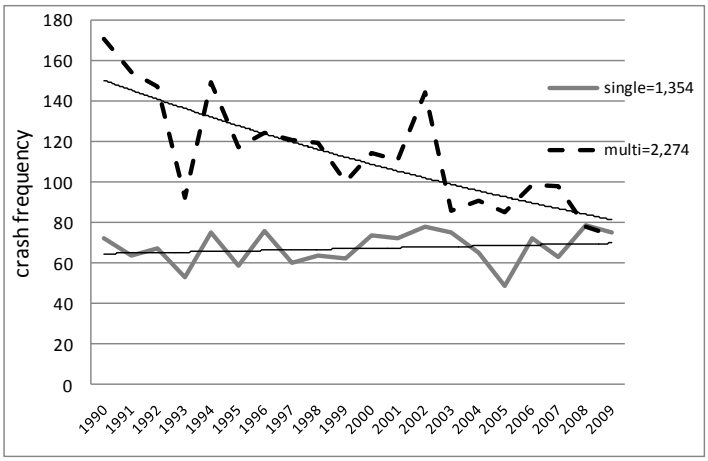

Figure 5: Comparison of single motorcycle and multiple vehicle crash frequency per year for intermediate age group (30-39yrs) from 1990 to 2009 in South Australia

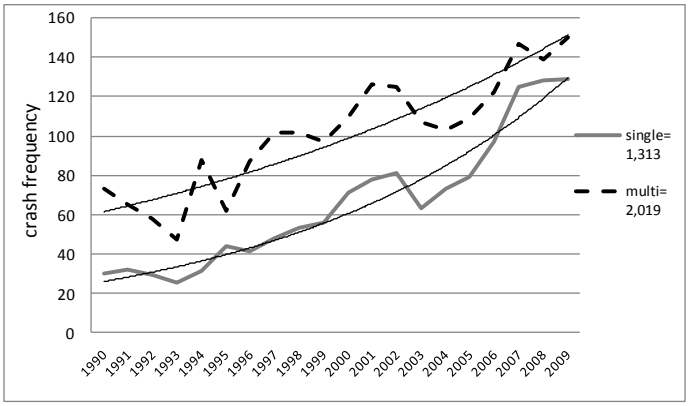

Figure 6: Comparison of single motorcycle and multiple vehicle crash frequency per year for older age group (40+yrs) from 1990 to 2009 in South Australia

The above figures clearly show the increase of the older age group for both single vehicle and multiple vehicle crashes. The younger age group shows a decline in frequency of yearly crashes for both single and multiple vehicles, while the intermediate age group shows a marked decline in multiple vehicle crashes and a stable yearly crash frequency for single vehicle crashes.

A comparison of metropolitan and non-metropolitan motorcycle crashes occurring in high and low speed areas.

The following section examines the geographical location of the crash and looks at trends over time for high speed limit (above 60kph) and low speed limit (60kph and below) roads in metropolitan (Adelaide) and non-metropolitan (outside Adelaide) locations. Figure 7 indicates a much greater frequency of motorcycle crashes occurring on the metropolitan low speed roads than any other road type. There has been a marked decline in the frequency of crashes on metropolitan low speed limit roads over the past 20 years. There has also been a decline in crashes on non-metropolitan low speed roads, while crash frequencies have remained relatively consistent on metropolitan high speed and non-metropolitan high speed roads.

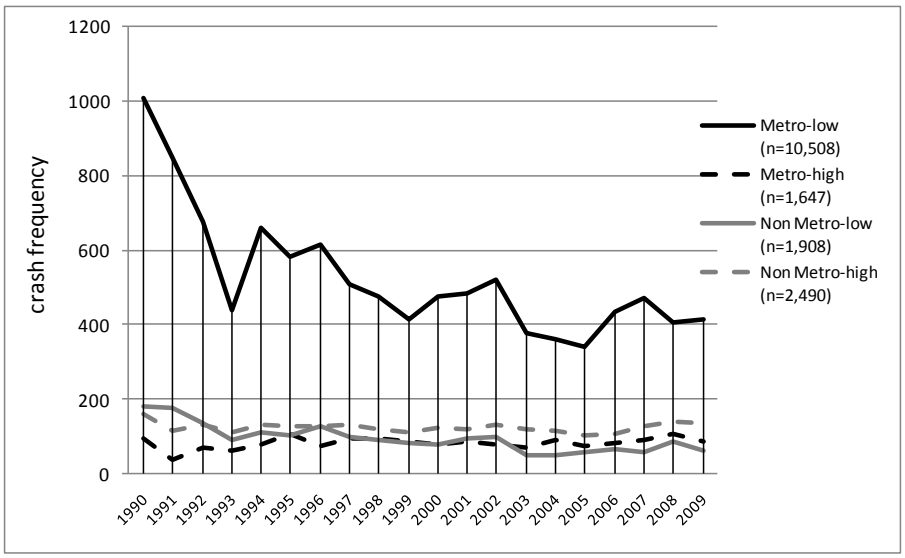

Figure 7: Comparison of frequency of motorcycle crashes per year for metropolitan and rural high and low speed areas 1990-2009

Using the same age group categories as above, a comparison was made of crash frequency for metropolitan and non-metropolitan motorcycle crashes occurring in high and low speed limit areas. Figures 8 to 11 show the results of an age group comparison for each speed limit/ geographic location.

Age group comparison for metropolitan low and high speed limit crashes

Figures 8 and 9 show the age group comparison for the low and high speed limit metropolitan areas. There has been a marked decline over the years for the younger age group, yet they remain the greatest overall contributors to both low and high speed metropolitan crashes. The intermediate age group has remained relatively consistent over the years but has been overtaken by the older age group in low speed metropolitan crashes, though not by a large amount. The older age group has

again increased in frequency of crashes across the past 20 years, particularly in recent years for the high speed metropolitan areas.

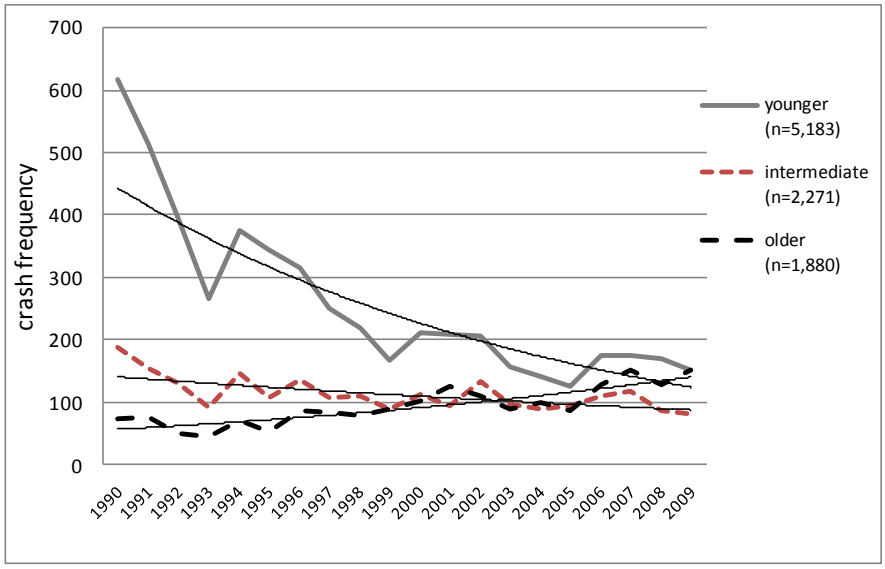

Figure 8: Frequency of low speed limit (60kph and below) metropolitan motorcycle crashes for each age group per year 1990-2009

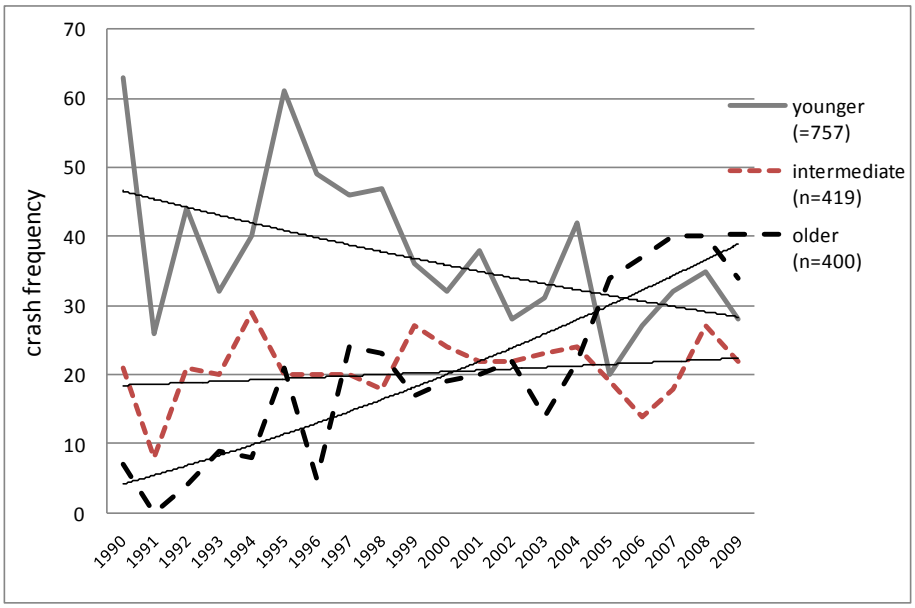

Figure 9: Frequency of high speed limit (above 60kph) metropolitan motorcycle crashes for each age group per year 1990-2009

Age group comparison for non-metropolitan low and high speed limit crashes

Figures 10 and 11 show the frequency of motorcycle crashes occurring in non-metropolitan low and high speed limit areas compared by age groups. It can be seen that the younger age group has significantly decreased in crash frequency in both low and high speed non-metropolitan areas, while the older age group has shown the greatest increase in crash frequency per year in the high speed non-metropolitan areas, particularly in recent years (2002 to 2009).

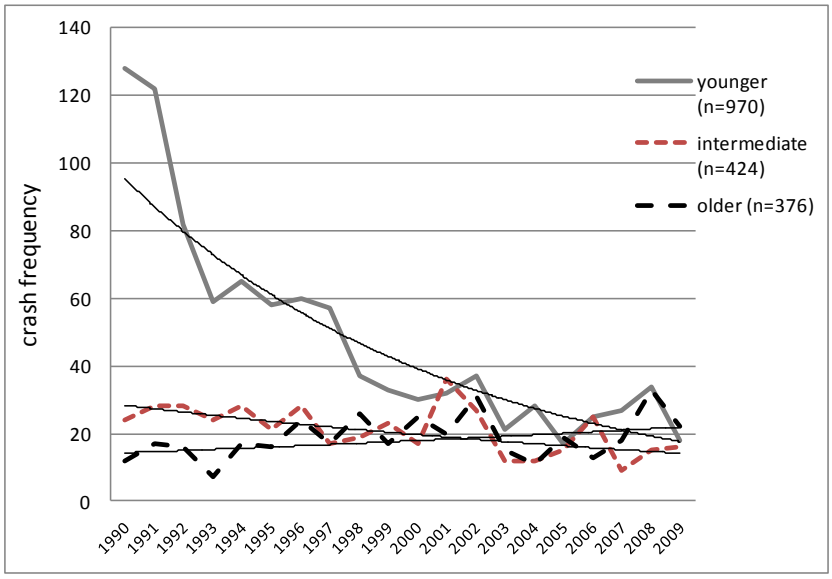

Figure 10: Frequency of low speed limit (60kph and below) non-metropolitan motorcycle crashes for each age group per year 1990-2009

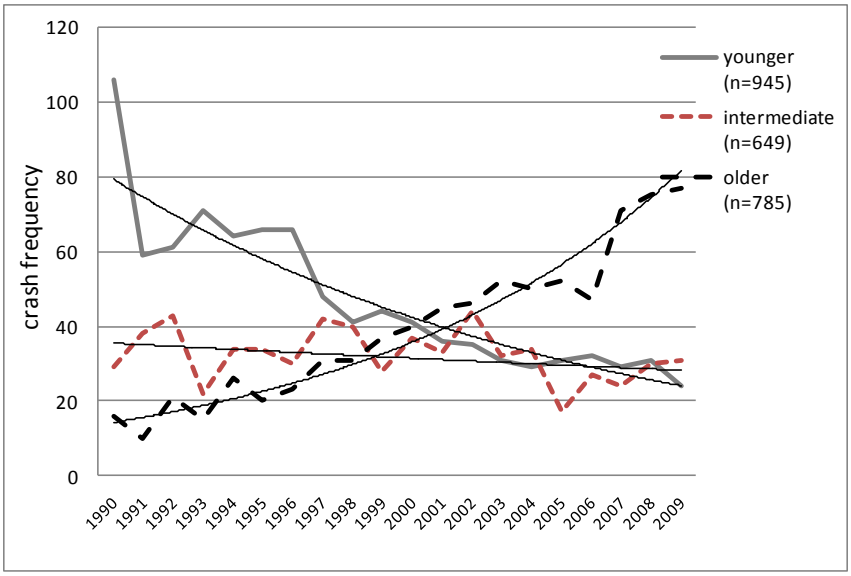

Figure 11: Frequency of high speed limit (60kph and above) non-metropolitan motorcycle crashes for each age group per year 1990-2009

Distribution of crashes per year from 1990 to 2009 for male and female motorcyclists in South Australia

Figure 12 shows crashes per year for male and female motorcyclists. Note that due to the differences in the total frequency of crashes between the two categories, the total crashes for males has been divided by 10 in order to better present the two sets of data on the same figure. It can be seen in Figure 12 that, apart for the difference in total frequency of crashes, there appears to be a similar trend in distribution of crash frequency over time for both genders.

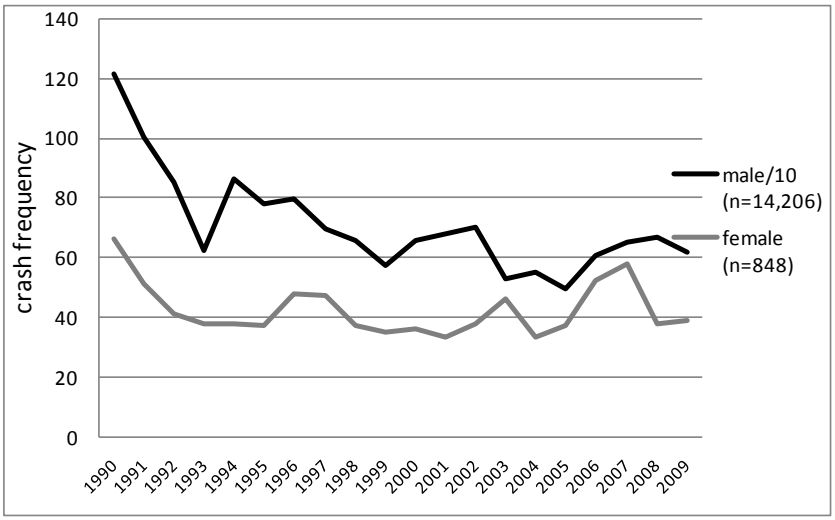

Figure 12: Comparison of male and female total motorcycle crashes per year 1990-2009
***Note: Total male motorcyclist crashes divided by 10**

Analysis of age groups for male and female motorcyclists involved in crashes in South Australia 1990 to 2009

A comparison of each age group according to gender of the motorcyclist revealed the same trends as identified in the above analyses. The greatest decline in crash frequency over time has been for the younger age group, for both male and females. The intermediate age group has remained consistent in crash frequency for females, with a slight declining trend over time for male intermediate ages. The older age groups showed an increasing trend over time for both genders, but a much greater increase in crash frequency for male older motorcyclists.

Discussion

The results show the recurring trend of a decrease in the frequency of motorcycle crashes in South Australia from 1990 to 2009, for the younger age group (16-29yrs), a stable trend for the intermediate age group (30-39yrs), and an increase in crash frequency for the older age group (40yrs and above). This was seen in each of the analyses, whether it was total motorcycle crashes, single and multiple vehicle crashes, analyses of speed and geographic location, or in the gender of the rider. Therefore, it appears that the trends over time are very different for the different age groups.

Unfortunately, an examination of overall registration data could not provide an explanation for this finding. The sales and registration data indicate increases in the number of motorcycles in roads in recent years but more detailed data separating motorcycle numbers by age group with motorcycle type and size is necessary to examine the possibility of changes in exposure across age groups (ABS, 2010). It may be that there has been a shift in modal choice between the age groups, with younger people preferring a car over a motorcycle, and older people using motorcycles for recreation. The results show some support for this as there was a much higher frequency in high speed non-metropolitan, and single vehicle crashes for the older age group, suggestive of recreational riding.

Alternatively, the differences in crash trends between age groups may be due to differences in safety and riding behaviour. The reduction in frequency of crashes for

the younger age group in recent years may be due to safer riding or the type of riding (commuting rather than recreational). The increase in crashes for the older age groups may be due to an increase in "returning" riders with expendable income (Jamson & Chorlton, 2009). These returning riders may overestimate their retained riding skills, particularly in light of the advances in motorcycle power and technology from 10 to 20 years ago. Haworth and Mulvihill suggest that returning riders were less likely to have taken a refresher training course, less likely have ridden for commuting or general transport and exhibit a pattern of riding which places them at a higher crash risk than other riders (Haworth & Mulvihill, 2005).

It is suggested that further research be conducted into the types of motorcycles involved in crashes, as well as more detailed research looking at the riding patterns and motivations of riders in different age groups. At present the police reported data of TARS do not include this information. This may prove useful in determining economic trends for age groups, motivational and behavioural trends over time allowing for identification of specific risks each group is exposed to.

It is suggested from this research that future interventions be directed to specific age groups and their motivation for riding. Targeted policing or education policies for recreational riding for older and returning riders may be of benefit, while a focus on strategies for commuting riding for younger motorcyclists may be a positive approach.

Conclusions

In conclusion, the increase in motorcycle crash frequency for the older age group in recent years needs to be examined further. The economic, social and behavioural motivation for their increase in crash frequency is not clear from the police-reported crash data alone. This group may provide an opportunity for targeted safety and training campaigns.

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