A SURVEY OF THE CRASH CHARACTERISTICS OF OLDER MOTORCYCLISTS

CM Mulvihill and NL Haworth
Monash University Accident Research Centre
Ph: 61 3 9905 4370, Fax: 61 3 9905 1809
email: Narelle.haworth@general.monash.edu.au

ABSTRACT

Motorcyclist fatalities and injuries are increasing in many developed countries as a result of an increase in crashes involving older riders (defined as aged 25 and over). Older riders can be categorised into three groups: continuing riders, returned riders and new riders. While there is widespread concern about the safety of returning riders, little is known about their crashes because returned and continuing riders cannot be separated in the mass crash data or the licensing data.

Therefore, an on-line survey of motorcycle riders aged 25 and over who have ridden in Australia in the last five years was undertaken. The survey compared the crash involvement of continuing, returned and new riders, assessed whether the factors contributing to these crashes differed and identified the implications for the content and effectiveness of rider training and other road safety measures.

The survey questionnaire collected information about riding patterns and crash involvement in the past five years and details of the most recent crash including: where and when it occurred, pre-crash factors, motorcycle characteristics and how the crash occurred. This paper focuses on the characteristics of crashes involving the three groups of older riders and their implications for rider training.

INTRODUCTION

The number of older motorcyclists killed or injured in crashes has increased in the last decade in many developed countries including the United States (Shankar, 2001; Stutts, Foss & Svoboda, 2004), Great Britain (Sexton, Baughan, Elliot & Maycock, 2004) and Australia (ATSB, 2002). In some countries, this increase has been the main contributor to an overall rise in motorcyclist crashes.

In Australia, the number of motorcyclist fatalities fell from a high of 299 in 1989 to 175 in 1997 and increased to 224 in 2002. The number of motorcyclist fatalities dropped back to188 in 2003 and increased again to 196 in 2004. However, since 1991, there has been a decrease in the number of riders aged under 25 killed and an increase in the number of riders aged over 25 killed. The percentage of riders killed aged over 25 increased from 49% in 1991 to 68% in 2004 (ATSB, 2005).

In Victoria, as in other jurisdictions, the involvement of "older" motorcyclists in crashes has increased since 1990. The number of riders in crashes aged 30 and over increased from 501 in 1991 to 1,120 in 2003. In contrast, the number of riders in crashes aged under 30 fell from 1,353 in 1991 to 663 in 2003. Riders aged 30 and over comprised 26.8% of riders in crashes in 1991 and this increased to 63.2% in 2003.

The trends in motorcycle involvement in crashes have mirrored changes in motorcycle registration and rider licensing. Australia-wide data from the Australian Bureau of Statistics (ABS) Motor Vehicle Census 2004 (ABS, 2005) shows that the number of motorcycles registered increased by 18.7% from 1999 to 2004. In contrast, numbers of passenger vehicles registered increased by only 9.7% over the same period. In New South Wales, the number of motorcycles registered to people aged 40 and over increased by 57% between 1995 and 2000, while the number of motorcycles registered to people aged under 25 years decreased by 33% (de Rome and Stanford, 2002). At the same time, the number of licences held by older riders also increased.

The pattern of riding by older riders may also contribute to their involvement in severe crashes. In New South Wales in 2000, older riders were involved in crashes further from home and more commonly on main roads and highways (with presumably higher travel speeds and the potential for more severe injury) than younger riders (RTA, 2000 cited in Christie and Newland, 2001). Similarly, in Victoria during the period 1991 to 2000, riders aged 30 and over were involved in relatively more rural crashes than younger riders. In New South Wales and Victoria, older riders (defined in New South Wales as riders aged 40 and over) were more likely than younger riders to be involved in single vehicle crashes and in crashes on curves and were less likely than younger riders to crash at intersections (Haworth, Mulvihill and Symmons, 2002; de Rome and Stanford, 2002). The finding that older riders were also over-involved in crashes in medium (65-95km/h) and high speed zones (100-110 km/h), suggests that this pattern of crashes may indicate a pattern of open road riding rather than commuting.

Older riders can be categorised into three groups:

- Riders who have held licences and ridden for many years (continuing riders)
- Riders who have held licences for many years but have returned to riding only recently (returned riders)
- Riders who have only obtained a licence recently (new riders).

Considerable concern has been expressed about the safety of returned riders (e.g. Christie and Newland, 2001; Haworth et al., 2002). Haworth et al. (2002) conducted a survey of older riders aged 30 and over in Victoria and found that while less than 10 percent of riders reported being involved in a crash, returned riders exhibited a pattern of riding which might place them at a higher crash risk than continuing and new riders. Returned riders were less likely than new riders to have undertaken a training course and were more likely to ride for recreation than continuing riders. Returned riders were more likely to have never commuted, have stopped commuting, have started touring and have never ridden for general transport. The pattern of riding among returned riders is suggestive of a pattern of open road riding; one that possibly has a greater potential for severe crashes. Haworth, Smith, Brumen and Pronk (1997) demonstrated that the crash risk associated with recreational riding is at least double that of commuting or general transport.

As the numbers of crashed riders in Haworth et al's (2002) survey were too small to detect reliable differences in crash frequency among continuing, returned and new riders, it was not possible to make conclusions about potential contributory factors in the crashes of these groups. As returned and continuing riders cannot be separated in the mass crash data or the licensing data, it was also not possible to determine differences in crash frequency or crash characteristics between continuing, returned and new riders using these sources.

The research aimed to support and extend the work of Haworth et al. (2002) by focusing in detail on the crash involvement patterns of a large sample of older riders in Australia. Older riders are defined differently in different states. As the target audience includes riders nation-wide and the most common definition of an older rider is a rider aged 25 or over, older riders were defined as those aged 25 and over.

METHOD

An on-line survey of motorcycle riders aged 25 and over was undertaken to explore potential contributors to crash risk such as attitudes, personal characteristics, self-reported riding behaviours and level of experience and training. The rationale for choosing this method and its advantages and disadvantages are discussed in a companion paper (Mulvihill & Haworth, 2005).

As the primary focus of the survey was to identify the characteristics of crashes of older riders, it was originally proposed to survey crashed riders only. However, it became apparent that interpretation of some of the contributing factors to crashes would be difficult in the absence of responses from a non-crashed group. Therefore the design of the survey was modified to allow this control information to be collected.

The questionnaire was designed to tap those variables regarded as likely to influence crashes involving motorcycle riders and which could be measured using self-reported questionnaire scales. The questionnaire consisted of seven sections that addressed:

1. Rider licence and training experience
2. Riding patterns
3. Rider accidents in the last five years
4. Rider most recent accident – when and where
5. Rider most recent accident - who and why
6. Personal information
7. Rider attitudes and experience

Riders who had been involved in at least one crash in the last five years were asked to complete all sections. Riders who had not been involved in at least one crash did not complete sections 4 and 5 (and parts of section 3). A crash was defined as having occurred on the road in Australia, and where someone was hurt, or the Police were called, or a vehicle was damaged to the extent that it had to be taken away.

The questions in the first two sections were mostly taken from the Motorcycling After 30 – Rider Questionnaire developed by Haworth et al. (2002) to examine Victorian licence holders aged over 30 years. Most of the items in the next two sections were taken from the Motorcycle Accident Questionnaire and Site Inspection Form developed by Haworth, Smith, Brumen and Pronk (1997) for their Case Control Study of motorcycle crashes in Victoria and the UK Survey of Motorcyclists developed by Sexton, Baughan, Elliot and Maycock (2004).

Riders were informed about the survey through four main avenues:

- advertisements placed in popular motorcycling magazines,
- an article in the Royal Automobile Club of Victoria (RACV) magazine,
- meetings, newsletters and websites of motorcycling clubs, and
- links or other information about the survey on websites likely to be visited by riders.

We attempted to minimise the problems of lack of Internet access and computer illiteracy by providing potential respondents the option to contact us to obtain a paper copy of the survey that could be returned to us via the post. This option was written into all of the advertising materials. A link was provided in the on-line questionnaire to a 'tips' page which respondents could access if they were experiencing difficulty accessing the survey due to problems of incompatible hardware or software systems.

Ethics approval for the study was granted by the Monash University Standing Committee on Ethics in Research on Humans on 14th February 2005. A draft questionnaire was posted on the Internet on 23rd February 2005 and piloted until 9th March 2005. The revised questionnaire was posted on the Internet on 9th March 2005. The closing date for the survey was mid-June 2005.

RESULTS

Survey responses

It is difficult to estimate a response rate for Internet-based surveys because the number of people who become aware of the survey but decide not to complete it is not known. Given the inability to calculate a traditional response rate for this study, an attempt was made to estimate the proportion of site visitors who completed the survey.

During piloting, 154 completed surveys were received. There were no counters in place during this period. Two counters were placed on the website for the final questionnaire. The first counter recorded that the introductory pages of the questionnaire (the Introduction and Explanatory Statement) were accessed 2,343 times. The second counter recorded 1,842 instances of someone accessing the questionnaire. Some of the discrepancy between the counters may have represented potential participants who were ineligible because they responded "No" to the filter questions relating to being 25 years or over and having ridden in Australia in the past five years.

Questionnaires were submitted by 1,290 respondents. The number of submitted questionnaires was thus 55% of Counter 1 and 70% of Counter 2. However, it is possible that individuals accessed the introductory pages of the questionnaire more than once before completing the questionnaire (e.g. read the introductory material and then decided to complete the questionnaire at a later time). Therefore these percentages are likely to be underestimates of the percentage of riders who accessed the questionnaire who then went on to complete it.

Paper copies of the questionnaire were requested by 101 people and 71 (70%) completed questionnaires were mailed back. Another three people printed their own copies of the questionnaire and mailed them back. In total, 1,518 respondents completed the questionnaire (1,290 online, 74 paper, 154 pilot). Of these, 18 cases were excluded because they did not answer most or all of the questions.

General characteristics of respondents

Of the 1,500 valid questionnaires, 930 (62%) were submitted by continuing riders, 281 (19%) were from new riders, and 262 were from returned riders (17%). Overall, most (45%) of respondents were residents of Victoria, with 28% from New South Wales and 13% from Queensland. Most respondents stated that they rode in both rural and urban areas.

Table 1 Characteristics of new, continuing and returned riders.

Characteristic	New	Continuing	Returned	
Mean age	39.3	45.6	49.3	$F(2,1470)=45.4$, $p<.001$
Age group				$\chi^2(8)=141.1$, $p<.001$
25-34	43.7%	21.7%	8.9%	
35-44	30.7%	27.0%	19.3%	
45-54	17.7%	34.3%	47.1%	
55-64	6.5%	13.6%	22.0%	
65+	1.4%	3.4%	2.7%	
Male	71.3%	92.2%	91.5%	$\chi^2(2)=91.7$, $p<.001$
Training course	93.2%	67.1%	56.9%	$\chi^2(2)=97.9$, $p<.001$
Years since licensed (SD)	2.3 (2.0)	21.1 (12.6)	26.5 (11.1)	$F(2,1386)=287.7$, $p<.001$

The characteristics of the three groups are summarised in Table 1. A one-way analysis of variance with post-hoc tests confirmed that the mean age of returned riders was higher than that of continuing riders which was higher than that of new riders. Chi-square tests were used to test the significance of differences in the proportions of riders from the three groups having particular characteristics and the significance values are presented in the tables. There were relatively more new riders in the 25-34 age group (44%) and relatively more returned riders in the 45-54 year age group (47%). Females comprised a larger proportion of new riders (29%) than continuing or returned riders (8% and 9%).

The three groups of riders also differed in their riding patterns (Table 2). Returned riders rode less distance per week and less often than continuing or new riders. The motorcycle was less likely to be their main means of transport and they were more likely to ride from October to March only (the warmer months).

Table 2 Riding patterns.

Characteristic	New	Continuing	Returned	Chi-square
Distance ridden per week (kms)				$\chi^2(12)=31.0$, $p<.005$
Zero	9.7%	6.5%	12.4%	
Less than 50	19.4%	13.9%	18.9%	
51-100	24.5%	26.4%	26.3%	
101-200	20.5%	21.7%	19.3%	
201-300	12.6%	12.6%	9.7%	
301-400	13.3%	16.3%	13.1%	
400+	0.0%	2.5%	0.4%	
Frequency of riding				$\chi^2(10)=51.4$, $p<.001$
Not at all	1.4%	1.3%	1.5%	
1-5 days/year	2.5%	2.6%	3.8%	
1-3 days/month	8.0%	13.7%	24.1%	
1-2 days/week	31.5%	28.3%	35.6%	
3+ days/week	56.2%	53.4%	33.3%	
Other	0.4%	0.8%	1.5%	
Main means of transport				$\chi^2(4)=67.2$, $p<.001$
Mostly motorcycle	38.0%	38.9%	18.4%	
Mostly car/other	33.3%	35.4%	61.3%	
Mixture motorcycle and car/other	28.7%	25.7%	20.3%	
Ride October to March only	9.7%	8.7%	14.2%	$\chi^2(2)=6.5$, $p<.05$

Crash involvement

Riders were asked how many crashes they had been involved in while riding their motorcycles on Australian roads in the last five years. They were asked to include only those crashes in which someone was hurt, the Police were called, or a vehicle was damaged to the extent that it had to be taken away. Overall, 445 riders (about 30%) reported that they had been involved in at least one crash. About 75% of these riders had been involved in one crash, 20% in two crashes, 4% in three crashes and 2% in four crashes.

The characteristics of riders who reported being involved in one or more crashes are compared with those of non-crash-involved riders in Table 3. Crash-involved riders were younger on average and more likely to be male. Continuing riders were over-represented among crash-involved riders. Crash-involved riders rode further per week and more frequently. The association between continuing riders and crash involvement is likely to reflect the fact that continuing riders rode further than returned and new riders.

For those riders who were crash involved, crash severity for the most recent crash was measured in terms of injuries sustained to the rider and the damage to the rider's motorcycle. Riders most commonly suffered slight injuries (cuts and bruises) (46% of crashes) rather than

no injuries or serious injuries. The percentages of riders in crashes who were not injured were similar across the groups (18-21%). Compared to continuing and returned riders, new riders in crashes were more likely to be slightly injured and less likely to be treated in a hospital emergency department or admitted to hospital.

Riders aged 55-64 were over-represented in serious injury (admitted to hospital) crashes. This may be because older riders are more susceptible to injury in a crash than younger riders.

Sports style motorcycles were the most common style of motorcycle ridden at the time of the crash (30%), followed by sports/touring motorcycles (21%). There was no significant difference in the styles of motorcycles in crashes for continuing, returned and new riders ($\chi^2(12)= 16.9$, $p>.05$.) although continuing riders appeared somewhat less likely to be riding cruiser style motorcycles.

Table 3 Characteristics of riders reporting involvement in a crash in the last 5 years and those not involved.

Characteristic	Crash-involved	Non-crash involved	p Value
Mean age	41.0 (11.9)	44.7 (11.4)	$t(1341)=5.4$, $p<.001$
Male	91.6%	85.4%	$\chi^2(1)=10.2$, $p<.005$
Group			$\chi^2(2)=11.7$, $p<.005$
New	18.6%	20.2%	
Continuing	68.0%	59.5%	
Returned	13.4%	20.3%	
Distance ridden per week (km)			$\chi^2(6)=17.8$, $p<.01$
Zero	7.4%	9.5%	
Less than 50	12.7%	17.6%	
51-100	24.5%	27.7%	
101-200	22.7%	19.7%	
201-300	12.0%	10.4%	
301-400	18.3%	14.3%	
400+	2.3%	0.8%	
Frequency of riding			$\chi^2(5)=25.2$, $p<.001$
Not at all	2.9%	0.7%	
1-5 days/year	2.9%	2.5%	
1-3 days/month	10.6%	16.4%	
1-2 days/week	25.7%	31.6%	
3+ days/week	56.9%	48.1%	
Other	0.9%	0.7%	
Training course	77.5%	68.5%	$\chi^2(1)=12.0$, $p<.005$

Crash types

Over half of the crashes were single vehicle (53%) (involving the motorcycle only). New riders appeared to be over-represented in single vehicle crashes (61%) compared to returned riders (55%) and continuing riders (51%).

About 53% of crashes occurred in low speed riding environments (60 km/h or less speed zones). About 23% occurred in medium speed riding environments (70-90 km/h speed zones) and 24% occurred in high speed riding environments (100-110 km/h zones). A greater proportion of crashes were single-vehicle in high speed riding environments (74%) than in medium (56%) and low speed (42%) riding environments ($\chi^2(2)= 29.6$, $p<.001$).

Overall, 153 respondents stated that their most recent crash had occurred at an intersection (28% of those who answered this item). The most common type of intersection was a T-intersection. Similar percentages of continuing, returned and new riders stated that their crash occurred at an intersection.

An attempt was made to have riders categorize their most recent crash according to the Definitions for Classifying Accidents Code (DCA code); a system used in Victoria to classify and describe crashes based on their configurations. Riders were asked to select which of the 10 DCA groups best described their crash. Then, within that group, they were asked to select which scenario best described their crash. Cross-tabulation of the responses to these items with the responses to simpler items such as "number of vehicles" and "intersection or not" suggests that the results of the DCA coding process were unreliable. Further investigation is underway to determine whether the problems arose from difficulties experienced by the respondents or from programming or coding issues.

Contributing factors to crashes

The level of experience with that motorcycle prior to the crash differed significantly among the three groups of riders ($\chi^2(6)= 56.7$, $p<.001$.). New riders were most likely to have ridden the motorcycle less than 1,000 kms (13.6%), followed by returned riders (8.5%) then continuing riders (4.4%).

Riders were asked whether any of a list of road surface factors contributed to their crash (multiple responses were allowed). Slippery surface (18% of riders in crashes) and loose gravel (18% of riders in crashes) were the road factors most commonly nominated by all three groups of riders. New riders were somewhat more likely to nominate loose gravel and less likely to nominate slippery surface.

Overall, 46% of riders said they were "not at all to blame" for the crash, 18% said "a little", 17% said "entirely", 12% said "a lot" and 7% said "about half". A larger proportion of continuing riders reported that they were not at all to blame for the crash (52%) compared to returned (42%) and new riders (32%). A larger proportion of new riders reported that they were 'quite a lot' and 'entirely' to blame for their crash (20% quite a lot, 28% entirely) than returned (12% quite a lot, 22% entirely) and continuing riders (9% quite a lot, 12% entirely).

About half of the riders reported that there was nothing they could have done to avoid the crash. Another 15% reported that they could have avoided the crash if they had better observation skills and abilities and about 13% said they could have slowed down earlier.

Riders were asked to nominate the main contributors on their own part to the crash (multiple responses were allowed). In 32% of crashes, riders considered that there was no contribution on their part to the crash. In 35% of crashes, riders considered that they had not noticed something until it was too late. New riders were more likely to nominate at least one contributor on their part to the crash. New riders more commonly than other riders nominated not being able to handle the motorcycle well enough (27%), not knowing what to do in the situation (21%), being unfamiliar with the location (20%), going too fast (17%) and not braking quick enough (12%).

The main contributors on part of other driver in multi-vehicle crashes (multiple responses were allowed) were considered by riders to be not noticing something until it was too late (40% of crashes), doing something unpredictable (32%), not giving way (31%) and being distracted or not concentrating (29%). Returned riders were more likely than other riders to consider that the other driver was going too fast (31%) or did not know what to do in the situation (31%). New riders were more likely than other riders to consider that the other driver did not notice something until too late (66%) or the driver was distracted or not concentrating (44%).

Rider training

Overall, 79% of respondents reported that they had undertaken a motorcycle rider training course. New riders were more significantly more likely to report that they had completed a training course (93%) than continuing (67%) and returned riders (57%). Continuing and returned riders were much more likely to have undertaken advanced rider training than new riders. New riders comprised a larger proportion of riders who had completed a Learner (22%) or a Licence course (48%) compared to continuing (5% Learner, 20% Licence) and returned riders (7% Learner, 13% Licence). Less than 10% of returned riders had completed a refresher course while almost 30% had completed an advanced course. Surprisingly, more continuing riders had completed a refresher course.

Riders who had completed a training course were more likely to have been involved in a crash. This counter-intuitive finding does not appear to be an artifact of trained riders riding further or more often, as both of these relationships were not statistically significant (training-distance ridden, $\chi^2(6)= 9.0$, $p>.05$; training-frequency ridden, $\chi^2(6)= 7.4$, $p>.05$). Rather, it appears to reflect the greater propensity for new riders to have undertaken training and their higher crash risk.

DISCUSSION

The results of this survey reinforce those of earlier studies (e.g. Haworth et al., 2002) that the distance ridden by many older riders is quite low. About half of the riders who responded rode less than 100 kms in an average week. Thus, motorcycling is a discretionary activity for these riders, rather than being their sole or favoured means of transport.

Continuing riders were over-represented among crash-involved riders, as were younger riders. Crash involvement increased with distance ridden and continuing riders rode further than new or returned riders. This may account for the over-representation of continuing riders in crashes. Older and returned riders appeared to be more seriously injured in crashes. It is

unclear from the data whether this outcome reflects differences in crash severity or greater susceptibility to injury in older adults.

New riders had relatively more single vehicle (motorcycle only) crashes than continuing or returned riders. The contributing factors appear to be inexperience on that particular motorcycle and difficulties with loose gravel and slippery surfaces.

These findings have important implications for rider training. The limited amount of riding by many riders means that skills that are trained may not receive sufficient practice. The paradox is that encouraging practice will increase exposure and, therefore, the absolute number of crashes.

Many returned riders have not taken refresher courses. New riders were more likely to have taken training courses than continuing or returned riders. Nevertheless, new riders reported a number of factors contributing to their crashes that relate to lack of development of both vehicle and cognitive skills specific to riding. These results suggest the need for increased skill development in a safe environment. More substantial off-road training for novice riders may have the potential to remedy some of these issues. Current training courses for novice riders are typically very short (one or two days) and do not provide sufficient skills for safe, unsupervised operation on real roads (Haworth, Smith & Kowadlo, 2000).

The positive relationship between training and crash involvement stemming from the greater propensity for new riders (who have a higher crash risk per km traveled) to have undertaken training was also found by Haworth et al. (2002).

REFERENCES

ABS (2005). Motor vehicle census 2004. Canberra: Australian Bureau of Statistics.

ATSB (2005). Road deaths Australia. 2004 statistical summary.

Christie, R. and Newland, R. (2001). Motorcyclist fatality and motorcycle sales patterns in Australia. Proceedings of the 2001 Road Safety Research, Policing and Education Conference, Melbourne, 18-20 November 2001.

de Rome, L and Stanford, G. (2002). Positioned for safety. Road safety strategic plan 2002-2005. Sydney: Motorcycle Council of NSW.

Haworth, N., Mulvihill, C. & Symmons, M. (2002). Motorcycling after 30. (Report 192). Melbourne: Monash University Accident Research Centre.

Haworth, N., Smith, R., Brumen, I., and Pronk, N. (1997). Case control study of motorcycle crashes (CR174). Canberra: Federal Office of Road Safety.

Haworth, N., Smith, R. and Kowadlo, N. (2000). Evaluation of rider training curriculum in Victoria. (Report 165). Melbourne: Monash University Accident Research Centre.

Mulvihill, C. & Haworth, N. (2005). Using the internet to collect survey data. Lessons from a survey of older riders in Australia. Paper submitted to the 2005 Road Safety Research, Policing and Education Conference, Wellington, 14-16 November 2005.

Sexton, B., Baughan, C., Elliot, M. & Maycock, G. (2004). The accident risk of motorcyclists. TRL Report. TRL 607. Department for Transport.

Shankar, U. (2001). Recent trends in fatal motorcycle crashes. In Proceedings of the 18th International Technical Conference on the Enhanced Safety of Vehicles. Washington. D.C.: National Highway Transport Safety Administration.

Stutts, J., Foss, R. & Svoboda, C. (2004). Characteristics of older motorcyclist crashes. Annual Proceedings of the Association for the Advancement of Automotive Medicine, 48, 197-211.

ACKNOWLEDGEMENTS

We would like to express our gratitude to the Motor Accidents Authority of New South Wales for funding this study. Thanks also to the motorcycle safety researchers and representatives of motorcycling organizations who provided feedback on the draft questionnaire and helped publicise the survey. Our special thanks to all the motorcyclists who completed the survey.

Ashley Verdoorn and Glenda Cairns did a great job in making the Internet survey work. Ian Morrison entered the data from paper questionnaires.