Exposure Study by Motorcycle Make and Type

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Biography

Dr Ron Christie is a registered psychologist and educator with over 20 years experience in the areas of road safety policy, program and countermeasure development/evaluation. Ron is a Member of the Australian Psychological Society and is a member of the US Transportation Research Board, Committee on Operator Education & Regulation. He was formerly Manager, Road User Behaviour with VicRoads and has been in private consulting practice for the last eight years. He has completed various road safety projects in Australia, Canada and New Zealand for government and private sector organizations.

Abstract

This study, funded by the Motor Accidents Authority of NSW (MAA), aimed to determine the annual distance travelled by registered motorcycles in NSW by make and type. This information was then related to patterns of crash involvement and crash risk for NSW motorcycles. The exposure survey was conducted in two parts with an initial mail-out to a random sample of 6,000 owners of NSW registered motorcycles to collect baseline survey data and odometer readings followed by a further mailing 6 months later to collect a final odometer reading and further information on usage patterns. The NSW Roads & Traffic Authority (RTA) assisted in drawing the initial sample of current motorcycle owners. A blind technique was used to protect the privacy of those in the sample and only mass, anonymous data were used in the analysis and preparation of this paper.

The paper summarises the analysis of exposure/usage data from the second, follow-up survey. Distance travelled estimates are compared with those from recent Australian Bureau of Statistics (ABS) vehicle usage surveys. Usage patterns by variables such as type and make of motorcycle, age of rider, experience of rider and area of residence are also reported. Self-reported crash involvement patterns are also reported and analysed. Overall, the preliminary pattern of results reported is not inconsistent with that reported in the Australian and international literature. However, it is of note that the estimated annual distance travelled for motorcycles in the sample was substantially higher than that of the last (2001) ABS estimate. This implies that the exposure to risk of motorcycles may be higher than previously thought. While this moderates the over-involvement of motorcycles relative to passenger cars per distance travelled, the relative risk is still very high.

1. INTRODUCTION AND BACKGROUND

The Motor Accidents Authority of NSW (MAA) commissioned an exposure study (ie distance travelled) of registered NSW motorcycles by type and make. The study aimed to determine the annual distance travelled by registered motorcycles in NSW by make and type then relate this to patterns of crash involvement and crash risk. Given the rising levels of motorcycle registrations and crashes experienced in NSW and other Australian jurisdictions in the last 5-10 years (Christie & Newland, 2001; Australian Transport Safety Bureau (ATSB), 2002), it was considered that contemporary data on usage/exposure would be useful to road safety practitioners and policy makers.

The exposure survey was conducted in two parts with an initial mail out to a random sample of 6,000 owners of NSW registered motorcycles to collect baseline survey data (January 2003) and odometer readings followed by a further mailing 6 months later (July 2003) to collect a final

odometer reading and further information on usage patterns. The NSW Roads & Traffic authority (RTA) assisted in drawing a random sample of current motorcycle owners for the initial mailing. To help prevent geographical bias, the sample was stratified to select balanced proportions of registered owners from the Sydney Statistical division, the Hunter Statistical Division and the rest of NSW. A blind technique was used to protect the privacy of those in the sample such that the researchers and MAA did not know the names or addresses of those owners drawn. To comply with privacy laws and confidentiality guidelines, only mass, anonymous data were used in the analysis and preparation of this paper.

The study targeted registered motorcycles as this was more likely to be valid and reliable relative to one based on rider licensing data for exposure purposes, as many motorcycle licence holders are inactive or dormant (the ratio of licence holders to registered motorcycles in NSW is almost five to one) (Christie & Harrison, 2002). While one could assume that a currently registered motorcycle was being used on-road by its registered owner, one could not assume that a person holding a motorcycle licence was an active rider. Participation in the survey was voluntary. However, the opportunity to win a full set of motorcycle leathers, boots, gloves and a prestige helmet was offered as an incentive by the consultants conducting the survey. A total of 2,226 survey returns were received from the initial mailing (a return rate of about 37%) and 1,010 from the follow-up (return rate about 44%). However, only 794 follow-up surveys were usable (ie 216 participants had either not supplied odometer readings at all, not supplied the second odometer reading, supplied erroneous or illegible readings, not supplied details of their motorcycle or had purchased a new motorcycle during the study period).

Apart from collecting the odometer readings, the short survey questionnaires used in both the first and follow-up surveys asked registered owners for information about where and when they used their motorcycle and for what purpose. It also gathered biographical information about the owner (eg age, gender and riding experience), summary information in respect of the motorcycle (eg make, model, age and engine capacity) and crash history.

This paper summarises the analysis of survey data from the second and final phase of the study (n=794). Usage and self-reported crash patterns by variables such as type of motorcycle, age of rider, experience of rider and area of residence are reported. As this paper provides only a brief overview, without explanatory tables and figures, the authors refer the reader to the full report when it is published by MAA for a more comprehensive treatment.

2. ANALYSIS AND RESULTS

Make and Type

Motorcycle type rather than model or make was used in the analysis as numerous models, and variants, were identified across 22 makes in the dataset. However, the proportions of motorcycles by make were similar to those found in the RTA NSW registration database and reported in Christie (2002). Eight makes accounted for more than 95% of all motorcycles in the sample (ie in descending order Honda 25.1%, Yamaha, 19%, Suzuki, 12.4, Kawasaki, 13.1% BMW, 9.9%, Harley- Davidson, 8.7%, Ducati, 3.9%, Triumph 3.3%). Relative to the RTA register, the sample contained higher proportions of BMWs (more than twice the representation in the RTA register). BMWs are mainly touring and sports-touring machines. Ducati and Triumph were also slightly over-represented in the sample. Honda, the largest manufacturer, was slightly underrepresented in the sample as were Harley Davidson and Suzuki.

For analysis purposes, motorcycles were classified against seven of the 10 basic types based on structure, configuration and intended use that appeared in National Highway Traffic Safety Administration/ Motorcycle Safety Foundation (NHTSA/MSF) (2000) and are commonly used within the motorcycle industry (ie traditional/naked, sports, cruiser, tourer, sports-tourer, trail/dual-purpose and scooter). Due to their low numbers, trikes and

motorcycle-sidecar combinations were not included in the sample. There were also no motorcycles of the tenth NHTSA/MSF *Other* classifications. The sample (n=794) comprised about 14% traditional/naked type motorcycles, 18% cruisers, 40% sports machines, 9% tourers, 1% sports-tourers, 13% trail/dual use and 4% scooters. As only 10 Sports-Tourer type motorcycles appeared in the sample, these were excluded from analysis by type.

Age, Gender and Residential Location

The majority of respondents were male (93%) and held a full NSW motorcycle licence (95%). Males tended to be older than females (ie mean age 44 years cf 40 years) and to have greater years of riding experience (ie mean 20 years cf 7 years). In median terms, respondents were 43 years old, rode 750cc machines that were about six years old, had about 18 years road riding experience and estimated that they rode about 5000 kilometres per annum. There was a statistically significant correlation (r=. 6) between estimated and actual annual distance travelled as measured by odometer.

The majority (45%) of respondents lived in the Sydney Statistical Division (SD) while 13% lived in the Hunter SD, 9% in the Illawarra SD and the balance in the Rest of NSW (34%)

Response patterns showed that those who completed the second, follow-up survey were more likely to be older riders with higher exposure levels (ie they rode more kilometres per week, month or year) – age and exposure differences were statistically significant (p<. 05). However, follow-up survey response was not significantly related (ie p>.05) to type of motorcycle, gender, licence type, self –reported accident record (from first survey), or place of residence.

Distance Travelled

An estimate of riding exposure (distance) was calculated as the difference between odometer readings multiplied by 365 divided by the number of days that elapsed between the two odometer readings. This produced the pattern shown in Figure 1 with a mean annual exposure of 5,208 km and a median of 3,576 km. It is of note that males rode significantly (p<. 05) greater annual distances than females - about 30% more.

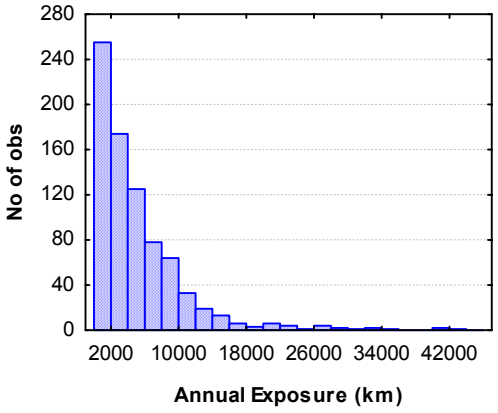

Figure 1. Annual exposure (km) from odometer readings by number of respondents

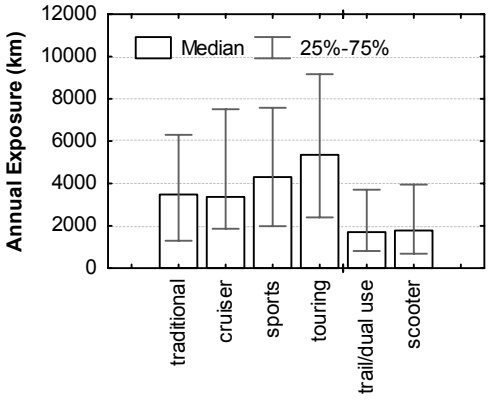

Figure 2. Median annual exposure (km) by motorcycle type

The mean annual distance traveled obtained for this sample is some 27% higher than the 4,100 km reported for Australian motorcycles in the last (October 2001) Australian Bureau of Statistics (ABS) vehicle usage survey (ABS, 2003). However, as noted in Christie & Harrison (2001), the ABS considered their estimates for motorcycles to be less reliable than those for other vehicles and to be underestimates rather than over estimates. The findings reported

here support the view that the ABS may have considerably underestimated the distance travelled by motorcycles on Australian roads. Notwithstanding this comment, it is clear from Figure 1 that about one third of respondents rode no more than about 2,000 km in a 12 month period and that the number riding more than the mean was very small.

When motorcycle type was considered, the pattern shown in Figure 2 emerged, showing that touring and sports machines travelled more kilometres per annum than other types. While this is not surprising for the former, it is somewhat unexpected for the latter. While traditional and cruiser types occupied the middle ground, trail/dual use machines and scooters travelled the lowest distances per annum, markedly less (ie half to one third) than all other types. This was perhaps to be expected as scooters are used mainly in urban settings and comments by some respondents suggested that trail bikes were often transported to rural locations for use.

While there was a statistically significant relationship between annual exposure and type of motorcycle ($p < .001$), there was none in respect of exposure and place of residence or age group quartile. Annual exposure was negatively correlated with the percentage of riding on roads in cities, towns, or suburbs ($r = -.08$), and was positively correlated with the amount of driving on urban and rural freeways ($r = .15, .18$ respectively). Likewise, annual exposure was correlated with weekday riding ($r = .2$), and with riding for commuting ($r = .2$). This suggests that those riding for commuting purposes and on other than local roads accumulate higher annual exposure levels (km travelled).

Crash Rate Estimates

The crash rate was calculated for groups of survey participants by dividing the number of self-reported crashes per year by the annual exposure estimate. The rate was expressed as the number of crashes per 100,000 km traveled. It should be noted that respondents were asked for the number of crashes of all types in which they were involved as a rider (regardless of severity or fault) in the previous 5 year period.

Analysis showed that the number of crashes was significantly correlated with the annual exposure estimate (spearman $r = .14$). The mean crash rate was 0.96 crashes per 100,000 km. This rate was higher for females (ie 1.03 crashes/100,000 km female and 0.96 crashes/100,000 km male) – difference NS. However, the numbers of crashes did not differ.

Differences in crash rates by motorcycle type are shown in Figure 3. Analysis showed that annual exposure and the number of crashes were both related to motorcycle type ($p < .001$ and $p < .05$ respectively). It is of note that, despite their low exposure in terms of annual kilometres travelled, the crash risk of trail/dual use machines was more than twice that of sports machines which, in turn, carried more than twice the risk of the remaining motorcycle types. Scooters showed the lowest crash risk relative to other types. A similar pattern to Figure 3 is found when crash numbers rather than risk are plotted.

It is of note that cluster analysis revealed a low-exposure cluster of riders with a high percentage of riding in off-road situations, low levels of on-road riding in all contexts, low level of weekday and commuting riding, and a high level of recreational riding. About 77% of motorcycles in this cluster were trail bikes. This cluster carried a crash risk two to six times that of other rider groups.

Two other high crash risk clusters emerged. One was characterised by a low level of experience and a high level of riding to commute on urban 2-way roads during the week. About 52% of motorcycles in this group were sports bikes. The other was a low-exposure group characterised by a high level of recreational riding on urban 2-way roads. About 40% of motorcycles in this group were sports bikes, and cruisers (21%) and traditional bikes (19%) also figured prominently. While both of these groups carried lower risk than the off-road cluster noted above, their crash risk was two to three times that of other groups.

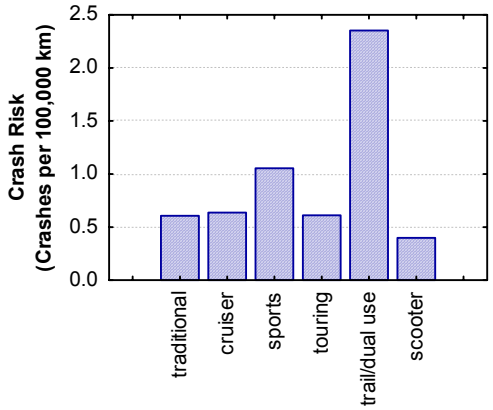

Figure 3. Crash risk (self reported) by motorcycle type

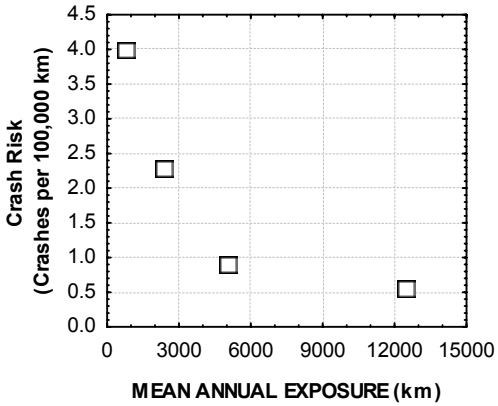

Figure 4. Crash risk by mean annual exposure

Although there were no significant differences in respect of exposure by SD, crash risk was significantly higher in the Sydney SD (1.2 crashes/100,000 km) relative to Illawarra (0.5 crashes/100,000 km), Hunter SD (0.8 crashes/100,000 km) and rest of NSW (0.7 crashes/100,000 km).

Crash risk was significantly related to age group (sample divided into quartiles) ($p < .0001$), indicating that those in the youngest quartile carried the highest risk (1.7 crashes/100,000 km) relative to the older quartiles (0.6, 0.85 and 0.5 crashes/100,000 km, respectively). The higher risk per distance travelled carried by young riders is not surprising and is consistent with previous research.

When crash risk by exposure group (defined as quartiles) was considered, the number of crashes was significantly related to exposure ($p < .05$) such that higher exposure levels were associated with more crashes, but the rate of increase in crash numbers with exposure was not as great as the rate of increase in exposure. This is shown more clearly in Figure 4 which shows crash risk at each mean estimate of annual exposure for the four exposure groups.

3. DISCUSSION

If the estimate of average annual distance from the sample is reliable, this implies that the exposure to risk of motorcycles is higher than previously thought – perhaps up to 27% higher. This would in turn reduce fatality estimates for motorcycles relative to passenger cars per distance travelled by a similar amount (from about 29 times higher to about 18 – based on Bureau of Transport Economic (BTE) (2000).

The over-representation of trail/dual use and sports type machines noted above is consistent with the conclusions of Christie (2002). In particular, the marked over-representation of trail/dual use motorcycles is of concern, as the actual exposure of this type is the lowest of all those examined. It suggests that greater levels of risk may attach to this type of motorcycle or to particular usage or location factors not explored in this study. Off-road or track/trail crashes may also differ from those that appear in mainstream crash data inn terms of probability and severity. However, Christie (2002) showed that injury severity levels for trail/dual use rider crashes were lower relative to those resulting from sports machine crashes and cost less in respect of individual MAA claims. This may suggest that sports type crashes may be a more productive target for countermeasure attention in terms of severity and cost reduction.

The higher risk of crashes in the Sydney SD is not surprising as there is perhaps greater opportunity for conflict with other road users in a busy, highly urbanized traffic environment relative to more rural and quieter situations.

This pattern where high exposure appears to moderate crash risk has been reported elsewhere in the literature in respect of car drivers (Hakamies-Blomqvist, 2003) and, to some extent, highly exposed truck drivers (BTE, 2000). This suggests that high levels of exposure may be protective to some extent as to achieve such levels one would need to also accumulate high levels of on-road experience and the competency skills that come with this. However, to achieve this seemingly protective level one would first need to pass through lower, perhaps more risky experience/exposure bands. In view of this, one could not simply advocate low-exposure riders using their motorcycles more on-road to achieve higher exposure/experience levels. As ABS usage surveys over the last decade suggest that exposure (annual distance travelled) is falling for motorcycles ABS (2003) and other research suggests that recreational motorcycle use (eg on weekends only) is rising (Christie & Newland, 2001), one could speculate that the size of the low-exposure, high crash risk group will increase.

While this paper has given only a brief overview of the exposure data collected and analysed, the authors suggest that it has provided some insight into patterns motorcycle exposure in NSW and the crash risk associated with these patterns.

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Keywords

Motorcycles, exposure-to-risk, crashes, NSW, Australia