

Alcohol in motorcycle crashes

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ABSTRACT

A case-control study of motorcycle crashes was undertaken in which injured riders and pillion passengers from 222 crashes in Melbourne, Australia were compared with 1200 motorcyclists riding through the crash sites at the same time of day and week.

Having a BAC greater than zero was associated with a five-fold increase in the odds of crashing compared to having a BAC of zero. The increase in risk associated with a BAC of greater than 0.05% was about forty-fold.

Night-time crashes were more likely to involve alcohol and had fewer controls than daytime crashes. Alcohol may play a smaller role in motorcycle crashes than in car crashes because of the largely daytime pattern of motorcycle riding.

Having a positive BAC was associated with greater riding experience, unlicensed riding, riding a borrowed motorcycle, carrying a pillion passenger, illicit drug use, excessive speed and single-vehicle crashes.

The odds ratios related to BAC level were possibly reduced by matching cases and controls on time of day and day of week and by the greater range of BAC values for cases than controls.

INTRODUCTION

In 1998, motorcyclists comprised 11.5% of road users killed and 11.1% of road users seriously injured in the State of Victoria, Australia. Yet, exposure measures collected as part of the case-control study reported here found that motorcycles comprise less than 1% of the traffic stream. Australia-wide analyses have demonstrated that the fatality and serious injury rates per 100 million kilometres travelled in 1995 were more than 20 times greater for motorcyclists than car drivers (Federal Office of Road Safety, 1997).

While a number of published studies have reported a very high involvement of alcohol in motorcycle crashes (e.g., Bray, Szabo, Timmerman, Yen and Madison, 1985 in California and Larsen and Hardt-Madsen, 1987 in Denmark), this does not appear to be the case in Australia. In Victoria in 1992 to 1998, 21% of motorcycle riders killed in crashes had BAC>0.05% (the legal limit for fully-licensed drivers and riders) compared with 26% of drivers of cars and car derivatives killed in crashes. The BAC was greater than zero but did not exceed 0.05% for 4% of car drivers killed and 6% of motorcycle riders killed. BAC data was missing for only about 4% of both groups. Thus, the involvement of alcohol in fatal crashes appears to be similar for motorcycle riders and car drivers in Victoria.

The study reported here was undertaken to identify the risk factors for motorcycle crashes by comparing the characteristics of motorcyclists in crashes with those riding safely. A case-control approach was taken in which three types of information were collected:

- detailed descriptive information about the crash and the resultant injuries
- comparison of features of cases and controls (rider and pillion, motorcycle, trip), and
- motorcycle exposure information (gathered as part of the control collection process).

This paper focuses on the estimation of the risk associated with alcohol use by comparisons of cases and their controls. The reader who is interested in other risk factors or the characteristics of the crashes or the motorcycle exposure data will find these addressed in the project technical report (Haworth, Smith, Brumen and Pronk, 1997).

It should be noted that the paper does not address an important aspect of alcohol in motorcycle crashes, that of alcohol in the other driver in multiple-vehicle motorcycle crashes.

MATERIALS AND METHODS

Selection and recruitment of cases

The cases comprised motorcycle crashes occurring on public roads in the Melbourne metropolitan area in which the rider or pillion passenger attended one of the seven participating hospitals or died. All motorcyclists admitted to hospital, irrespective of injury level, were eligible to participate. For non-admitted patients, only motorcyclists with injuries corresponding to an Injury Severity Score (ISS) of 5 or greater were included. An example of injuries comprising an ISS of 5 would be a simple fracture in one leg and abrasions or contusions to another body region.

Injured motorcyclists were interviewed regarding the crash and previous riding details and their medical records were examined to determine weight, height and injury details. Helmets and motorcycles were inspected, and crash sites were inspected and ridden through to establish possible contributing roadway factors.

The Victoria Police notified the study team of the location and timing of fatal motorcycle crashes. Details of fatal crashes were provided by the investigating Police, witnesses and friends and relatives of the rider.

Selection and recruitment of controls

The controls were motorcyclist trips that passed the crash site at the same time of day and week as the crash occurred. Where possible, initial interviewing of control motorcyclists was conducted one week after the crash, with follow-up by telephone. In some instances, recruitment of controls was undertaken two (or occasionally more) weeks after the crash.

A two-person team stopped motorcyclists with signs and procedures in accordance with the VicRoads Worksite Traffic Management Code of Practice (VicRoads, 1995). Control motorcyclists who stopped were asked their date of birth, licence status and details of the current trip, and were breath-tested using a Lion 5D2 device. In addition, they were asked their first name and telephone number for a follow-up interview that assessed longer-term issues such as training and licensing.

A limited number of observational variables were collected for those motorcyclists who did not stop and those who stopped but declined to participate in the study.

Analysis design

This study utilised a matched design where an attempt was made to collect a set of controls for each case which were matched on time and location of riding. A matched analysis (conditional logistic regression) was used to calculate the odds ratios. The matched analysis had the advantage of overcoming difficulties associated with having differing numbers of controls per case but meant that cases for which controls were unable to be recruited had to be dropped from the study.

RESULTS

Controls were able to be recruited for 205 cases (1225 controls).

Data availability

Overall, BAC values were available for 66% of crashed riders and 90% of those control riders who stopped. There were no missing rider BACs for any of the 24 fatal crashes. For hospital admission crashes, 39% of rider BACs were missing. For crashes where the rider was treated at the Emergency Department and not admitted, 36% of rider BACs were missing. This level of missing data remained despite a thorough examination of both hospital and police records.

The characteristics of crashes for which BAC was known and those crashes which were reported to Police but BAC was unknown were similar. Crashes which were not reported to Police (and therefore BAC was missing) were more likely to be single vehicle crashes involving loss of control of the motorcycle.

The BAC reading was unavailable for 54 control riders (10%) who refused to be tested. Some of these riders refused because they did not drink alcohol or had not done so recently, others because they said they disapproved of random breath testing. Riders for whom a follow-up interview was conducted were equally likely to have refused the breath test as those riders for whom only a roadside interview was conducted (9% versus 11%). The reliability of the data is also supported by the prevalence of alcohol being similar to that found in Police random breath testing.

BAC values

Table 1 shows that 13% of crashed riders for whom BAC was known had BAC>0.05%, compared to less than 1% of control riders. Given the missing data, between 9% and 43% of all cases could have had BAC>0.05% and less than 1% to 10% of all controls could have had BAC>0.05%. Crashed riders were not only more likely to have a positive BAC, but those with positive BACs tended to have higher values than those controls with positive BACs.

Less than 1% of the controls for which BAC was known had a reading in excess of 0.05% (the legal limit for fully licensed riders). This meant that many of the statistical analyses had to rely on comparing riders with zero readings with riders with any alcohol at all.

Table 1. Percentages of cases and controls according to BAC level. Percentages are of known. The possible range is given in brackets.

Variable	% Cases	% Controls
BAC>.000	19 (12-46)	3 (3-13)
BAC>.050	13 (9-43)	<1 (<1-10)
BAC level		
zero	82	97
<=.050	5	3
•0Sto.149	8	<1
>=.150	5	0

There was a greater involvement of alcohol in single-vehicle than multiple-vehicle crashes. The rider had a BAC of greater than zero in 31% of single-vehicle crashes, compared with 5% of multiple-vehicle crashes. The rider had a BAC of greater than 0.05% in 26% of single-vehicle crashes, compared with 10% of multiple-vehicle crashes.

The known BAC levels were similar for fatal and non-fatal crashes. However the missing data for 40% of non-fatal crashes may be biased toward zero readings. If this was the case, then the true BAC levels would be expected to be higher in fatal than non-fatal crashes.

Relative risk of crash involvement

Having a BAC greater than zero was associated with a five-fold increase in the odds of crashing compared to having a BAC of zero (see Table 2). The increase in risk associated with a BAC of greater than 0.05% was about forty-fold. However, if riders with positive BACs were less likely to stop at the control sites, then the odds ratios associated with alcohol would be somewhat inflated.

Table 2. Odds ratios and confidence intervals for alcohol variables, unadjusted and adjusted for age group and licence status. Highlighted odds ratios are statistically significant at the 95% level.

Variable	Unadjusted	Adjusted for	
		Age group	Licence status
BAC>.000	5.6 2.4-13.1	5.2 2.2-12.5	4.9 2.0-11.8
BAC>.050	44.3 5.5 - 353.2	38.3 4.6 - 318.6	39.4 4.7 - 329.7
.000<BAC<.051	1.5 0.5-4.7	*	*

* insufficient data to compute adjusted odds ratios

Having a positive BAC was associated with a number of other risk factors including: unlicensed riding, riding a borrowed motorcycle, carrying a pillion passenger, illicit drug use and excessive speed.

Time of day of alcohol and riding patterns

About one-third of crashes with BAC exceeding 0.05% occurred between midnight and 6 am, compared to only 5% of crashes with BAC less than or equal to 0.05%. Thirty-six percent of crashes with BAC exceeding 0.05% occurred from 6 pm to midnight, compared with 22% of crashes with BAC less than or equal to 0.05%.

There was relatively little motorcycle riding at night (6 pm to 6 am), with the mean number of motorcycles per hour and the proportion of traffic that motorcycles comprised both being lower than in daytime.

DISCUSSION

Given that alcohol has traditionally been the most important source of impairment leading to crashes, the unavailability of BAC data for a large number of crashes is disturbing. It also constrains the extent to which the study is able to estimate the magnitude of alcohol as a risk factor and investigate its associations with other factors (e.g. recreational riding).

There are several issues to be considered in interpreting the odds ratios related to BAC level. The first is the effect on the odds ratios of matching on time of day and day of week. Alcohol use, for car drivers at least, has a distinctive time of day and day of week pattern. A consequence of having matched cases and controls on these variables is that the controls recruited would have been more likely to be of the same alcohol status as the cases than would have occurred if the set of controls was a random sample of motorcycle riding. Therefore, the calculated odds ratios in this study may have underestimated the true odds ratios to some extent.

The second issue relating to the interpretation of the odds ratios for $BAC > 0.05\%$ and $BAC > 0.00\%$ is that the range of BAC values in cases was greater than that in controls. This would have reduced the odds ratios, again leading to the calculated odds ratios underestimating the true odds ratios.

Almost 70% of the crashes in which alcohol was involved occurred between 6 pm and 6 am (compared with about 25% of the crashes not involving alcohol). Yet the amount of riding was only about half that occurring during daytime. Therefore the relative lack of night-time riding may contribute to the low overall involvement of alcohol in motorcycle crashes.

CONCLUSIONS

This study found that the rider had a $BAC > 0.05\%$ in 13% of fatal and non-fatal injury crashes where BAC was known. Less than 1% of the controls for which BAC was known had a reading in excess of 0.05% (the legal limit for fully licensed riders). Having a BAC greater than zero was associated with a five-fold increase in the odds of crashing compared to having a BAC of zero. The increase in risk associated with a BAC of greater than 0.05% was about forty-fold.

Comparisons with car drivers are not straightforward but it appears that alcohol involvement in motorcycle crashes is probably less (or at least no worse than) that of car drivers. One of the reasons for the lower involvement of alcohol may be the largely daytime pattern of motorcycle riding.

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