In Depth Study of Rural Road Crashes in South Australia

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Alcohol, crash

Abstract
An in depth study of rural road crashes in South Australia was conducted from 1998 to 2000 and produced detailed information about a sample of 236 crashes. This information was analysed to assess the contributions of different factors, such as varieties of driver error and inadequacies in road infrastructure, to the causation of rural road crashes and the severity of consequent injuries. Crashes involving alcohol intoxicated drivers were more likely to be single vehicle crashes and to involve male and teenage drivers. Such crashes were usually the result of the driver losing control of the vehicle, particularly after the vehicle ran off the road and onto an unsealed shoulder. The injuries and fatalities resulting from these crashes were usually caused by the vehicles striking roadside hazards close to the side of the road. It is concluded that efforts to reduce the role of alcohol in rural road crashes are best directed at males, and great gains are likely through reduction of teenage drink driving. However, reductions in rural drink driving crashes are also very likely if shoulders are sealed, road edges are marked with lines and roadside hazards close to the road edge are eliminated or protected.

Introduction
Very little research is conducted in the road safety field in which researchers attend the scenes of road crashes, especially those in rural areas, as soon as they occur, and investigate the nature of the crashes and their contributory antecedents in depth (eg 1,2). In depth research of this type is a useful tool for assessing accurately the factors most commonly involved in the causation of crashes and consequent injuries, and also for generating new hypotheses concerning possible countermeasures and their likelihood of success. This study was conducted to look at road, vehicular and driver factors and their contribution to a large sample of rural road crashes. This paper, however, will focus only on the crashes in which alcohol intoxication of a driver contributed to the causation of the crash.

Method
An in depth study of rural road crashes on South Australian roads was conducted by the Road Accident Research Unit with the data collection phase of the study running for two years from 1 March 1998 to 29 February 2000.

Vehicle crashes eligible for inclusion in the study were those to which an ambulance was called and which occurred on public roads outside the metropolitan area but within 100 km of Adelaide, the capital city of South Australia. Notification of crashes was obtained by monitoring ambulance radio frequencies and also by pager notification from the South Australian Ambulance Service.
Road Accident Research Unit staff members were available on call to attend crash scenes during the day seven days per week and on Thursday and Friday nights until midnight. These two nights and during the day on Saturday and Sunday were selected as on-call periods following an examination of the time of day and day of week distribution of calls for an ambulance to attend vehicle accidents in the study area during the previous year.

Some fatal cases were able to be investigated on the day following the crash if the scene had been marked up by the Police Major Crash investigators. This enabled the inclusion in the study of some crashes that occurred outside the on-call periods. However, that the fact that no team members were on call to attend crashes on Saturday nights or on any night between midnight and 9am biased our sample to some extent against inclusion of alcohol related crashes.

The information collected on each case included:
- photographs of the crash scene and vehicles involved
- video record of the crash scene and vehicles in selected cases
- examination of the road environment, including traffic control measures
- a site plan of the crash scene and vehicle movements in the crash
- examination and measurements of the vehicles involved
- interviews with crash participants, witnesses and police
- information on the official police report
- information from Coroner’s reports
- injury data on the injured crash participants

Blood alcohol concentration information was collected for the study from two sources. First, attending police officers are instructed to conduct a breath alcohol test on all crash involved drivers. Secondly, the law requires that all persons aged over 14 who are treated at hospital as a result of injuries sustained in a road crash have a blood sample taken for BAC analysis. Both these sources of data were available for use in the study.

**Results**
The study consisted of the in-depth investigation of 236 rural road crashes. Of these, 54 (23%) resulted in at least one fatality, and a further 76 (32%) in at least one crash participant being admitted to hospital. There was an over-representation of severe crashes in the sample, due in part to the ability to follow up fatal crashes occurring outside of the study on-call times.

Of the 236 crashes, there were 143 in which the BAC for each driver was known to be zero and 27 crashes in which one of the drivers recorded a positive BAC. Information concerning BACs for drivers in the remaining crashes was not able to be obtained for one of a number of reasons, the most common being that the drivers were neither injured severely enough to attend a hospital nor asked by the police to submit to a breath analysis.

Six of the 27 drivers with a positive reading recorded BACs below the South Australian legal limit of 0.05gm/L, but two of these drivers only held provisional licences and therefore were not allowed to have a positive alcohol reading at all. Of the remaining 21 drivers, nine recorded BACs between 0.05 and 0.15gm/L and 12 recorded BACs above 0.15gm/L. These results illustrate that the crash involved drivers with positive BACs tended to have very high levels of alcohol in their blood.
It is also likely that in two of the cases, alcohol played a very minor role in the crash causation, if at all. In one case, a driver with a BAC of 0.05gm/L was in a car that was struck by another vehicle that was out of control, and it is unlikely that he would have been able to avoid the collision even if he had no alcohol in his system. In another crash, a teenage female driver ran off the road after she attempted a dangerous, high speed overtaking manoeuvre on the wrong side of the road. The driver had a BAC of 0.012gm/L when her provisional licence required her to have a zero BAC. However, it is likely that her inexperience at driving at that speed (110-120km/h), the fact that she had had very little sleep the night before the crash, the possibility that her boyfriend in the passenger seat was encouraging her to drive dangerously, and her failure to wear appropriate footwear or her prescribed glasses, would, in sum, provide sufficient explanation, in terms of driver error, for the occurrence of the crash rather than the small amount of residual alcohol left in her system from the night before.

The remainder of the results section compares the crashes involving the 21 drivers with illegal BACs, in which alcohol intoxication was likely to have been a contributory factor to the causation of the crash, with those 143 crashes involving only drivers known to have no alcohol in their blood.

Table 1 provides details of the differences between alcohol and non-alcohol involved rural road crashes in terms of crash type. The figures for crashes in which BACs were unknown for one or more drivers are also shown for comparison purposes. The table shows that cases in which a driver had an illegal BAC were more likely than other crashes to be single vehicle run-off-the-road crashes. Given that crashes classed as “head on” in this study were similar to single vehicle crashes, in that they were precipitated by a driver losing control of his or her vehicle rather than by conflicts with other traffic, Table 1 shows that loss of vehicular control was the precipitating factor in over 95 per cent of crashes involving alcohol. This tendency for crashes involving alcohol to be single vehicle or head on crashes more often than non-alcohol crashes was statistically significant ($\chi^2(1)=7.52, p<.01$).

Table 1: Crash type according to alcohol involvement

<table>
<thead>
<tr>
<th>Crash Type</th>
<th>Alcohol</th>
<th>Non Alcohol</th>
<th>Unknown</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Vehicle</td>
<td>17</td>
<td>72</td>
<td>16</td>
<td>105</td>
</tr>
<tr>
<td>Head On</td>
<td>3</td>
<td>22</td>
<td>14</td>
<td>39</td>
</tr>
<tr>
<td>Other Midblock</td>
<td>-</td>
<td>12</td>
<td>14</td>
<td>26</td>
</tr>
<tr>
<td>Intersection</td>
<td>1</td>
<td>37</td>
<td>28</td>
<td>66</td>
</tr>
<tr>
<td>Total</td>
<td>21</td>
<td>143</td>
<td>72</td>
<td>236</td>
</tr>
</tbody>
</table>

The sex of the 21 alcohol affected drivers and the drivers in the crashes not involving alcohol is shown in Table 2. Males were in the majority for both alcohol and non-alcohol involved crashes, but the percentage of males in the former (90) was far greater than that in the latter (59), and the difference was statistically significant ($\chi^2(1)=7.79, p<.01$). Therefore, alcohol affected drivers involved in crashes in rural areas were far more likely to be male than drivers in crashes in which alcohol intoxication was not present.

Table 2: Sex of the driver according to alcohol involvement

<table>
<thead>
<tr>
<th>Sex</th>
<th>Alcohol</th>
<th>Non Alcohol</th>
<th>Unknown</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</table>
Table 3 provides details of the age of the alcohol affected drivers and the drivers in the crashes not involving alcohol. It is apparent that crashes involving alcohol impairment more commonly featured teenage drivers and less commonly featured drivers aged over 40 than crashes in which no drivers recorded illegal BACs. The lower likelihood of drivers over the age of 40 being involved in alcohol related rural crashes was statistically significant ($\chi^2(1)=4.84, p<.05$).

Table 3: Age of the driver according to alcohol involvement

<table>
<thead>
<tr>
<th>Driver Age (Yrs)</th>
<th>Alcohol Involved</th>
<th>Non Alcohol Involved</th>
<th>Unknown</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>16-19</td>
<td>7</td>
<td>32</td>
<td>14</td>
<td>53</td>
</tr>
<tr>
<td>20-29</td>
<td>4</td>
<td>52</td>
<td>25</td>
<td>81</td>
</tr>
<tr>
<td>30-39</td>
<td>6</td>
<td>39</td>
<td>17</td>
<td>62</td>
</tr>
<tr>
<td>40-49</td>
<td>3</td>
<td>41</td>
<td>28</td>
<td>72</td>
</tr>
<tr>
<td>50+</td>
<td>1</td>
<td>55</td>
<td>32</td>
<td>88</td>
</tr>
<tr>
<td>Total</td>
<td>21</td>
<td>219</td>
<td>116</td>
<td>356</td>
</tr>
</tbody>
</table>

Investigation of roadway characteristics and alcohol related crashes revealed that one road feature common in the such crashes was an unsealed shoulder. Of the 20 alcohol related crashes precipitated by loss of vehicular control, there were 13 in which the vehicle moving onto an unsealed shoulder played a role in the causation of the crash. In 11 of these 13 crashes, the vehicle ran off to the road to the left (traffic keeps to the left in Australia). On five occasions this occurred on a straight section of road and on six occasions on the outside of a right curve. The lower coefficient of friction of the unsealed shoulder in each of these cases either contributed directly to a loss of control, or made it more difficult for the driver to steer the vehicle back onto the road successfully.

In six of the 13 crashes in which an unsealed shoulder contributed to the causation of the crash, there was also no edge lining to delineate the side of the road. The lack of clear visual cues indicating the position of the road edge would have increased the likelihood that the alcohol affected driver would allow a wheel to move onto the unsealed shoulder, resulting in loss of control. It is also notable that in five of these six occasions, when alcohol affected drivers ran off the road where there was a lack of edge lining, it was night time, when visibility of the road edge without road markings would have been compromised.

The 17 single vehicle crashes featuring an alcohol affected driver all involved the vehicle striking one or more roadside hazards. In nine of these 17 crashes, the main roadside hazard struck by the vehicle was a tree and in another five it was a utility pole. In two of the three head on collisions involving an intoxicated driver, the most injurious impact was also with a roadside hazard following the collision with the other vehicle. The average distance between the road edge and the trees struck in alcohol related crashes was 3.8m, while the average distance to a utility pole was 3.9m. All of the poles and all but one of the trees were within 6m of the road edge.

Discussion
Rural road crashes involving alcohol tended to involve drivers with very high BACs, as has been found previously in South Australia (3). These crashes were also more likely to be single vehicle crashes and to involve young male drivers. This suggests that countermeasures aiming to change driver and/or drinking behaviour, whether they be educative or enforcement related, should be directed particularly at young males.

However, the results also suggest that there are road features that are equally as prominent in alcohol related rural crashes as the involvement of young male drivers.

First, unsealed shoulders were found commonly to have played a contributory role in crash causation. It is likely that alcohol intoxication in many cases would have been responsible, at least partly, for a driver veering off the road onto the shoulder. On roads where this shoulder was unsealed, the greatly reduced coefficient of friction of the shoulder compared to the road surface would have made it difficult for the driver to regain control of the vehicle. In some cases, the driver never managed to steer the vehicle back onto the road before striking an object by the roadside. In other cases, the driver steered back toward the road but the vehicle yawed across to the other side of the road where it either struck another vehicle or continued off onto the roadside.

Secondly, related to the problem of unsealed shoulders, alcohol intoxicated drivers often ran off the road at locations where there was no road edge lining, especially at night when visibility of the road edge would have been compromised. The beneficial effect of edge lining on the lateral position of a vehicle driven by an intoxicated driver has been demonstrated in past research (eg 4).

Thirdly, collisions with roadside hazards, particularly trees and utility poles, were very common in alcohol related crashes. The roadside hazards that were struck in these crashes were almost all less than six metres from the road edge, with the average distance being less than four metres.

On the basis of these findings, it can be concluded that successful methods of reducing alcohol related crashes in rural areas would include sealing of shoulders, line marking of road edges and clearance of roadside hazards within 10m of the side of the road. Due to these crashes commonly beginning with vehicles running off the road to the left on right curves, the implementation of these countermeasures should begin on the outside of right curves. These road treatments, as well as specifically reducing the likelihood of alcohol related crashes, would be of benefit to all drivers (5).

Finally, although drivers in alcohol related crashes have exhibited carelessness by the very act of driving while intoxicated, it is not acceptable that such drivers should pay for their mistakes with serious injuries or worse. Although countermeasures for alcohol related crashes that are aimed at changing the behaviour of drinking drivers are both worthwhile and necessary, it is important that these measures are complemented by those directed at the road infrastructure. One of the clearest findings from the in depth study was that crashes are the result of a combination of factors related to both the drivers and the environment in which they are expected to drive.

References


