Drinking Drivers' Estimates of BAC

Douglas J. Beirness, Traffic Injury Research Foundation
Robert D. Foss, West Virginia University
Robert B. Voas, National Public Services Research Institute
Karen M. Sprattler, Minnesota Department of Public Safety

1.0 INTRODUCTION

Although the magnitude of problems associated with drinking and driving has decreased, many people continue to drive after consuming too much alcohol. Perhaps one factor contributing to the persistence of drinking-driving problems is an inability among drinkers to determine reliably how much is "too much". Drinkers are often faced with difficult task of determining whether the extent of their alcohol consumption on a given occasion has rendered them unfit to drive -- either through impairment or an elevated BAC.

The relevance of subjective decisions about driving after drinking is enhanced by the proliferation of per se laws, which specify a particular BAC above which it is illegal to operate a motor vehicle. The value of per se laws in facilitating enforcement and adjudication is not in question; however, drinkers' abilities to comply with such laws remains at issue.

There exists a diverse body of research indicating that social drinkers' subjective estimates of their BAC, as well as perceptions of their own state of intoxication or impairment, are often at variance with their actual BAC as determined by breath analysis (Beirness, 1984; 1987; Bois & Vogel-Sprott, 1974; Martin et al., 1991). Recent research has suggested that the absolute magnitude of errors in estimating BAC may not be as important as the direction of such errors (Beirness, 1987). In an ad lib drinking situation, drinkers whose estimates of BAC were below its actual value (under-estimators) reported significantly fewer symptoms of intoxication and perceived themselves as being less impaired than those whose estimates of BAC were higher than its actual value (over-estimators). Under-estimators also drank more alcohol and attained higher peak BACs. Nevertheless, despite their higher BACs, under-estimators were most likely to report that they felt capable of driving. These findings suggest that the error in subjective appraisals of BAC and/or intoxication may lead under-estimators to the mistaken belief that they are not impaired and capable of driving.

The prevalence of under- and over-estimates of BAC among actual drinking drivers has never been determined from on-road studies. Such is the purpose of this paper. Using data collected as part of the 1990 Minnesota roadside survey of nighttime drivers (Foss et al., 1991), this paper examines the extent to which drivers with a BAC in excess of the
statutory per se limit are more likely than drivers who are below the limit to under-estimate their BAC.

2.0 METHOD

During two weeks in September 1990, voluntary interviews were conducted with 2,857 drivers between the hours of 10 p.m. and 3 a.m. in 16 Minnesota communities. As part of the interview, drivers were asked if they had consumed any alcohol in the past 12 hours. Those who responded affirmatively were then asked to provide an estimate of their BAC at the present time. To facilitate BAC estimates, drivers were shown a 14 cm X 21 cm card, on which was printed an Alcohol scale. This scale consisted of a graded line labelled ".00 No Alcohol" at one end and ".20 Large Amount of Alcohol" at the other. The midpoint of the scale was marked as ".10 Legal Alcohol Limit". Using this scale, drivers were asked to indicate what they thought their BAC was at the moment.

All drivers were then screened for the presence of alcohol with a passive alcohol sensor (CMI Alcolmeter Voice Activated Sensor). Drivers who registered a BAC of .02% or higher on the passive sensor were asked to provide a breath sample using an evidentiary quality preliminary breath test device (Intoximeter Alco-Sensor III).

3.0 RESULTS

Of the 765 drivers who indicated that they had had a drink in the past 12 hours, 709 provided an estimate of their BAC. Of these, 271 were found to have a BAC less than .02% and are, therefore, not considered in further analyses. The remaining 438 drivers provided estimates of BAC that ranged from .00% to .17%. Drivers' estimates of BAC were compared with actual BACs by subtracting measured BAC from estimated BAC. The signed difference between actual and estimated BAC was classified according to the direction of the estimation error. Estimates that were within plus or minus .01% of actual BAC were considered to be essentially accurate and were labelled "Even". Drivers whose estimates were more than .01% below actual BAC were labelled "under-estimators"; those whose estimates were more than .01% above actual BAC were labelled "over-estimators".

Overall, 50% of drinking drivers were classified as under-estimators; 32% were over-estimators. The remaining 19% provided estimates of their BAC that were within .01% of its actual value.
Bac Estimation Error Type
According to Driver BAC

Figure 1 shows that the type of estimation errors was highly related to actual BAC. Over-estimates of BAC were most common among drinking drivers who had a BAC below .05%. Under-estimates of BAC were predominant among drivers with BACs over .05%. Almost all drivers (94%) who had a BAC in excess of the statutory per se limit (i.e., .10%) under-estimated their BAC; all 37 drivers who were found to have a BAC of .15% or higher under-estimated their BAC.

Table 1 presents the percentage of the three BAC estimation error groups according to driver sex and age groups. Younger drivers were more likely to under-estimate their BAC, while older drivers were more likely to over-estimate. Just over 70% of drinking drivers age 16 to 20 under-estimated their BAC compared to about 40% of drivers age 35 and over.

Men comprised 76% of all three BAC estimation error types. Within male and female groups, however, the distribution of BAC estimation error types did not differ. Men and women were equally likely to under-estimate their BACs. Approximately half of the 333 men and 105 women provided an under-estimate of BAC; about a third of both men and women over-estimated BAC.
Characteristics of BAC Estimation Error Groups

<table>
<thead>
<tr>
<th>Estimator Error Type</th>
<th>Under (n=217)</th>
<th>Even (n=82)</th>
<th>Over (n=139)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>50.1%</td>
<td>19.5%</td>
<td>30.4%</td>
</tr>
<tr>
<td>Female</td>
<td>47.9</td>
<td>15.9</td>
<td>36.2</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16-20</td>
<td>71.3</td>
<td>17.9</td>
<td>10.8</td>
</tr>
<tr>
<td>21-24</td>
<td>49.9</td>
<td>21.1</td>
<td>29.0</td>
</tr>
<tr>
<td>25-34</td>
<td>52.6</td>
<td>18.7</td>
<td>28.7</td>
</tr>
<tr>
<td>35-44</td>
<td>41.6</td>
<td>15.7</td>
<td>42.8</td>
</tr>
<tr>
<td>45+</td>
<td>42.1</td>
<td>19.0</td>
<td>38.9</td>
</tr>
</tbody>
</table>

Overall, seat belt use among drivers surveyed was 49%. This rate varied, however, according to the type of BAC estimation error. Among under-estimators, the seat belt use rate was only 35%; among over-estimators, 60% were found to be wearing their seat belts.

4.0 DISCUSSION

The present findings provide the first empirical demonstration of BAC estimation errors among drinking drivers. As predicted on the basis of findings from laboratory studies, drivers with a BAC in excess of the statutory limit were considerably more likely than drivers with lower BACs to under-estimate their BAC.

Under-estimators were typically younger, had higher BACs, and were less likely than over-estimators or even-estimators to be wearing a seat belt. Youth and failure to buckle-up are characteristics associated with increased likelihood of crash involvement, which, when combined with a BAC in excess of the statutory per se limit, create a situation of exacerbated risk for under-estimators.

Despite the predominance of under-estimators among legally impaired drivers, the extent to which errors in estimating BAC actually contribute to the decision to drive after consuming alcohol remains unknown. Other research, however, indicates that those who under-estimate BAC also report fewer symptoms of intoxication, suggesting...
lower sensitivity to the effects of low to moderate doses of alcohol (Beirness, 1987; Martin et al., 1991). This relative insensitivity to alcohol's effects, whether innate or as a result of acquired tolerance, would render such individuals less able to determine accurately the extent of their state of intoxication. Consequently, these individuals may be unable to determine when their ability to operate a motor vehicle safely has become impaired. Even with BACs in excess of the statutory limit, under-estimators may believe they are capable of driving safely.

On the other hand, over-estimators generally believe themselves to be more intoxicated than their BAC would suggest. As expected, these individuals were less likely to drive after drinking than under-estimators and, when they did so, they most often were found to have a BAC below the statutory limit.

Taken together, the evidence suggests that self-estimates of BAC may reflect the degree of acquired tolerance to alcohol. Alcohol tolerant individuals experience fewer subjective symptoms of intoxication and display a lesser degree of behavioural impairment than less tolerant individuals (O'Malley and Maisto, 1984; Vogel-Sprott, 1979). If estimates of BAC are an indicator of tolerance, then under-estimators would experience fewer overt signs of intoxication and/or impairment which may lead them to believe they are capable of driving even at BACs in excess of the statutory limit. Whether their self-perceptions are an accurate reflection of the degree of behavioural impairment remains an empirical question. In any event, because of their relatively high BACs underestimators are a high-risk group for alcohol-related crash involvement.

The present findings suggest that further reductions in the magnitude of the alcohol-crash problem might be realized through efforts to inform drinkers about the inherent dangers in relying on their own estimates of BAC and/or intoxication when making decisions concerning the legality or safety of their driving after consuming alcohol. While over-estimators tend to err on the conservative side, under-estimators are likely to consider themselves capable of driving even when their BAC is in excess of the statutory limit. With the proliferation of per se statutes and continuing efforts to reduce these BAC limits, it is imperative that drinkers be aware of the implications of basing decisions about driving on their own subjective estimates of BAC or intoxication. Breath testing devices strategically placed in licensed drinking establishments, used under the supervision of a person able to assist in their use and interpretation of the results, is one approach. Another approach involves developing specific educational/training programs that combine information about alcohol and its metabolism with feedback about BAC during a supervised drinking session. Such programs could prove especially beneficial for under-estimators who may experience fewer symptoms of intoxication, and may display a lower degree of behavioral impairment, even with BACs in excess of the statutory limit. The purpose of such a program would be to teach this high-risk group how to use information about their own consumption along with the internal sensations of intoxication to estimate their BAC and degree of impairment more accurately in situations that might involve driving.
ACKNOWLEDGEMENT

This research was supported in part by the Minnesota Department of Public Safety. Conclusions presented here represent those of the authors and not necessarily the Minnesota Department of Public Safety. The authors wish to express their appreciation to Art Wolfe, Michael George and Margreta Cheney for their assistance in the design and completion of this study.

REFERENCES


