THE PREVALENCE OF ALCOHOL INTOXICATION IN THE NIGHT-TIME ECONOMY

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Abstract — Aim: To assess the prevalence of alcohol misuse in the night-time economy. Method: A random sample of 893 people were interviewed and breathalysed in 24 repeated, cross-sectional surveys over the course of a year in the city centre streets of a European capital city between 11.00 PM and 3.00 AM. Results: Median blood alcohol concentration (BAC) in men was 0.13% (min = 0%, max = 0.33%) and in women was 0.09% (min = 0%, max = 0.27%) — which were below the threshold used to indicate ‘at risk BAC’ (0.15%; for men t = 9.32, P<0.001 and for women t = 17.54, P < 0.001). Men provided higher BACs than women (t = 7.17, P < 0.001). The relationship between age and BAC for men described an inverted ‘u’, peaking at 29 years, but for women the relationship was positive and linear. BAC was inversely related to the ability to remember and report the evening’s consumption. Conclusion: At risk intoxication was apparent only in a minority of drinkers, who were mostly employed men in their late twenties, but a third of men and half of women had consumed more than the recommended daily limit. The probability for respondents to recall past consumption diminished as BAC increased suggesting self-report data are not suitable to assess consumption in heavy drinkers. Breath analysis surveys are valuable in understanding alcohol misuse in the night-time economy.

INTRODUCTION

Although previous studies of alcohol use have utilized breath analysis (Beirness et al., 2004) this has yet to be done in a city centre street location. This is an important omission since, although valuable information using self-report and similar measures has been collated (e.g. Hammersley and Ditton, 2005; Measham and Brain, 2005), tackling alcohol misuse in the night-time economy (NTE) needs to be based on accurate assessments of drunkenness (Holder, 2000; Gmel et al., 2006).

Risk factors for city centre alcohol misuse are numerous and include features of individual drinkers such as age and gender (Whelan, 1999), irresponsible alcohol promotions and poorly trained servers selling alcohol to underage or already intoxicated drinkers (Homel et al., 1997). Community-oriented interventions have successfully moderated levels of consumption in major cities in New Zealand, Canada, Sweden, Finland, Australia and the United States, (Casswell and Gilmore, 1989; Giesbrecht and Pederson, 1992; Romelsjö et al., 1993; Homel et al., 1997; Holder, 2000). However, much of the evidence used to target interventions is incomplete. For example, test purchasing, where police confederates who are below the age at which alcohol can be purchased legally attempt to purchase alcohol in licensed premises, only provides information on the accessibility of alcohol to underage drinkers not on the prevalence of underage drinkers.

Despite Cardiff having lower levels of alcohol related mortality than many other cities in the UK (Breakwell et al., 2007), in 2004 and 2005 Cardiff attracted negative media interest including several high profile television documentaries, such as the BBC programme ‘Drunk and Dangerous’ in which reporters followed city-centre police and described brawls, assaults, public vomiting, urination and other drunk and disorderly behaviour. Subsequently, local newspapers labelled Cardiff ‘The city of fear’ and the UK’s ‘binge drinking capital’ (Edwards, 2004; McAlaney and McMahon, 2006). In Cardiff, further evidence of alcohol-related problems came from the Tackling Alcohol-related Street Crime (TASC) (Maguire and Nettleton, 2003) project, a partnership initiative involving the city authority, police and health services which began in July 2000 and was funded as part of the UK Government’s targeted policing initiative. TASC data, which included data from the Accident and Emergency Unit of the local hospital (Maguire and Nettleton, 2003), indicated that 5% of both perpetrators and victims of alcohol-related crime were below 18 years of age, the legal purchasing age in the UK. Together, these factors prompted the design of the surveys reported here.

Although subjective estimates of consumption are commonly used to assess levels of misuse and are the principal means by which policy decisions are made (Beirness et al., 2004), they are known to be unreliable (McAlaney and McMahon, 2006), not least because they do not take account of consumption rates or body mass and therefore cannot be used to determine blood alcohol concentration (BAC) and therefore risk of harm (Kiefer and Spanagel, 2006). Furthermore, if drinkers cannot recall how much they have consumed or their reported levels of consumption are not consistent with BAC levels, the use of self-report data as a basis for consumption guidelines and other interventions is unjustified. On the other hand, if drinkers’ subjective estimates of intoxication prove reliable indicators of intoxication there is no need for objective breath analysis.

The purpose of this paper is to present data from a novel series of city centre surveys of drinkers, to calculate the prevalence of city centre alcohol use from objective breath analysis data and to assess how BAC varied by age, gender, alcohol consumption, time of night and mode of transport home.
METHODOLOGY

Twelve repeated cross-sectional surveys were conducted on one Friday and one Saturday evening (11.00 PM – 3.00 AM) over a 13 month period. The survey methodology was piloted and refined. Sampling biases in the same survey are reported elsewhere (Perham et al., 2007) and showed a small under-representation of more sober respondents. The method used to determine this sampling bias was as follows: surveyors were asked to complete an estimate of intoxication (a ten point Likert scale where ten was ‘very drunk’ and one was ‘sober’) for both respondents and non-respondents. Using the alcometer data we were able to assess the relationship between subjective rating of drunkenness (SRD) and BAC for respondents. This relationship was positive and significant (r = 0.56, P < 0.001) suggesting the SRD was a reliable indicator of BAC. SRDs for respondents and non-respondents were compared. A two-sample Wilcoxon rank-sum test on SRD by group indicated that respondents were rated more drunk (mean = 5.27, SD = 2.12) than non-respondents (mean = 4.80, SD = 2.24; z = 3.130, P < 0.01). Although this difference between the mean scores is small, overall BAC findings reported below should be regarded as slightly higher than they would have been if the sample had been truly representative.

Sampling strategy

Two groups of surveyors, working in pairs (accompanied by a plain-clothed police officer to enhance surveyors’ safety) were stationed at one of three pre-designated city centre street locations. Data were monitored by closed-circuit television. As TASC data indicated that alcohol-related disorder was most prevalent were monitored by closed-circuit television. As TASC data were well lit, because they were main thoroughfares in and out of the city centre and because they were selected on the basis of high density of nearby licensed premises, because they were well lit, because they were main thoroughfares in and out of the city centre and because they were monitored by closed-circuit television. As TASC data indicated that alcohol-related disorder was most prevalent between 11.00 PM and 3.00 AM at the weekend (Maguire and Nettleton, 2003) the survey targeted this time period on one Friday and one Saturday each month across 12 months. The first survey (December 2004) started at 9.00 PM to ensure that methods were feasible and to afford time to address any unforeseen problems. To enhance random sampling, every seventh person to cross a pre-selected point (e.g. a litter bin) was asked to participate. Furthermore, it is feasible that the demography of drinkers varies by day. This is most applicable to student drinkers as the city surveyed contained a large university. Typically, student-themed nights are hosted in licensed premises during the week meaning students may drink elsewhere or not at all on the survey nights. For this reason the sample reported here should be regarded as typical of the Friday and Saturday evenings when the survey was conducted rather than the drinking population of Cardiff as a whole. Consent was given verbally by respondents, when they received their brief explanation of the study. The relevant University Ethics of Research Committee was consulted, and the local police force conducted a health and safety review before offering their support.

Materials

Surveyors collected a variety of information but only data relevant to the study aims are described here—gender, date of birth and the time that drinkers had started drinking that day, occupational status (employed, unemployed or student), exact time of survey and mode of transport home. Surveyors estimated alcohol units consumed in the current drinking session by recording the number of drinks reportedly consumed by drink type (e.g. wine, strong lager, alcopops). A UK standard unit was assumed where one unit contains 8 grams of alcohol.

Procedure

Respondents were informed that the survey was anonymous, that they would be breathalysed and that they were not obliged to answer any of the questions. Responses were noted by one surveyor and respondent’s BAC was recorded using a breath analyser—the Lion Laboratories Alcometer—by the second surveyor, after the questionnaire had been completed. Consistent with manufacturer’s guidelines, participants drinking alcohol at the time of interview were not offered an alcometer test. This was to avoid including data which might have reflected residual alcohol in the mouth. Respondents who were smoking were asked not to blow smoke into the alcometer. The alcometers were recalibrated once every three months at the manufacturer’s laboratory. At the end of each interview, the respondent was offered a lollipop in appreciation of their time and a written, detailed description of the project, contact information for the project co-ordinator and a web address (www.lions.cf.ac.uk) where they could monitor project progress.

RESULTS

The alcometer provided a measure of breath alcohol concentration which was converted to milligrams ethanol/100 ml blood (BAC), the metric most commonly used to report intoxication.

Twenty-four surveys were completed between December 2004 and 2005 (none in September 2005 principally due to a lack of available surveyors), two surveys each month, one on a Saturday and one on a Friday evening of the same weekend. They were conducted by two pairs of surveyors in one of three pre-designated city centre street locations. Data from the additional 2 h (9.00 pm – 11.00 pm) of the December 2004 survey were eliminated from analyses (N = 44) leaving 893 participants, 314 females (mean age = 24.74 years, SD = 7.05) and 579 males (mean age = 25.05 years, SD = 6.42) who provided both age and BAC data between 11.00 PM and 3.00 AM.

Age

Age data were derived from respondents’ date of birth and the survey date. No significant difference between the mean age of men (mean age = 25.03 years, SD = 6.42) and women (mean age = 24.74 years, SD = 7.05; t = 0.61) was observed. Fifteen respondents provided their dates of birth that indicated they were below 18 years of age, and for 12 of these there was evidence of alcohol intoxication in three males (0.35% of all drinkers surveyed; mean BAC = 0.15,
Providing an estimate of consumption in units decreased.

Regression various polynomials of age onto BAC and selecting the model which minimized the Akaike Information Criteria (Navarro, 2005) by gender showed the relationship between age and BAC for women was linear whereas for men followed a second order polynomial peaking at 29 years. As age increased BAC increased for women whereas for men as age increased BAC initially increased and then decreased.

**Drinking session duration and estimated units**

Six hundred and thirty eight respondents reported the time that they started drinking and session duration was then calculated using the time of the survey. These data indicated that men (mean duration = 7.13 h, SD = 3.39) reported that they drank for longer than women (mean duration = 5.72 h, SD = 2.82; \( t = 5.25, P < 0.001 \)).

Surveyors were able to estimate the units of alcohol consumed by 382 respondents, 30.9% of all female respondents (mean units = 7.04, SD = 4.69) and 69.1% of all male respondents (mean units = 10.59, SD = 6.65; \( t = 5.24, P < 0.001 \)). For these male respondents, 62% reported they had consumed over four units whereas 65.09% women had consumed over three units, the advised daily consumption measures. For both men and women the prevalence of binge drinking increased over time according to consumption measures. For both men and women the prevalence of binge drinking increased over time according to consumption measures.

**Blood alcohol concentration**

In all months, men demonstrated higher BACs (mean BAC = 0.12%, SD = 0.07) than women (mean BAC = 0.09, SD = 0.06; \( t = 7.17, P < 0.001 \) for each comparison; see also Table 2). Of the 893 respondents included in these analyses 7.05% demonstrated zero BAC. Further, taking 0.15% BAC as the threshold for ‘at risk’ BAC (Beirness et al., 2004), mean BACs for both males \( t = 9.32, P < 0.001 \) and females \( t = 17.54, P < 0.001 \) were significantly below this level but 16.88% of all women and 36.44% of all men yielded BACs greater than 0.15%. A one-way ANOVA indicated that mean BAC did not vary by hour of survey (F(3, 889) = 0.58) or according to whether respondents were on their way home (mean BAC = 0.11%, SD = 0.07) or going to a licensed premises (mean BAC = 0.11%, SD = 0.06; \( t < 1 \)). However, respondents indicating that they were going to consume more alcohol following participation in the survey (mean BAC = 0.12%, SD = 0.06) yielded higher BACs compared to respondents who said that they had finished drinking that evening (mean BAC = 0.12%, SD = 0.07; \( t = 3.94, P < 0.001 \)).

**Prevalence of binge drinking**

Binge drinking was defined as consumption of more than 8 units for men and more than 6 units for women (Binge Drinking and Public Health, 2005) in a single drinking session. Table 1 presents the percentage of men and women binge drinking by hour and gender using both BAC and consumption measures. For both men and women the prevalence of binge drinking increased over time according to consumption data whereas intoxication remained stable.
The categories 'limousine', 'public transport' and 'taxi' were combined with 'lift' category as they were all forms of mechanized transport in which respondents were passengers (69.75%; mean BAC = 0.12%, SD = 0.06). A one-way ANOVA yielded a significant man effect of transport home (‘lift’, ‘walk’ and ‘drive’) on BAC (F(2, 860) = 27.19, P < 0.001) and Scheffé’s posthoc test indicated that the BAC of respondents driving home (mean BAC = 0.03%, SD = 0.05) was significantly lower than for those walking (mean BAC = 0.12%, SD = 0.07; P < 0.001) and getting a lift (mean BAC = 0.12%, SD = 0.06; P < 0.001) whereas no difference between walkers and passengers was observed (P = 0.61). An interaction of gender on transport home was also observed (χ²(2) = 19.19, P < 0.001)—the Kruskal Wallis Test to investigate simple effects indicated that proportionately more men (30.27%) than women (17.63%) intended to walk home whereas more women (79.66%) than men (65.77%) intended getting a lift (P < 0.001).

### Table 1. Mean (and standard deviation) estimated units consumed and BAC by hour of survey and gender with proportion identified as binge drinking (BD) according to UK guidelines (Binge Drinking and Public Health, 2005)

<table>
<thead>
<tr>
<th>Hour</th>
<th>Units Male</th>
<th>BAC Male</th>
<th>Units Female</th>
<th>BAC Female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (SD)</td>
<td>(BD %)</td>
<td>Mean (SD)</td>
<td>(BD %)</td>
</tr>
<tr>
<td>23:00–00:00</td>
<td>5.86 (6.46)</td>
<td>31</td>
<td>3.37 (3.99)</td>
<td>27</td>
</tr>
<tr>
<td>00:00–01:00</td>
<td>8.21 (7.37)</td>
<td>43</td>
<td>4.42 (4.36)</td>
<td>32</td>
</tr>
<tr>
<td>01:00–02:00</td>
<td>9.08 (7.04)</td>
<td>55</td>
<td>6.24 (5.87)</td>
<td>39</td>
</tr>
<tr>
<td>02:00–03:00</td>
<td>11.80 (8.16)</td>
<td>62</td>
<td>8.54 (5.03)</td>
<td>66</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BAC category Percentage of respondents</th>
</tr>
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<tbody>
<tr>
<td>&gt; 0.00</td>
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<tr>
<td>0.00</td>
</tr>
<tr>
<td>0.08</td>
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<tr>
<td>0.10</td>
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<tr>
<td>0.12</td>
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<td>0.15</td>
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<td>0.20</td>
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<td>0.30</td>
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</tbody>
</table>

### Table 2. Prevalence of BAC by gender. The UK drink drive limit is 0.08% and the threshold for ‘at risk’ BAC 0.15% (Bertime et al., 2004)

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (SD)</td>
<td>(BD %)</td>
</tr>
<tr>
<td></td>
<td>0.13 (0.07)</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>0.12 (0.07)</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>0.13 (0.06)</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>0.12 (0.06)</td>
<td>29</td>
</tr>
</tbody>
</table>

### CONCLUSION

This novel series of late night city centre street surveys provides a unique insight into alcohol use in this environment. Most strikingly perhaps, taking a blood alcohol concentration (BAC) of 0.15% as the benchmark for ‘at risk’ BAC, more than a one-in-three of men and one-in-six women yielded BACs over this threshold. However, according to consumption estimates, more than half of women and a third of men had consumed more than the recommended daily limits. Intoxication also varied by age, gender and occupation.

The relationship between age and BAC, for men, described an inverted ‘u’, BAC peaking at 29 years, but for women the relationship was positive and linear; older women were more intoxicated than younger women whereas men in their late twenties were more intoxicated than older and younger men. The age-intoxication relationship is likely to be complex and may be affected by numerous factors, including disposable income and family and occupational responsibilities incompatible with excessive intoxication late at night. It is possible that men in their late twenties, those who were most intoxicated, could afford more alcohol and had fewer responsibilities at home at that age whereas women were in a position to drink more heavily as children grew up. Thus, these age-intoxication trajectories may reflect differential constraints at home and at work as well as wealth. Overall, these analyses suggest that it is not younger drinkers, students or the unemployed who are most vulnerable to ‘at risk’ BAC levels in the city centre.

Consistent with the existing literature (Holmila and Raitasalo, 2005; Murphy et al., 2005), men demonstrated...
higher BACs than women. However, men were not only more intoxicated but also reported spending more time drinking than women. There was a positive association between drinking session duration and intoxication. However, levels of intoxication did not vary by hour of survey. Taking these findings together, this suggests that drinkers reach a certain level of intoxication which they then seek to maintain throughout the evening. This finding is consistent with observations made by Hammersley and Ditton (2005) who found, in a survey of drinkers, that 'the majority of people planned to drink a quantity of alcohol that represented a risk for their health, with a mean for men of 14 units and for women just under 10. However, this quantity was planned for consumption over a number of hours and, while the quantity was excessive, drinking rates were generally moderate, with only 13% planning to drink 2 or more units per hour. Indeed a third of the sample planned to drink more slowly than they could metabolize alcohol (on average). It would appear that the 'drinking session' may be managed by drinkers rather than just an impulsive urge for greater consumption. For these reasons, future research may seek to follow drinkers across an evening to assess initial consumption levels (possibly at home and using cheaper off-licence alcohol), how they relate to consumption in the NTE and later subjective reports.

An important finding in this study is the unreliability of consumption data. Most respondents could not recall how many drinks they had consumed, in large part, due to their intoxication. Although there was some evidence of a positive relationship between BAC and consumption most of the variance in BAC could not be accounted for by consumption estimates. This is relevant from a policy perspective since advice on acceptable levels of consumption in units is central to alcohol harm reduction strategies. This advice assumes that drinkers are aware, during a drinking session, of the amount they have consumed and are able to use this information to guide future consumption. This suggests that a key policy objective should be to keep intoxication levels below the point at which drinkers’ cease to be aware of their consumption. In turn, these findings suggest that once intoxication reaches this point intoxication levels can only be controlled by external agencies—through the influence of sober friends, law enforcement, bar and security staff and other personnel for example.

Estimates from TASC data were that those below 18 years of age who were either a complainant or defendant in alcohol-related disorder represented approximately 5% of the total drinking population. However, in this survey, only three male and nine female intoxicated 17 year olds were identified and none younger than this. There are two plausible explanations for this discrepancy. First, 17 year olds may have avoided surveyors, perhaps fearing that involvement might have repercussions. Second, the surveys may have identified the proportion of underage city centre drinkers accurately but underage drinkers are overrepresented in defendant and complainant populations. Such an overestimation is to be expected if juveniles are more at risk compared to older age groups. Consistent with this, investigations of the developmental trajectories of aggressive behaviour (Nagin et al., 1995; Nagin and Tremblay, 2005) show that delinquent behaviour is more prominent in adolescence and declines with age.

The finding that drinkers who intended to consume more alcohol had higher BACs than those who had finished drinking at the time of the survey is consistent with the notion that greater BAC promotes risk taking (Lane et al., 2004). However, reassuringly, those intending to drive home demonstrated lower BACs than others. Although there were few in this category, this finding suggests that those who decided prior to the drinking session how much they would consume were able to keep to this limit. This indicates that deterrence may curb consumption and therefore that law enforcement might be key to wider alcohol harm reduction policy.

In conclusion, the findings of this novel survey challenge the widespread belief that underage drinking is commonplace in the NTE and that younger drinkers are most intoxicated. Alcohol misuse was restricted to the minority which, for the purpose of future interventions, should be identified and targeted, particularly since after a certain level of intoxication has been reached, drinkers appear to become unable to recall quantities of further consumption. Overall, objective BAC measures provide unique insights of drinking behaviour in the NTE, especially because accurate estimates of consumption are rarely possible in this context and will likely assist in the development of both individual and environmental oriented alcohol reduction strategies.

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REFERENCES


