This is a pre-copyedited, author-produced PDF of an article accepted for publication in Alcohol & Alcoholism *following peer review. The definitive publisher-authenticated version,* 'How Will Alcohol Sales in the UK Be Affected If Drinkers Follow Government Guidelines?' (Baumberg 2009). *Alcohol & Alcoholism*, 44(5):523-528 *is available online at* http://dx.doi.org/10.1093/alcalc/agp053 . *The supplementary material is available from my own website at* http://www.benbaumberg.com/files/2009-AlcAlc-CSR%20do%20files.ZIP

How will alcohol sales be affected if drinkers follow government guidelines in the UK?

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Running title: Alcohol sales and government guidelines

Key words: distribution of consumption, corporate social responsibility, CSR, drinking guidelines, government guidelines, alcohol policy

Abstract

Aims: the proportion of alcohol consumption that is above government guidelines ('risky drinking') has been estimated in several countries, suggesting that reductions in risky drinking would lead to significant declines in total alcohol consumption. However, this has not previously been conducted transparently in the UK. Furthermore, existing studies have under-explored the importance of several methodological decisions, as well as not closely examining the meaning of these figures for debates on 'corporate social responsibility' (CSR).

Methods: secondary analysis of the amount of alcohol consumption above various Government guidelines in four British datasets for 2000-2002: the National Diet and Nutrition Survey; the General Household Survey; Smoking, Drinking and Drug Use Among Young People; and the March 2002 ONS Omnibus Survey.

Results: risky drinking accounts for 55-82% of total consumption by 18-64 year olds, depending on the definition of risky drinking used. If only alcohol above the government guidelines is counted, this falls to 22-47%. Consumption by underage drinkers accounts for 4.5% of total consumption, while consumption by drink-drivers accounts for 0.5-8.0% depending on the assumptions made.

Conclusions: Methodologically, the study shows that at least two decisions have considerable importance: the definition of risky drinking used, and whether we count all drinking (as in most previous studies) or only drinking above guidelines. Substantively, these studies do not directly show that drinks companies' profitability would be affected by declines in risky drinking.

Nevertheless, they are valuable for present debate in themselves and form the basis of a more

complex analysis of alcohol CSR.

Introduction

Despite the existence of conditions for which the risk increases with any level of alcohol consumption, many governments have decided to issue guideline levels for 'sensible' drinking (ICAP, 2003) to provide help for citizens faced with a complex array of epidemiological evidence. Rather than looking at the lowest-risk level of alcohol consumption (White et al., 2002), the guidelines try and decide on an *acceptable* level of risk – a threshold that requires judgement as well as evidence, with the most sophisticated recent attempt in Australia suggesting a cut-off of a 1 in 100 lifetime chance of dying from an alcohol-attributable cause (Rehm et al., 2008). In the UK these guidelines were first clearly defined in 1992 after more than a decade of discussion (Department of Health, 1995), and numerous reports investigate the proportion of drinkers who drink above the guideline level.

However, no peer-reviewed studies in the UK have investigated the *proportion* of alcohol consumption that is above the government guidelines (Department of Health, 2008:12 refers to an internal estimate without explaining the methodology). This contrasts with recent studies in Canada (Stockwell et al., 2005), the US (Foster et al., 2006) and Australia (Stockwell et al., 2008), as well as studies looking at the proportion of alcohol consumed by underage drinkers (Doran et al., 2009; Foster et al., 2003). These all suggest that reductions in the level of risky drinking would lead to (often significant) declines in the total sales[i] of alcoholic drinks. Several public health professionals have also used this – alongside earlier evidence on the skewed nature of the distribution of drinking (Lemmens et al., 2001) – within debates on the role of alcoholic drinks companies (see below).

Even where studies have been conducted, the sensitivity of the results to assumptions and methods has been under-explored. Only one recent study has looked at the important of different versions of government guidance, finding these significantly affect the results (Stockwell et al., 2005). Similarly, the results from different surveys within the same country are rarely compared (Foster et al., 2006). Finally, and most importantly, none of the published papers discuss whether we should include all risky drinking, or only risky drinking above the guideline levels.[ii]

This study therefore estimates the proportion of consumption accounted for by risky drinking in the UK, and also makes three contributions to the wider use of such figures. Firstly, the study considers the importance of various assumptions simultaneously. Secondly, the study demonstrates the use of bootstrapped confidence intervals for these estimates. Finally, the study discusses the meaning of these figures in the context of wider debates on 'corporate social responsibility' (CSR) among drinks companies.

Methodology

To estimate the share of total alcohol consumption that is accounted for by risky drinking, two methodological decisions first need to be made: how to define 'risky drinking', and which parts of this risky drinking should be counted.

Defining 'risky drinking': this study considers three definitions of risky drinking taken from government guidelines:

1. The main definition follows the current 'sensible drinking message' that drinkers should not regularly exceed 3-4 units/day (men) or 2-3 units/day (women), a unit being 8g/10ml of pure alcohol. In practice this is operationalised as ≤4(men)/≤3(women) units/day (PMSU, 2004:11) – noting that this ignores the suggested 1-2 days per week of non-drinking (Goddard, 2001:14).

2. Before 1995, the government guidelines were based on weekly rather than daily limits of 21(men)/14(women) units. These were still used by the 2004 Alcohol Strategy as a definition of 'moderate to heavy drinking' (PMSU, 2004:11).

3. Drinking relatively large amounts of alcohol on single occasions – 'binge-drinking' – is associated with particularly high risks of harm (Anderson and Baumberg, 2006:ch4). While there is no NHS definition of binge-drinking, the Prime Minister's Strategy Unit defined it as more than twice the current daily guidelines; i.e. >8(men)/>6(women) units/day (PMSU, 2004:11).

This study also looks at the share of consumption involved in two other aspects of risky drinking: underage drinking and drink-driving. The definitions of these are more straightforward as all consumption in these situations can be considered risky, but the way of estimating these is discussed in more detail below.

Counting risky drinking: among researchers conducting similar studies, there has been a debate about whether researchers should count *all* risky drinking or only drinking that is actually above the guidelines. For example, if risky consumption for men is defined as >4 units/day, then the 5 units/day drunk by a given man could be seen as either 5 units of risky drinking (the entire consumption) or only 1 unit (the consumption above the guidelines). This study conducts estimates under *both* assumptions, to enable us to examine their effects (this also aids comparability with previous studies).

Data Sources

Using the Institute of Alcohol Studies' Data Map – a publicly available resource for secondary analysis on alcohol, available from www.ias.org.uk – it became clear that no single survey contained data on daily as well as weekly drinking, in the full age range of the population, and including data on drink-driving behaviour. It was therefore decided to conduct estimates using several separate surveys from a single period, 2000-2001. These surveys are briefly described below and in Table 1; further information is available in Web Appendix 1. Readers wishing to

replicate the analysis or look for further detail on the data cleaning process can access the full

Stata code for this study in Deposit #11472 from ICPSR (http://www.icpsr.umich.edu/ICPSR/).

Table 1 – Descriptive statistics for datasets used in this paper

	NDNS	*GHS*	*SDDYP*	*ONS Omnibus*
Sample size	1,724	14,081	8,820	1,773
Data Archive reference	SN5140	SN4518	SN4648	SN4701
Weights supplied	Yes	Yes	No	Yes
Age range	19-64	16+	10-17	18+
Mean age (years)	40.6	46.4	13.1	48.5
% female	51.7%	52.0%	50.6%	53.2%
Method	7 day diary	Interview (self completion 16-17 year olds)	Self-completion	Interview
% drinkers	73.2%	88.6%	22.8%	88.2%
Mean consumption (units/wk)	13.4	12.0	2.2	11.6
Share of consumption reported *	59.9%	60.7%	n/a	57.0%

Data refer to sub-sample that were asked all relevant alcohol/drink-driving questions.

* Under-reporting is calculated assuming constant reporting behaviour in all age groups, using SDDYP data for under-16s, and (in the case of NDNS) GHS data on 16-18 year olds and 65+ year olds / (in the case of ONS Omnibus) GHS data on 16-17 year olds. Total alcohol sales in the UK are calculated from HMRC tax receipt data. Population data for 2001. Population data was taken from National Statistics estimates of the mid-year population 2001 [available from http://www.statistics.gov.uk/statbase/ssdataset.asp?vlnk=8525&More=Y accessed 5/2/2008]

The main survey used in this analysis is the National Diet and Nutrition Survey (NDNS), as it is one of the few surveys to ask about daily as well as weekly consumption. However, NDNS does not cover the full age range of the drinking population, hence the General Household Survey (GHS) was used for older drinkers and 16-18 year olds based on a standard quantity-frequency measure for each of six types of alcoholic drink (see Web Appendix for details). For the ages covered in both surveys, this also allows us to compare average consumption assessed via two methods: a seven-day diary (NDNS) vs. an interview-based quantity-frequency recall of average drinking behaviour over the past 12 months (GHS). While seven-day measures are not generally recommended for alcohol surveys as they may not be a good guide to an individual's usual consumption (Stockwell, In Press:58), seven-day diaries may be slightly better at capturing unusual consumption that is ignored when people are asked about how much they 'usually drink' (although not to the level of past-day reports; Greenfield and Kerr, 2008). They may therefore be more suited to estimating the proportion of alcohol consumed above daily and weekly thresholds at the population level.

To get information on 11-15 year old drinkers, the Smoking, Drinking and Drug Use among Young People (SDD) survey was used. Mean alcohol consumption in each single-year age group from SDD and GHS and the 18+ age group from GHS was multiplied by age-specific population data for 2001, taken from National Statistics estimates (see Table 1). Finally, the March 2002 ONS Omnibus survey is the closest survey to this time period that contains data on both self-reported drinking and drink-driving. This includes separate questions on the self-reported past-12-month frequency of (i) any drinking before driving and (ii) driving over the legal drink-driving limit, which may be considered as upper and lower limits. For each, the share of alcohol

consumption on such occasions was estimated in two ways. Firstly, it was assumed that on each

reported drink-driving occasion, people drank an average amount (calculated from their

personal average). Secondly, it was assumed that on each reported drink-driving occasion,

people drank as much as the maximum that they reported drinking before driving in the past 12

months. (Information on the average amount drunk before driving was not available). These

assumptions are discussed below.

Calculating confidence intervals

While the estimates are straightforward, producing confidence intervals (CIs) for them is more

difficult as no formal mathematical expression is available, and previous studies have therefore

often not included them (e.g. Stockwell et al., 2008). Where they have been included (Foster et

al., 2006; Greenfield and Rogers, 1999), these appear to be based on the survey-design-adjusted

CI for the *mean consumption* in those drinking over Government guidelines. This is a different

quantity than their *share* of consumption, and consequently the estimates do not take into

account sampling error around the proportion of people consuming over Government

guidelines.

This study instead uses non-parametric bootstrap estimates to create confidence intervals

(Carpenter and Bithell, 2000; Efron and Tibshirani, 1993). These were done using the

'bootstrap' command in Stata v9.0, with 2,000 replications and using the 'bca' option to provide

BC_a estimates as recommended by Efron and Tibshirani. However, because the estimates for

underage drinking use three different surveys, it was not possible to produce boostrapped

confidence intervals for these estimates.

Results

Main results – counting all drinking

The main NDNS results using the conventional method of counting all drinking are shown in the third column of Table 2. The share of total alcohol consumption by 18-64 year olds accounted for by risky drinking ranged from 55% for binge-drinking, to 82% for the current sensible drinking guidance.

Table 2 – Share of total alcohol consumption in risky drinking, 19-64 year olds in NDNS 2000/1

Risky drinking definition	*Proportion of drinkers affected*	*Share of consumption by risky drinking (95% CI)**	
		Total	**If replaced by max advised level**
Current guidance (>4 units/day (m), >3 units/day (f))	*55.2%*	82.3% (80.7, 83.9)	46.6% (44.8, 48.6)
(Old) weekly guidance (>21 units/wk (m), >14 units/wk (f))	*28.0%*	73.7% (70.8, 76.6)	36.1% (33.7, 38.7)
Binge-drinking (>8 units/day (m), >6 units/day (f))	*39.1%*	54.7% (51.8, 57.8)	22.3% (20.6, 24.3)

* Confidence intervals for main estimates are bootstrapped; see methodology section for details.

Given that NDNS only includes 18-64 year olds, GHS was used to look at the implications of including a full adult age range for the weekly definition of risky drinking (the more recent daily definition not being available in GHS). Table 3 shows that restricting the age range *within GHS* increases the share of consumption accounted for by risky drinkers – unsurprisingly given that those over 65 are less likely than younger drinkers to drink heavily, although the extent of this reduction is generally small.

Table 3 – Share of total alcohol consumption by risky drinkers, comparing GHS and NDNS

Risky drinking definition	*Survey*	*Age-group*	*Proportion of drinkers affected*	*Share of consumption in risky drinking (95% CI)**	
				Total	**If replaced by max advised level**
Weekly (>21 units/wk (m), >14 units/wk (f))	NDNS	19-64	28.0%	73.7% (70.8, 76.6)	36.1% (33.7, 38.7)
	GHS	19-64	24.8%	69.9% (68.6, 71.2)	35.5% (34.1, 37.1)
	GHS	18+	22.3%	68.7% (67.5, 69.9)	34.7% (33.4, 36.2)

Main results – only counting drinking above the guidelines

If we only count drinking above the guidelines, we obtain the estimates in the fourth column of Table 2. These estimates are considerably lower than the estimates based on all risky drinking; for example, under the current sensible drinking guidelines, risky drinking accounts for 46.6% rather than 82.3%. The differences will be greater where the threshold for risky consumption is highest (it is consumption between zero and the guideline level that is different in the two methods). As a result, the difference is greatest for the binge-drinking definition (from 54.7% to

22.3%) as this has the highest threshold. The impact of looking at the full age range in Table 3 is similar if smaller than that described above.

Underage drinking

At the time the research was first undertaken there was no guideline for risky consumption in underage drinkers.   While draft guidance has been published more recently (Chief Medical Officers, 2009), it seems reasonable to treat all underage drinking as counter to government advice given its illegality. The results shown in Table 4. In total underage drinking accounts for 4.5% of consumption, this being primarily among 15-17 year olds rather than under-15s.

Table 4: Share of total alcohol consumption accounted for by under-age drinking in 2000/1

Age group	*Average consumption units/wk (95% CI)*	*Dataset*	*Population in this group 000s*	*Share of consumption*
10 year olds	0.16 (0, 0.48)	SDD	791.9	0.0%
11 year olds	0.14 (0.06, 0.21)	SDD	778.9	0.0%
12 year olds	0.41 (0.32, 0.50)	SDD	771.8	0.1%
13 year olds	1.2 (0.99, 1.41)	SDD	782.2	0.2%
14 year olds	2.96 (2.58, 3.35)	SDD	764.9	0.4%
15 year olds	5.83 (5.34, 6.33)	SDD	756.3	0.8%
16 year olds	10.23 (9.92, 10.55)	GHS	761.2	1.4%
17 year olds	13.66 (13.59, 13.74)	GHS	732.6	1.7%
Adults (18+)	12.01 (11.67, 12.36)	GHS	45,757.1	95.5%

Drink-driving

Table 5 shows the results from the drink-driving estimates, based on the occasions that people reported they drove after drinking. There are two measures of drink-driving behaviour and two different assumptions for each. Method 1 assumes that drink-drivers drank their personal average consumption level before driving, while method 2 assumes that drink-drivers drank their maximum reported drinking-before-driving level in the past 12 months.   Unsurprisingly method 1 produces greater estimates than method 2; the method 2 figures would seem likely to be more accurate, but given likely under-reporting in the drink-driving data (see Limitations below) the method 1 results are included as an upper bound.

Table 5 – Drink-driving

Risky drinking definition	*Percentage of population*	*Method ‡*	*Share of consumption in drink-driving days (95% CI)**
Self-reported drink-driving	29.3%	1	8.0% (7.8, 8.2)
		2	4.2% (3.9, 4.4)
Self-reported driving above the legal limit	7.9%	1	1.0% (0.9, 1.1)
		2	0.5% (0.3, 0.7)

* Confidence intervals for main estimates are bootstrapped; see methodology section for details.
‡ Method 1 assumes that people drink as much on every drink-driving occasion as their own average consumption; Method 2 assumes that people drink as much on every drink-driving occasion as their own maximum reported drinking-before-driving in the past 12 months. See Methodology section for further discussion.

If we then compare the two self-report measures of drink-driving, we see that the share of consumption drunk before driving *at all* is much greater than the share of consumption drunk before *breaking drink-driving laws*. This is unsurprising; the former is an upper bound of the true figure (as it includes legal drinking-before-driving) while the latter is a lower bound (due to social desirability effects and lack of knowledge about the law). Even so, the size of the difference is perhaps surprisingly large (4.2-8.0% vs. 0.5-1.0%).

Limitations

There are several limitations to the estimates presented here.   Firstly, the Government

guidelines differ from the absolute lowest-risk level of alcohol consumption in the UK (White et

al., 2002).[iii] Were we to use this definition, nearly all of the alcohol consumed in the UK would

be involved in risky consumption, however calculated. For example, if risky drinkers instead

drank the absolute lowest-risk amount, total consumption would decline by 91.7% (95%

bootstrapped CI 90.9-92.5%). However, this ignores the difference between *any* risk and

acceptable risk; the White et al figures also do not account for drinking patterns.

Secondly, the drink-driving data appear to be unreliable. For example, of those reporting very

frequent drink-driving, many report drink-driving more often than they report drinking *per se*.

Simultaneously, nearly half of those drinking 10+ units on the last drink-driving occasion said

they were not over the legal limit when they drove, suggestive of (predictable) social desirability

effects or ignorance of the law. The drink-driving estimates are therefore not robust and only

give indicative figures as to the likely share of consumption associated with drink-driving.

Third, it is well-established that most surveys of alcohol consumption find less alcohol has been

drunk than has been recorded as sold. The volume of alcohol reported in surveys is usually 40-

60% of total consumption (Stockwell et al., 2005), and previous similar studies have accepted

low coverage rates of 30-40% (Foster et al., 2003; Miller et al., 2006). In this study, 57-60% of

alcohol consumption is reported in the surveys (see Table 1). To the extent that under-reporting

is greater among heavier-drinking respondents (Goddard, 2008) and heavy drinkers are less

likely to respond (Bloomfield et al., 2003), there will be an under-estimate in the share of consumption associated with risky drinking.

There are two other minor limitations of the research. The survey of young people (SDD) is unweighted and restricted to England, and will therefore produced biased estimates for Great Britain as a whole. However, consumption at ages 11-15 is very low (as shown in Table 4), hence even relatively large biases will have small effects on the overall results. The other minor limitation is that the NDNS data are diary-based unlike the rest of the data that is interview-based. In particular, interview-based data represents people's reports of their average consumption in the past 12 months, and unusually heavy drinking occasions will be missed out from these self-reports. However, comparing NDNS and GHS data for 19-64 year-olds in Table 3, the effect seems relatively small.

Discussion

Comparisons to other studies

While different studies internationally have used different definitions of risky drinking and are based on different survey methodologies, it is possible to undertake a cautious comparison between studies to set the present results in context. These comparisons can account for the differences in 'standard drink' sizes between countries, but there will be unaccounted-for differences between standard drinks and the actual drink size poured in the country (Stockwell et al., 2008). Beginning within the UK, it is reassuring that the estimates are close to the Department of Health figures (2008:12). They estimate that drinking above the government weekly guidelines accounted for 76% of UK alcohol consumption (in 2006 using updated conversion factors), which is relatively close to the 69% estimated here (for 2001 using GHS and the old conversion factors).

Looking internationally, the limited comparison available suggests the UK figures are higher than the estimates for the US and Canada but roughly comparable to those from Australia. This is most clearly apparent for the estimates counting all drinking: 46% of alcohol consumption in the US (Foster et al., 2003) and 61% in Canada was above 3.4 UK units/day (Stockwell et al., 2005), compared to 82% of consumption by 18-64 year olds being above 4 (men)/3(women) units/day in the UK. Similarly, 42% of Canadian consumption was above 6.8 (men)/5.1(women) UK units/day (Stockwell et al., 2005), and 60% above 7.5(men)/5(women) UK units/day in Australia (Stockwell et al., 2008), compared to 55% of consumption being above the slightly higher UK binge-drinking guidelines (8(men)/6(women) units).

The impact of different assumptions

Of the three methodological decisions mentioned in the Introduction, this study has shown that two of these matter considerably. Firstly, higher government guidelines reduce the amount of consumption accounted for by risky drinking. This is unsurprising in itself but perhaps more so in degree; for example, 55% of all consumption is accounted for by government-designated binge-drinking, compared to 82% if risky drinking is defined as the government's official sensible drinking message. These differences are particularly large if we only count drinking above the guidelines, in which case binge-drinking accounts for 22% of consumption while the sensible drinking message accounts for 47%.

Secondly, both this study and Foster et al 2003 show that it matters whether we count all drinking or just drinking above guidelines. Risky drinking here consistently accounts for a majority of sales if we count all drinking (55-82%) but only a minority if we only include drinking above the guideline levels (22-45%). Finally, the results did not change significantly between a diary-based (NDNS) and survey-based (GHS) methods, suggesting that examining the same estimates from different surveys is non-essential.

Implications
Finally, does this study purport to show – like other studies have claimed (Anderson, 2003:4; Hawks, 1993) – that *"it is not in the alcohol industry's financial interest to voluntarily enact strategies to reduce underage or adult excessive drinking"* (Foster et al., 2003:994)? In fact, these figures do not directly show a conflict of interest for two reasons.

Firstly, the figures relate to total sales by *volume* rather than total sales by *value*. Other studies have attempted to estimate the value of sales by risky drinkers (Doran et al., 2009; Foster et al., 2006), but this is usually done without adjusting for the lower spending-per-unit in underage and heavy drinkers compared to others (accepted by Foster et al., 2003:992; and confirmed by Kerr and Greenfield, 2007). Accounting for this would be possible but would require special DEFRA permission to use the special access version of the Expenditure and Food Survey. In the meantime, we can only say that the proportion of spending by risky drinkers will be lower than the proportion of consumption by them.

Secondly, the figures ignore other reasons why it would be in drinks companies' 'enlightened self-interest' to reduce risky drinking. It is these reasons that enable the companies on the board of the International Center for Alcohol Policies to claim that *"we take strong exception with the assertion that 'there is a fundamental conflict' between commercial interests and the public health goal… Our operators…see no contradiction between these goals"* (Leverton et al., 2000:1430). This is not to say that such a view is necessarily justified, but rather that these other reasons must themselves be empirically considered – and these are covered in detail elsewhere (Baumberg, In Press).

Nevertheless, the results presented here are valuable figures to add to the public debate in their own right (Tom Greenfield, personal communication on 27/1/2009) – although they can be framed differently from different perspectives. Drinks companies could emphasise that less than half of 18-64 year-old's consumption is accounted for by risky drinkers, if we only look at the consumption that is actually above the guidelines. Consumption due to underage drinking (4.5%) and drink-driving (0.5 – 8.0%, probably closer to the former) do not change this

conclusion substantially. This is lower than the estimates in previous studies and reflects the importance of looking only at consumption above the guidelines, a methodological assumption that drinks companies could argue is justified given their focus on getting drinkers to 'drink responsibly' rather than to stop drinking per se.

At the same time, CSR critics could argue that even in this situation, there is a sizeable amount of consumption (at least 22-47%) accounted for by risky drinkers. If we assume that this would only be marginally affected if we looked at the value rather than volume of sales – which may or may not be true – this means that a very strong 'enlightened self-interest' motive is required for drinks companies to have reason to reduce risky drinking. Furthermore, there are other occasions when it may be more sensible to look at all consumption, in which case the share of consumption in risky drinking rises to 55-82%. Some effective policy options may be more likely to turn risky drinkers into non-drinkers, or to have an equivalent impact by reducing consumption among the entire population. And as Tim Stockwell has pointed out (in a personal communication on 25/1/2009), for a person drinking over the guidelines it is not possible to say which of the drinks they consume are risky and which are not; essentially they are *all* involved in the risky consumption.

In conclusion, this paper's contribution has been partly methodological and partly empirical. Methodologically, the study has shown the sensitivity of estimates of the consumption accounted for by risky drinkers to different definitions of risky drinking and different counterfactuals, as well as introducing bootstrap methods to calculate confidence intervals for the estimates. Empirically, this paper has transparently estimated for the first time the consumption accounted for by risky drinkers in the UK, and better-examined the implications of

these results for policy. From this, we have the necessary starting point for a more complex

analysis of the phenomenon of alcohol CSR, an analysis that is developed elsewhere (Baumberg,

In Press).

Conflict of Interest Declaration

Acknowledgements

Standards Agency (FSA) in collaboration with the MRC Resource Centre for Human Nutrition

Research, and sponsored by the FSA and Department of Health), the <u>ONS Omnibus Survey,</u>

<u>March 2002</u> (produced by the Social Survey Division of ONS, and sponsored by the Department

of Health, Department of Customs and Excise, Home Office Alcohol Research Unit, ONS

Population and Demography Division, Department for Work and Pensions, and ONS Social

Survey Division), and <u>Smoking, Drinking and Drug Use among Young People, 2001</u> (produced by

NatCen and NFER, sponsored by the Department of Health).

All data was supplied by the UK Data Archive (Study Numbers are given in Table 1). All data are

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copyright holders, funders or the UK Data Archive bear any responsibility for the analysis or

interpretation of the data contained in this document.

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[i] 'Sales' here refers to the *amount* rather than the *value* of alcohol sold; see the Discussion.

[ii] This has however been investigated for the US in unpublished work by Loran Archer, which was presented to an ICAP committee in 2000. This also included four different definitions of risky drinking.

[iii] The age-specific lowest-risk level of consumption at ages 16-24, 25-34, 35-44, 45-54, 55-64, 65-74, 75-84 and 85+ respectively estimated to be 0, 0, 2, 5, 7, 8, 8, 8 units/week (men) and 0, 0, 0, 1, 2, 3, 3, 3 units/week (women).