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How is alcohol consumption affected if we account for under-reporting? A hypothetical scenario

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Background: This study predicts the implications of under-reporting of alcohol consumption in England for alcohol consumption above Government drinking thresholds. **Methods**: Two nationally representative samples of private households in England were used: General LiFestyle survey (GLF) and Health Survey for England (HSE) 2008. Participants were 9608 adults with self-reported alcohol consumption on heaviest drinking day in the last week (HSE) and 12 490 adults with self-reported average weekly alcohol consumption (GLF). Alcohol consumption in both surveys was revised to account for under-reporting in three hypothetical scenarios. The prevalence of drinking more than UK Government guidelines of 21/14 (men/women) alcohol units a week, and 4/3 units per day, and the prevalence of binge drinking (>8/6 units) were investigated using logistic regression. **Results**: Among drinkers, mean weekly alcohol intake increases to 20.8 units and mean alcohol intake on heaviest drinking day in the last week increases to 10.6 units. Over one-third of adults are drinking above weekly guidelines and over three-quarters drank above daily limits on their heaviest drinking day in the last week. The revision changes some of the significant predictors of drinking above thresholds. In the revised scenario, women have similar odds to men of binge drinking and higher odds of drinking more than daily limits, compared with lower odds in the original survey. **Conclusion**: Revising alcohol consumption assuming equal under-reporting across the population does not have an equal effect on the proportion of adults drinking above weekly or daily thresholds. It is crucial that further research explores the population distribution of under-reporting.

Introduction

Reported alcohol consumption typically amounts to 40–60% of total alcohol sales in studies conducted internationally.[1–6] This observation has been persistent over time in the UK where average weekly alcohol consumption in the last 12 months from the General LiFestyle survey (GLF)[7] is compared with alcohol sales data for the UK, which is calculated using clearances of pure alcohol based on average strengths for beer, wine and cider, compiled by HM Revenue and Customs (HMRC).[8]

Mean weekly alcohol consumption was 12.3 units per week (using the revised method) per adult (aged 16+) in Great Britain in the GLF 2008.[9] Alcohol sales are available at a UK level and were equivalent to 20.5 units per week per adult (aged 16+) for the financial year 2008–09.[8] Over 8 units (20.5 units – 12.3 units = 8.2 units) a week are not accounted for in the GLF 2008. Alcohol consumption as a proportion of alcohol sales is 60% (12.3 units/20.5 units × 100 = 60%). The implications of under-reporting to this extent for alcohol consumption in England are explored using GLF 2008 and Health Survey for England (HSE) 2008.

There are several reasons for the discrepancy between self-reported consumption and alcohol sales, aside from the accuracy of participants' reporting. Previous work has attempted to understand and account for these differences in the data.[6,10] Table 1 updates and extends this account relevant for this study. Although it is not possible to quantify all the factors listed, it is plausible that the total amount of alcohol not captured in HMRC sales statistics outweighs that not captured in social surveys. In this case, calculating reported alcohol consumption as a proportion of alcohol sales leads to a conservative estimate of the extent to which reported alcohol consumption under-estimates actual consumption.

This study concerns under-reporting in the broad sense, to cover consumption that is not captured in social surveys due to the various forms of under-reporting: selective reporting, recall bias and accidental under-estimation. Although other recent studies have revised alcohol consumption to compensate for low coverage successfully[11–12] this study is the first to investigate the potential implications of under-reporting for alcohol consumption and draws attention to the importance of more accurate measures of alcohol consumption becoming available at a population level.

Methods

Source of data

The GLF was an annual longitudinal survey with a 4-year sample rotation (since 2005) designed to be representative of the adult (aged 16 and above) population living in private households in Great Britain (including students in halls of residence since 2008).[13] The GLF used a probability, stratified two-stage sample design. Full details of the GLF methodology are available in published reports.[14]

The GLF included questions on alcohol consumption from 1978 until the survey ended in 2011. These are administered as part of the main survey interview (self-completion questionnaire for 16- to 17-year olds) and are designed to measure average weekly alcohol consumption. Average weekly alcohol consumption, based on beverage specific quantity frequency questions on alcohol consumption in the preceding 12 months, was available for 12 490 adults living in England in GLF 2008 (from a total of 14 041 adults aged 16+ in England in the sample).

The HSE is an annual cross-sectional survey designed to be representative of the adult (aged 16+) population living in private households in England.[15] A multistage stratified probability sampling design is used. Full details of the HSE methodology are available in published reports.[16]

The HSE has included questions about alcohol consumption since the survey began in 1991. These are generally administered as part of the main survey interview (self-completion questionnaire for 16- to

Table 1 Quantifying alcohol consumption that is not captured in social surveys or in HMRC sales statistics

Alcohol sold but not captured in social surveys (for reasons other than under-reporting)		Alcohol consumption not captured in alcohol sales statistics	
Description	**Estimate**	**Description**	**Estimate**
Drinking by people outside sampling frame: under 16 years	Average weekly alcohol = 12.9 units in 11- to 15-year olds in 2010.[31] After taking into account prevalence, this is equivalent to 5 million units a week or 0.6% of alcohol sales.	Legal imports, illegal imports, informal production and homebrew	A 2013 UK study estimated this to have an effect of +1.23l on per capita sales estimates[11], however another study estimated this as 2 litres per capita in the 1990s.[32] This is equivalent to 175 million units a week in England in 2010. HMRC has a strategy to tackle alcohol fraud but information is lacking.[33–34] Personal correspondence with the Craft Brewing Association, the National Association of Wine and Beermakers, and homebrew online shops has confirmed there is no estimate of homebrew available for the UK.
Drinking by people outside sampling frame: homeless	50 430 households were in temporary accommodation in 2011.[35] Even if each household contained two adults, this is equivalent to 0.2% of the adult population in 2011. A 2013 UK study estimated this to have an effect of +0.08 litres on per capita survey estimates[11]	Counterfeit production	None available. This is of increasing concern to the industry; the WSTA launched a fraud prevention unit in May 2011.[36]
Drinking by people outside sampling frame: people living in institutions (armed forces, hospital, residential care, etc.). Students are included in GLF.	A 2013 UK study estimated this to have a net effect of −0.041 litres on per capita survey estimates (military = +0.006l, mental health institutions = −0.003l, care homes = −0.034l, and prisons = −0.010l)[11]	Consumption of non-beverage alcohol (e.g. antibacterial handwash)	None available
Drinking non-responders to surveys	A 2013 UK study estimated this to have an effect of +1.24 litres on per capita survey estimates (non-responding groups estimated were: students = +0.03l, dependent drinkers = +.01l, proxy interviewees in GLF = +0.20l)[11]	Consumption of UK residents while overseas	595 million nights spent abroad in 2011.[37] A 2013 UK study using 2006 data and per capita consumption estimates for key countries and estimates the net impact of tourism to be 0.86l[11]. However this may be underestimated: a 2011 survey by the world's largest travel website of 6671 respondents in France, Italy, Germany, Spain and the UK found 65% of British people drink more on holiday than at home, compared with a European average of 41%.[38]
Alcohol that is bought but not consumed: used in cooking, disposed of as reaches expiry, spillage/ wastage, stockpiling or storage.	Industry estimate for spillage/wastage is <10%.[10] A 2013 UK study estimated this to have an effect of −0.82l on per capita survey estimates (spillage/ wastage = −0.76l, food use = −0.06l).[11] Net effect of storage/stockpiling needs to be considered as previously stockpiled alcohol may be being consumed.		
Alcohol that is cleared for sale but not sold.	None available		
Consumed in the UK by foreign visitors	235 million nights spent in UK by foreign visitors in 2011.[37]		
Estimated total	**Between 1.9 and 2.1 litres per capita**	**Estimated total**	**Between 2.1 and 2.9 litres per capita**

17-year olds) and relate to alcohol consumption over the previous week, including heaviest drinking day in the last week. Heaviest drinking day in the last week, based on beverage and size-specific quantity questions, was available for 9608 adults aged 16 or above in HSE 2008. This is 99.3% of respondents who reported drinking alcohol in the last week (from a total of 15 102 adults aged 16+ in the sample).

Revising alcohol consumption

One UK unit is equivalent to 10 ml (8 g) ethanol. Weekly alcohol limits of 21 units for men and 14 units for women were introduced in a Royal College of Physicians report in 1987[17]; drinking above this level is often termed 'hazardous'. It has been recommended not to regularly exceed daily limits of 3–4 alcohol units a day for men, and 2–3 units a day for women, by the UK Chief Medical Officers since 1995.[18] The Department of Health in England's definition of binge drinking is consuming more than double the recommended limits in one session—≥8 units for men or ≥6 units for women.[19]

The GLF is used to explore weekly (hazardous) drinking, and the HSE is used to explore drinking above the upper limit of the recommended daily limits, or binge drinking, on the heaviest drinking day in the last week. Therefore, the analyses are restricted to adults drinking alcohol in the last week as non-drinkers are not included in the revision. Assessing misclassification of self-reported non-drinkers was beyond the scope of this study.

The change to the proportion of respondents drinking above certain levels is explored in three revised scenarios, summarized in table 2. Scenarios 2 and 3 were chosen because there is evidence that under-reporting varies by these factors. Although under-reporting is also likely to vary by demographic and social factors, there is no evidence to suggest the magnitude or the direction of these associations. The scenarios were generated using the relevant multiplier so that alcohol consumption was revised with the aim of matching alcohol sales. Scenario 1 assumes an equal proportion of under-reporting among all drinkers based on comparison of GLF with HMRC sales data. Scenario 2 assumes that heavy drinkers under-report proportionally more than light drinkers, based on the GLF/HMRC comparison and

Table 2 Description of three under-reporting scenarios

Scenario		Under-reporting level(s)	Multiplying factor
1	Equal under-reporting	39.8% globally	×1.66
2	Under-reporting varying by consumption level	Alcohol consumption split into tertiles	T1: × 1.25
		T1 (lightest) = 20%	T2: × 1.67
		T2 (middle) = 40%	T3: × 2.5
		T3 (heaviest) = 60%	
3	Under-reporting varying by drink type	Globally = 39.8%	Globally = × 1.66
		Beer/cider = 49.3%	Beer/cider = × 1.97
		Wine = 21.5%	Wine = × 1.27
		Spirits = 59.5 %	Spirits = ×2.47

findings that recall accuracy is lower among heavier drinkers.[20,21] For scenario 3, alcohol consumption as a proportion of alcohol sales was calculated by drink type using the GLF/HMRC comparison by drink type, as coverage varies greatly by drink type. Average weekly alcohol intake or heaviest drinking day in the last week was revised accordingly.

Outcome measures

Mean alcohol intake is calculated for both average weekly intake and heaviest drinking day in the last week in the original survey for each of the scenarios. The prevalence, among drinkers, of drinking above certain thresholds relating to UK Government drinking guidelines was investigated in the original survey and revised scenario 1 (scenarios 2 and 3 generate similar results, data not shown).

Multivariate logistic regression was used to estimate the odds of drinking more than these thresholds in the original surveys and revised scenario 1 (scenarios 2 and 3 generate similar results, data not shown), controlling for sex, age, region, equivalized household income quintile and Index of Multiple Deprivation (IMD) 2007 quintile (HSE only). These covariates were selected *a priori* because they are known risk or protective factors for alcohol consumption. All statistical analyses were completed in Stata 12.

Results

Alcohol consumption

Average weekly alcohol consumption is available for 12 490 adults (54% women) in England in the GLF 2008. Heaviest drinking day in the last week is available for 9608 adults (50% women) in the HSE 2008. The mean weekly alcohol intake and mean alcohol intake on heaviest drinking day in the last week for each of the three revised scenarios are summarized in the supplementary table 1.

Drinking with reference to Government guidelines

Descriptive statistics

In revised scenario 1, the prevalence of drinking more than the weekly guidelines increases by 15% points in men and 11% points in women such that 44% men and 31% women drink above the weekly guidelines (supplementary figure 1). The prevalence of drinking above the daily limit increases by 19% points in men and 26% points in women such that 75% men and 80% women would have drunk more than 4 and 3 units on their heaviest drinking day in the last week, respectively (supplementary figure 2). The prevalence of binge drinking increases by 20% points in men and 28% points in women such that the revised proportion binge drinking is similar to the original proportion drinking more than the recommended daily limits for both men and women (52–56%).

Table 3 Odds of average weekly alcohol intake >21/14 units in GLF 2008 and revised scenario 1

	Original GLF 2008		Revised scenario 1	
	OR	95% CI	OR	95% CI
Sex (female)	0.68	0.63–0.75**	0.61	0.57–0.66**
Age (1 year increase)	1.00	0.99–1.00*	1.00	0.99–1.00**
Income quintile				
1 (lowest)	1.00		1.00	
2	0.97	0.83–1.15	1.04	0.91–1.20
3	1.41	1.21–1.64**	1.59	1.39–1.82**
4	1.80	1.55–2.09**	1.94	1.70–2.21**
5 (highest)	2.65	2.29–3.07**	3.06	2.68–3.49**
Region				
North East	1.00		1.00	
North West	0.98	0.80–1.22	1.00	0.82–1.22
Yorkshire and the Humber	0.95	0.76–1.18	0.92	0.75–1.12
East Midlands	0.77	0.61–0.97*	0.81	0.66–1.00*
West Midlands	0.72	0.58–0.91*	0.76	0.62–0.93*
East of England	0.59	0.47–0.74**	0.63	0.51–0.77**
London	0.70	0.56–0.89*	0.67	0.54–0.82**
South East	0.77	0.62–0.95*	0.73	0.60–0.88**
South West	0.89	0.72–1.11	0.76	0.62–0.93*

Odds ratios from logistic regression, mutually adjusted. $N = 12\,490$ drinking adults.
*$P < 0.05$, **$P < 0.001$.

Multivariate analysis

Drinking more than the weekly limits (21/14) (table 3): Women are significantly less likely than men to drink above the weekly limits, and the odds ratios (ORs) are similar in the original survey and revised scenario [OR 0.68, 95% confidence interval (CI) 0.63–0.75 and OR 0.61, 95% CI 0.57–0.66, respectively]. The highest three income quintiles are significantly ($P < 0.001$ in each case) more likely to drink more than weekly guidelines in both the original survey and revised scenario. In the revised scenario, the South West becomes significantly less likely to drink more than the weekly guidelines than the North East (OR 0.76, 95% CI 0.62–0.93).

Drinking more than the daily limits (4/3) (table 4): In the original survey, women are significantly (OR 0.89, 95% CI 0.81–0.98) less likely than men to drink above the daily limits on their heaviest drinking day in the last week; however, in revised scenario 1, women are significantly more likely than men to drink above the daily limits (OR 1.37, 95% CI 1.23–1.54). This did not hold in scenarios 2 and 3 (results not shown, OR 0.66, 95% CI 0.59–0.73 and OR 0.74, 95% CI 0.67–0.83, respectively). The highest two income quintiles are significantly ($P < 0.01$ in both cases) more likely to drink above the daily limit than the lowest quintile in both the original survey and revised scenario. In the original survey, the most deprived quintile is significantly more likely to drink above the daily limits than the least deprived quintile (OR 1.20, 95% CI 1.01–1.42), but this is no longer significant in the revised scenario (OR 1.21, 95% CI 0.99–1.48). In the revised scenario, Yorkshire and the Humber becomes significantly less likely to drink above the daily limits than the North East (OR 0.68, 95% CI 0.51–0.91).

Binge drinking (8/6) (table 4): In the original survey, women are significantly less likely than men to binge drink (OR 0.66, 95% CI 0.60–0.73), but in the revised scenario, the OR increases such than women are equally as likely as men to binge drink (OR 1.02, 95% CI 0.93–1.12). The OR in scenario 2 is similar to scenario 1, but the OR in scenario 3 is similar to the original survey (results not shown). In the original survey, there are no significant associations between income quintile and binge drinking. However, in the revised scenario, the highest two income quintiles are significantly more likely to binge drink than the lowest quintile (OR 1.31, 95% CI 1.11–1.55 and OR 1.36, 95% CI 1.15–1.61, respectively). In the

Table 4 Odds of drinking above daily limits or binge drinking on heaviest drinking day in the last week in HSE 2008 and revised scenario 1

	Above daily limits (>4/3 units)				Binge drinking (>8/6 units)			
	Original HSE 2008		Scenario 1		Original HSE 2008		Scenario 1	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Sex (female)	0.89	0.81–0.98*	1.37	1.23–1.54**	0.66	0.60–0.73**	1.02	0.93–1.12
Age (1 year increase)	0.97	0.97–0.97**	0.98	0.97–0.98**	0.96	0.96–0.96**	0.97	0.97–0.97**
Income quintile								
1 (lowest)	1.00		1.00		1.00		1.00	
2	1.09	0.91–1.29	1.09	0.90–1.32	0.93	0.77–1.13	1.05	0.88–1.25
3	1.14	0.96–1.35	1.13	0.93–0.37	0.92	0.76–1.11	1.08	0.91–1.29
4	1.39	1.17–1.64**	1.31	1.08–1.59*	1.09	0.91–1.31	1.31	1.11–1.55**
5 (highest)	1.42	1.20–1.68**	1.77	1.45–2.15**	1.16	0.97–1.39	1.36	1.15–1.61**
Deprivation quintile								
1 (least deprived)	1.00		1.00		1.00		1.00	
2	1.08	0.94–1.24	1.07	0.91–1.26	0.91	0.73–1.14	1.11	0.97–1.28
3	0.93	0.81–1.08	0.98	0.83–1.16	0.85	0.67–1.07	0.95	0.83–1.10
4	1.06	0.91–1.24	1.06	0.88–1.26	0.74	0.58–0.96*	1.07	0.92–1.24
5 (most deprived)	1.20	1.01–1.42*	1.21	0.99–1.48*	0.67	0.53–0.86*	1.24	1.05–1.47*
Region								
North East	1.00		1.00		1.00		1.00	
North West	0.95	0.76–1.18	0.85	0.64–1.13	0.56	0.44–0.71**	0.95	0.76–1.18
Yorkshire and the Humber	0.84	0.67–1.06	0.68	0.51–0.91*	0.51	0.40–0.67**	0.81	0.65–1.02*
East Midlands	0.69	0.54–0.88*	0.73	0.54–0.99*	0.48	0.37–0.62**	0.68	0.54–0.87*
West Midlands	0.68	0.54–0.86**	0.64	0.48–0.86*	0.51	0.39–0.67**	0.66	0.52–0.83**
East of England	0.57	0.46–0.72**	0.54	0.41–0.73**	0.62	0.48–0.79**	0.56	0.44–0.70**
London	0.55	0.43–0.70**	0.49	0.36–0.66**	1.13	0.97–1.31	0.53	0.42–0.68**
South East Coast	0.54	0.42–0.69**	0.51	0.38–0.69**	0.97	0.82–1.13	0.52	0.41–0.66**
South Central	0.54	0.42–0.69**	0.51	0.38–0.70**	1.13	0.95–1.33	0.53	0.42–0.68**
South West	0.60	0.47–0.75**	0.53	0.40–0.71**	1.21	1.01–1.45*	0.60	0.47–0.76**

Odds ratios from logistic regression accounting for complex survey design, mutually adjusted. $N = 9608$ drinking adults.
*$P < 0.05$, **$P < 0.001$.

original survey, the two most deprived quintiles are significantly less likely to binge drink than the least deprived quintile (OR 0.74, 95% CI 0.58–0.96 and OR 0.67, 95% CI 0.53–0.86, respectively). In the revised scenario, the gradient reverses, and the most deprived quintile is significantly more likely to binge drink than the least deprived quintile (OR 1.24, 95% CI 1.05–1.47). This is also observed in scenarios 2 and 3 (results not shown). In the revised scenario, all regions except for the North West and Yorkshire and the Humber are significantly less likely to binge drink than the North East ($P < 0.001$ in all cases).

Discussion

Each of the three revised scenarios makes a substantial change to alcohol intake and the proportion of drinkers drinking more than the thresholds described. In particular, women are affected more than men. Women go from being significantly less likely to drink above the daily limits or to binge drink on their heaviest day in the last week, to being significantly more likely to drink above the daily limits and equally likely as men to binge drink in revised scenario 1. This can be partly explained by differences in the proportion of drinkers whose reported consumption was originally close to but not yet above these thresholds; in revised scenario 1, the daily limits effectively become 2.4 units for men and 1.8 units for women. For women, this is exceeded by drinking a single 175 ml glass of wine (at 12% alcohol by volume = 2.1 units); so it is perhaps not surprising that women are more heavily affected. There is merit in a more detailed analysis of mean consumption (weekly and heaviest day) by subgroup in the original and revised scenarios, but this is beyond the scope of this study.

Gradients observed for binge drinking across income and IMD quintiles appear to oppose one another in the revised scenario, with the most affluent income quintile and the most deprived IMD quintile more likely to binge drink. The reason for this is not known. It could be an artefact of the method of revising consumption (reporting accuracy may in fact vary by income or area deprivation) or might be explained by relatively high proportions of heavy drinkers living in deprived city centres.

The public health consequences of under-reporting can be understood considering the positive associations between alcohol consumption and mortality—for instance, the J-shaped relationship with cardiovascular disease (after 18, 20) or the linear relationship with other diseases such as some cancers. If this association is considered, for any given level of (reported) alcohol consumption, alcohol-related disease or mortality will be higher in under-reporters than the general population, and correct reporters will be at a lower risk. Under-reporters would be operating on a linear or J-shaped curve to the left of that of correct reporters.

In addition, if the Government drinking guidelines are based on epidemiological evidence of self-reported consumption and harm, and under-reporting is so prevalent, this could imply perverse incentives for alcohol policy. If the guidelines are based on evidence that consumption above a certain level is associated with harm, and this consumption is under-reported, the resulting guidelines may be perceived as 'artificially low'. Whether the guidelines ought to be set to reflect actual consumption, or instead that which is perceived or would be reported, is a complex issue that this study draws attention to for the first time. Data on alcohol-related harm are also based on self-reported consumption, and this article highlights the issues with the use of self-reported data.

Further research is necessary to understand the population distribution of under-reporting and to identify social, demographic and alcohol-related 'risk factors' for under-reporting alcohol consumption. This will make possible the identification of groups at higher risk of alcohol-related disease or mortality than their reported alcohol consumption reflects. Further, under-reporting weights for social surveys could be developed.

Strengths

This is the first study to consider the implications of under-reporting for alcohol consumption beyond guidelines. It demonstrates that under-reporting is a serious issue, the importance of which reaches beyond the accuracy of measuring alcohol consumption for its own sake, and into consequences for public health. This study highlights improving understanding the population distribution of under-reporting as a priority for alcohol researchers.

Limitations

This study makes the assumption that the difference between alcohol consumption reported in the GLF and total alcohol sales can be attributed wholly to under-reporting. On the basis of the evidence available, this may even be a conservative estimate because it is likely that the total amount of alcohol not captured in HMRC sales statistics exceeds the total amount of alcohol not captured in social surveys (see table 1: the sum of the second column is likely to exceed the first column). Although this is yet to be fully quantified, the Global Methods Director for a large market research agency (*Anonymous*, personal communication, 2011) agreed this is likely. We believe the assumption that alcohol consumption in the GLF is under-reported by 40% is justified.

Revising average weekly alcohol consumption in the GLF using alcohol sales and self-reported average weekly alcohol consumption (based on beverage-specific quantity-frequency questions about the last 12 months) accounts for what is believed to be total alcohol consumption. The application of this same revision using the same multiplier to a single drinking occasion, heaviest drinking day in the last week, assumes that recall of the drinks drunk on the heaviest drinking day in the previous 7 days is comparable with recall of beverage-specific quantity and frequency of alcohol intake in the last 12 months. As it is probable that recall over a shorter time period is better than a longer period (see Refs. 23–29), in the real world, the under-reporting of the heaviest drinking day in the last week might not be as much as the 40% assigned. Therefore, it is possible that the results for the heaviest drinking day in the last week may be an over-estimate.

A further assumption in the analyses, which considered only revised scenario 1, is that drinkers under-report their alcohol consumption equally by 40%. Although this is an obvious simplification, it is intended to highlight the potential impact that under-reporting has. The precise nature of the relationship between alcohol consumption and reporting accuracy is unknown; so improved specification of this scenario is impossible in the absence of data on the population distribution of under-reporting.

Scenarios 2 and 3 explored how variations in under-reporting would impact on alcohol consumption with limited success. Revised scenario 2 over-estimates alcohol consumption (average weekly alcohol consumption exceeded per capita alcohol sales), but the results from the multivariate analyses was broadly very similar to scenarios 1 and 3 (results not shown, data available from lead author). Revised scenario 3 is very similar to scenario 1. This similarity is in part be attributable to the fact that the drink type-sensitive revision could only be undertaken where participants reported drinking a single type of alcoholic drink (beer *or* wine *or* spirits) on their heaviest drinking day in the last week. As a substantial proportion (20% in GLF, 21% in HSE) of participants drink a combination of drink types, their alcohol consumption was revised using the method in scenario 1. As well as these alcohol-related factors described, the distribution of under-reporting is likely to vary by other alcohol-related factors and demographic and social factors. This is the subject of ongoing research by the authors.[30]

Conclusion

Attention has been drawn to the public health consequences of under-reporting in detail for the first time. The multivariate analyses show that even assuming an equal level of under-reporting (scenario 1) does not have an equal effect on the prevalence of drinking above some of the thresholds described. The implications of under-reporting for the prevalence of drinking above the three thresholds are different in different population groups—with women, those on high incomes, and those in deprived areas particularly affected for binge drinking. Future work will investigate demographic, social, and alcohol-related factors to understand the distribution of under-reporting. This will enable health professionals to more accurately estimate patients' alcohol consumption based on their reported consumption and illuminate areas where targeted alcohol education initiatives should be developed.

Supplementary data

Supplementary data are available at *EURPUB* online.

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Key points

- Self-reported alcohol consumption in social surveys is 60% of total alcohol sales in England in 2008.
- Even assuming an equal proportion of under-reporting, there are some changes to the significant sociodemographic predictors of drinking above Government thresholds; with women, those on high incomes, and those living in deprived areas particularly affected for binge drinking.
- Exploring the population distribution of this under-reporting could enable health professionals to identify at-risk populations and/or for under-reporting weights to be developed for social surveys.

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