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Measuring Alcohol Consumption in Population Surveys: A Review of International Guidelines and Comparison with Surveys in England

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Abstract

Aims: To review the international guidelines and recommendations on survey instruments for measurement of alcohol consumption in population surveys and to examine how national surveys in England meet the core recommendations.

Methods: A systematic search for international guidelines for measuring alcohol consumption in population surveys was undertaken. The common core recommendations for alcohol consumption measures and survey instruments were identified. Alcohol consumption questions in national surveys in England were compared with these recommendations for specific years and over time since 2000.

Results: Four sets of international guidelines and three core alcohol consumption measures (alcohol consumption status, average volume of consumption, frequency and volume of heavy episodic drinking) with another optional measure (drinking context) were identified. English national surveys have been inconsistent over time in including questions that provide information on average volume of consumption but have not included questions on another essential alcohol consumption measure, frequency of heavy episodic drinking. Instead, they have used questions that focus only on maximum volume of alcohol consumed on any day in the previous week.

Conclusions: International guidelines provide consistent recommendations for measuring alcohol consumption in population surveys. These recommendations have not been consistently applied in English national surveys, and this has contributed to the inadequacy of survey measurements for monitoring vital aspects of alcohol consumption in England over recent years.

INTRODUCTION

Monitoring alcohol consumption across a population is crucial to evaluating whether national policies and approaches are being effective in reducing alcohol-related harm (World Health Organization Regional Office for Europe, 2012; World Health Organization, 2010). Individual-level alcohol consumption data obtained using general population surveys have advantages over other measures of alcohol use such as sales data. They measure not only the volume but also patterns of individual alcohol consumption (World Health Organization, 2000) and allow researchers to link alcohol drinking with related consequences as well as to adjust for individual-level characteristics (Dawson, 2003). Furthermore, individual-level data enable comparison of drinking patterns between population subgroups (World Health Organization, 2000). However, self-reported alcohol consumption typically only accounts for 40–60% of total alcohol sales (Midanik, 1982; Bellis *et al.*, 2009; Boniface and Shelton, 2013). This underestimation of self-reported alcohol consumption is

likely to occur mainly due to sampling-frame issues (Shield and Rehm, 2012; Meier *et al.*, 2013), non-response bias (Zhao *et al.*, 2009; Maclennana *et al.*, 2012; Meiklejohn *et al.*, 2012; Gorman *et al.*, 2014) and under-reporting bias (Boniface *et al.*, 2014; Stockwell *et al.*, 2014; Livingston and Callinan, 2015). For example, general population surveys normally include people living in private households; hence, they do not take into account the alcohol consumption among homeless people, military personnel, people in care homes, university students living in halls of residence and prisoners, some of which groups are more likely to be involved in heavy drinking (Meier *et al.*, 2013).

In addition to the above limitations, the survey instruments themselves and the framing of the questions are likely to influence the adequacy of survey measures of alcohol consumption (Feunekes *et al.*, 1999; Rehm *et al.*, 1999; Dawson, 2003; Heeb and Gmel, 2005; Greenfield and Kerr, 2008). Multiple guidelines for how drinking should be measured in surveys have been proposed, but whether they are consistent in their recommendations has not been considered to date.

In the UK, alcohol survey data substantially underestimate alcohol consumption extrapolated from sales data, and this underestimation has increased over time (Catto, 2008). According to the General Lifestyle Survey (GLF) in 2008, the survey underestimation of alcohol consumption was around 40% when compared with the sales data (Boniface and Shelton, 2013), and the difference between GLF measure and alcohol sales was equivalent to 430 million units a week (Bellis *et al.*, 2009). In other words, a bottle of wine per adult (16 years and over) per week is unaccounted for due to survey underestimation (Bellis *et al.*, 2009). Adjusting GLF survey data to account for several potential biases from the methodology of the surveys, such as undersampling of dependent drinkers, increased the GLF's annual per capita alcohol consumption estimate, but it still remained 22% lower than the estimate obtained from equivalent alcohol sales data (Meier *et al.*, 2013). The issues with alcohol survey instruments in English surveys may have contributed towards this residual underestimation. It is important, therefore, to identify whether alcohol consumption measures from English surveys are based on the best available survey instruments. This study aims to identify and compare the recommendations on alcohol survey instruments from international guidelines and to establish whether national surveys in England are adequately measuring the key aspects of alcohol consumption.

METHODS

A literature search for international guidelines for measuring alcohol consumption in general population surveys was carried out. It was conducted within the websites of the World Health Organization (WHO), National Institutes of Health (NIH), Centres for Disease Control and Prevention (CDC), European Commission, UK Department of Health (DH) and the UK Office for National Statistics, as well as the PubMed database, by using the following search strategy: (recommendations OR standards OR guidelines OR agreement) AND (measuring OR monitoring OR reporting OR questions) AND (alcohol consumption OR ethanol consumption OR drinking alcohol OR drinking pattern). From the results of these searches, we identified those publications that provide international guidelines for measuring alcohol consumption among adults (age ≥16) in general population surveys. The references cited by identified guidelines were also scrutinized in order to identify any other existing international guidelines.

We extracted data on alcohol consumption measures and recommended survey instrument or questions from each guideline and the process used to establish them. When guidelines had both a minimum set of questions and a recommended set of questions for alcohol research, the recommended set of questions was extracted. The analysis was limited to the recommendations on alcohol survey instruments that measure levels and patterns of alcohol consumption. Therefore, the recommendations for measuring alcohol consequences or minimizing other limitations of national surveys, such as sampling-frame issues, under-reporting and non-response bias, were not included in the analysis.

We then looked for commonality between the guidelines in terms of recommended measures and survey instruments and described these common core recommendations. For example, all four guidelines recommend measuring frequency and volume of heavy episodic drinking (binge drinking) and using Graduated Quantity Frequency (GQF) questions as the survey instrument.

Finally, we identified the three major general population surveys that have been collecting alcohol consumption data using detailed questions on average volume of consumption and heavy episodic drinking among adults (age ≥16) in England (Goddard, 2007) and have been used to provide national-level estimates on adults alcohol consumption (Robinson and Harris, 2009; Office for National Statistics, 2013b; Lifestyles Statistics-Health & Social Care Information Centre, 2014). These are the Health Survey for England (HSE), GLF (previously called the General Household Survey, GHS) which ceased in 2012, and the Opinions and Lifestyle Survey (previously called the Omnibus Survey). All three surveys provide national data for England; GLF and Opinions and Lifestyle survey additionally provide data for other countries of the Great Britain. Alcohol consumption questions in these surveys were compared with the common core recommended alcohol consumption measures and survey instruments identified from the international guidelines. For each survey, the most recently available version of the questionnaire with alcohol consumption-related questions was used for initial comparison; for the HSE, this was 2013; for the GLF, 2011; and for the Opinions and Lifestyle Survey, this was 2008/2009 (Office for National Statistics, 2009; Office for National Statistics, 2011b; NatCen Social Research and University College London, 2013). After 2009, the Opinions and Lifestyle Survey did not include alcohol consumption questions; but in 2012, some of the GLF's alcohol consumption questions were transferred into it (Office for National Statistics, 2011a). We then assessed the consistency of the alcohol-related questions in each survey over time, from the year 2000 onwards until its most recent survey.

RESULTS

Guidelines for measuring alcohol consumption

Four sets of international guidelines that provide recommendations for measuring alcohol consumption in general population surveys were identified; the International Guide for Monitoring Alcohol Consumption and Related Harm by the WHO; Agreement on ways to measure alcohol consumption by the Kettil Bruun Society (KBS), an international organization of scientists engaged in research on alcohol use and alcohol problems; Recommended Alcohol Questions by the National Institute on Alcohol Abuse and Alcoholism (NIAAA); and Standardized Measurement of Alcohol-Related Troubles (SMART) Project Guidelines by the European Commission (Dawson and Room, 2000; World Health Organization, 2000; National Institute on Alcohol Abuse and Alcoholism, 2003; Moskalewicz and Sieroslawski, 2010).

In 2000, the WHO published the International Guide for Monitoring Alcohol Consumption and Related Harm aiming to provide

guidance on epidemiological monitoring of alcohol consumption and to improve the global and regional comparability of alcohol-related data (World Health Organization, 2000). It was drafted by a large number of leading experts in alcohol research with reference to the relevant evidence at that time. An agreement on ways to measure and report drinking patterns and alcohol-related problems in adult general population surveys was developed at the thematic conference of KBS held on April 2000, with participation of over 40 researchers from 12 countries (Dawson and Room, 2000). This thematic conference used 26 research papers plus the WHO guidance document mentioned above to draw their conclusions.

In 2003, a task force of the National Institute on Alcohol Abuse and Alcoholism (NIAAA, 2003) developed four recommended sets of alcohol questions for surveys that can include only a limited number of alcohol questions. They developed these using the recent epidemiological studies at that time and the WHO guide.

The European Commission's SMART project published its guidance and recommended alcohol questions for European countries in 2010. This project developed standardized comparative survey methodologies on heavy drinking, binge drinking, context of drinking, alcohol dependence and alcohol-related problems as well as public support for alcohol policy measures for use in the European Union (EU) (Moskalewicz and Sieroslawski, 2010). The methodology, developed on the basis of a review of European survey experiences from over 20 countries as well as a literature review, was tested in 10 countries with different sociocultural background and patterns of alcohol consumption.

All four guidelines emphasize that the surveys measuring alcohol consumption need to contain items on alcohol drinking status, average volume of alcohol consumption, and frequency and volume of heavy episodic drinking, where the volume of alcohol is calculated by multiplying the quantity and frequency of relevant drinking occasions over the past year. A minimum set of three questions (that can be used to obtain all above-mentioned alcohol consumption measures) have also been provided by the guidelines as shown in Table 1. In addition to this minimum set, all four guidelines give their recommended items for surveys that are able to include a larger number of questions. These include more detailed questions on volume of average alcohol consumption, frequency and volume of binge drinking and an optional section on drinking context (Table 1). For measuring average volume of alcohol consumption, Beverage Specific Quantity Frequency (BSQF) questions were identified as the most appropriate survey instrument, whereas Quantity Frequency (QF) questions were identified as adequate when surveys have limited resources and space for alcohol questions. QF questions measure how often alcohol was consumed and how much on each occasion, whereas BSQF questions do the equivalent for different types of alcohol beverage separately. All guidelines recommend GQF questions to assess heavy episodic drinking. GQF questions start by asking for the highest level of consumption on any occasion during the past year and then, based on the answer, ask a series of follow-up questions on frequency of consuming lesser quantities (e.g. frequency of consuming more than 144, 96, 60, 36 or 24 g of pure alcohol) (Dawson and Room, 2000; World Health Organization, 2000; Moskalewicz and Sieroslawski, 2010).

In addition to the above questions on essential alcohol consumption measures, questions on drinking context were also recommended by all four guidelines. Commonly recommended drinking context questions ask whether participants drank with or without meal, alone or with others and the place of drinking.

Some other additional alcohol consumption measures were also recommended by individual guidelines. For example, the WHO and SMART guidelines recommended including questions on unrecorded consumption (home brewed or purchased abroad) and duration of heavy drinking occasions. However, these additional questions were recommended for surveys that can include a large number of questions and they were not commonly recommended by all four guidelines.

Comparison of English survey questions with guidelines

Comparison of the most recently available questionnaire with guidelines

For all three surveys, the most recently available questionnaire with alcohol consumption-related questions covered only two essential alcohol consumption measures out of the three essential measures recommended by the international guidelines (Table 2). They are alcohol drinking status and average volume of alcohol consumption. English surveys addressed these two essential alcohol consumption measures precisely according to the international guidelines by using questions on abstention and BSQF questions with the past year as the reference period.

English surveys did not include questions on the frequency of heavy episodic drinking, the other essential measure recommended by the international guidelines. They have used an alternative set of questions on binge drinking that focusses only on the volume of alcohol consumed on the heaviest drinking day of the last week. The guidelines, on the contrary, recommend using GQF questions that measure not only the volume of binge drinking but also the frequency of binge drinking with the past year as the reference period.

In addition to the above questions on essential alcohol consumption measures, questions on drinking context were not addressed at all by either HSE or GLF. However, the Opinions and Lifestyle Survey included some of the recommended items on drinking context such as questions on place of drinking.

Comparison of survey questions overtime from the year 2000 onwards

The next phase of the analysis, which is the assessment of the consistency of alcohol-related questions in each survey over time from the year 2000 onwards, showed that HSE and GLF surveys have broadly maintained their structure over time. However, there has been some inconsistency in the inclusion of BSQF questions that provide data on the average volume of alcohol consumption, a core measure. The BSQF question category has been excluded for 8 years in HSE, from 2003 to 2010. The GLF has also been inconsistent in including BSQF and overall frequency of drinking questions; BSQF questions were not included in the GLF in 2003/2004, 2004/2005 and in 2007 questionnaires. There have also been some changes in the total number of questions asked, the order of questions and the wording of questions. The Opinions and Lifestyle Survey was not included in this phase of the analysis as it did not include alcohol consumption questions annually.

DISCUSSION

Alcohol consumption data from national surveys are essential for epidemiological and public health research purposes, and existing international guidelines are broadly consistent in their recommendations for how alcohol consumption should be measured in these surveys. Alcohol consumption status, average volume alcohol consumption, and frequency and volume of binge drinking are the essential alcohol consumption measures recommended by all four guidelines with another recommended item on drinking context for surveys that can include a large number of questions. English national surveys have collected data only on two core items, as they did not include questions on the frequency of binge drinking. The alternative method they have

Table 1. Common core categories of alcohol consumption measures and the associated questions recommended by international guidelines (**M**: minimum set of questions for surveys with limited resources)

Required measures (reference period)	Recommended survey instrument	WHO Guidelines in 2000	KBS Conference Guidelines in 2000	NIAAA Guidelines in 2003	EU Commission (SMART) Guidelines in 2010
(1) Alcohol drinking status (past year and lifetime)—CORE ITEM	Questions on abstention	Derived from the Question 1 below when respondents have not drunk in the past year. Abstention—past 12 months abstention—lifetime	Derived from the Question 1 below when respondents have not drunk in the past year. Abstention—past 12 months abstention—lifetime	Derived from the Question 1 below when respondents have not drunk in the past year. Abstention—past 12 months abstention—lifetime	Derived from the Question 1 below when respondents have not drunk in the past year. Abstention—past 12 months abstention—lifetime
(2) Volume of alcohol consumption (past year)—CORE ITEM	Quantity frequency questions—QF (past year)	(1) In the past year, how often did you drink any alcoholic beverage? (**M**)	(1) Overall frequency of drinking considering all types of alcoholic beverages (**M**)	(1) During the last 12 months, how often did you usually have any kind of alcoholic drink? (**M**)	(1) How often did you drink beer, wine, spirits or any other alcoholic drink in past 12 months?
		(2) How many drinks did you usually have on days you drank in the past year? (**M**)	(2) Usual quantity of drinking, all alcoholic beverages together (**M**)	(2) During the last 12 months, how many alcoholic drinks did you have on a typical day you drank alcohol? (**M**)	(Recommendations for usual quantity—not included)
	Beverage-specific quantity and frequency—BSQF (past year)	(3) After a filter question that determines whether or not specific type of beverage was consumed, ask for the largest as well as usual beverage specific quantity and frequency	(3) Beverage-specific frequencies of drinking, usual quantities of drinking, size of usual drink, maximum quantity and frequency	(3) Beverage-specific consumption	(2) How often did you drink beer in the past year? (3) How much did you drink on average on a day when you drank beer over the past 12 months? Repeat Q2, 3 for wine, sprits and for another type
(3) Frequency and volume of heavy episodic drinking (past year)—CORE ITEM	GQF questions starting with the largest number of drinks (past year)	(4) Counting all types of beverages combined, what was the largest number of drinks that you drank in a single day in the past year?	(4) The largest amount drunk in last 12 months, all beverages together?	(4) The largest number of drinks containing alcohol you drank within 24 h during the past year?	Recommendations not included
			(5) How often above amount was consumed?	(5) How often above amount was consumed? Repeat Q5 for lifetime	
		(5) In the past year, how often did you drink five or more drinks of any alcoholic beverage or combination of beverages in a single day? (**M**) (Preferably should obtain from questions with cut-off values of 12+, 8–11, 5–7, 3–4 and 1–2 drinks, a drink is equivalent to 12 g of pure alcohol)	(6) Frequency of consuming >60 g ethanol or if above, frequency of consuming>96 g ethanol in a single day? (**M**) (Preferably should obtain from questions with cut-offs: 24, 36, 60, 96, 144 and 240 g of pure alcohol)	(6) During the last 12 months, how often did you have five or more (males) or four or more (females) drinks containing any kind of alcohol in within a two hour period? (**M**) (A drink is equivalent to 12 g of pure alcohol)	(4) How often in the past 12 months, have you had six drinks or more on one occasion? (Which is equivalent to 60 g of pure alcohol) (5) Repeat Q4 for 12 drinks

Continued

Table 1. Continued

Required measures (reference period)	Recommended survey instrument	WHO Guidelines in 2000	KBS Conference Guidelines in 2000	NIAAA Guidelines in 2003	EU Commission (SMART) Guidelines in 2010
(4) Drinking context OPTIONAL ITEM	Questions on drinking context	(6) During the past year, where did you usually drink?	(7) Questions on whether the participant *Had drinks with meals or not	(7) Questions on drinking contexts	(6) When you drink alcohol do you usually drink *With a meal or at some other time?
		(7) What proportion of time you spent in different locations	*Had drinks on a weekday/weekend	(Specific questions not included)	*Where?
			*Had drinks alone or with others		*With whom?
		(8) How often did you drink in above-mentioned locations?	*Had drinks in public (bar/restaurants) or not in public		

used, which focusses on volume of alcohol drunk in the heaviest drinking day of the last week, is likely to underestimate the scale of heavy drinking in England. The inclusion of beverage-specific questions, the only source of information in English surveys for measuring volume of average alcohol consumption, has been inconsistent over time.

It is perhaps not surprising that some of the guidelines are consistent, as they have been constructed by some of the same leading experts in the field and based on their understanding of the available evidence. The recommendations from the SMART project stand alone in resulting from a full systematic review of the evidence, and with testing of these recommended questions across multiple European countries, including the UK. It is reassuring that the recommendations of the SMART project on essential alcohol consumption measures are similar to those of the other guidelines. We have compared the guidelines with national survey data for England. Welsh and Scottish Health Surveys containing similar, but not identical, alcohol questions to those in the HSE also exist, and the GLF and Opinions and Lifestyle Survey provide data for other UK countries as well; however, in the interests of clarity, we have focussed on surveys used in England.

We have used the guidelines as a means of assessing the quality of alcohol consumption data for in England but it should be recognized that consistency with the guidelines may still not constitute successful alcohol consumption measurement. Even surveys that have the 'best-case' measures according to the guidelines are likely to produce estimates that are lower than sales. This will be partly due to biases in who is surveyed in the national surveys, resulting from the sampling frame and non-response, but problems with the survey instruments remain. For example, BSQF is the recommended survey instrument to measure volume of alcohol consumption according to all four international guidelines, but BSQF is less reliable for measuring irregular drinking patterns since it is based on average measures and it does not capture the volume of alcohol taken as a combination of various types of drinks (Moskalewicz and Sieroslawski, 2010). There have been attempts to improve the recording of self-reported alcohol consumption by using more detailed drinking location-specific questions (Casswell *et al.*, 2002; Casswell *et al.*, 2012), and by using the 'yesterday' method, which includes questions about the amount of alcohol consumed on the day before the interview (Stockwell *et al.*, 2008). The 'yesterday' method has proved to be effective in minimizing under-reporting of overall alcohol consumption, but it appears to be best used to augment other methods capable of describing longer-term alcohol drinking patterns such as the GQF (Stockwell *et al.*, 2008). The location-specific alcohol consumption questions have been used by the International Alcohol Control Study (IAC). For Australia and New Zealand, this method has generated alcohol consumption estimates that were equal to 86 and 94% of alcohol sales, respectively (Casswell *et al.*, 2002; Livingston and Callinan, 2015). However, this highly detailed method is time consuming and may not be suitable for multi-purpose surveys of the type discussed in this paper (Casswell *et al.*, 2012).

Heavy episodic drinking, extreme drinking or binge drinking refers to a drinking pattern of consuming an intensive volume of alcohol over a short period of time that is likely to lead to intoxication and acute consequences (World Health Organization, 2014; World Health Organization, http://www.who.int/substance_abuse/terminology/who_lexicon/en/). According to the WHO, heavy episodic drinking is defined as 'drinking at least 60 g (7.5 units) or more of pure alcohol on at least one occasion in the past 30 days' (World Health Organization, 2014), where 60 g is an approximate cut-off value for high-risk drinking, though the cut-offs used for high-risk drinking varies slightly between countries (World Health Organization, 2000). For example, in the UK, binge drinking is defined as drinking twice or more than the sensible drinking limits of 3–4 units per day for men and 2–3 units per day for women, where a unit represents about 8 g ethanol (Parlimentary Office of Science and Technology, 2005; HM Government, 2007). The English surveys may use questions on the maximum amount of alcohol drunk on the heaviest drinking day of the previous week, rather than the GQF questions on frequency of heavy drinking incidences over the last year, because they are aiming to identify those drinking above the sensible drinking limits and binge drinking limits as defined by the DH who use daily benchmarks (Goddard, 2007; Office for National Statistics, 2013a). However, the shorter reference period of last week is likely to greatly underestimate the proportion of heavy drinkers and miss infrequent drinkers (World Health Organization, 2000; National Institute on Alcohol Abuse and Alcoholism, 2003; Moskalewicz and Sieroslawski, 2010). Even though it is difficult to estimate exactly by how much binge drinking is being underestimated in English surveys as a result of the current survey approach, a study from Canada that compared the GQF measure on last year alcohol consumption with a weekly drinking measure on previous week consumption found that the former gave five times higher prevalence estimate of binge drinking (Rehm *et al.*, 1999). Therefore, the English survey binge drinking measure based on just one

Table 2. Comparison of English survey questions with the common core categories of alcohol consumption measures recommended by international guidelines

Required measures (reference period)	Recommended survey instrument	HSE (2013)	GLF (2011)	ONS Opinions Survey (2008/2009)
(1) Alcohol drinking status (past year and lifetime)—CORE ITEM	Questions on abstention	(1) Do you ever drink alcohol nowadays, including drinks you brew or make at home? (2) If Q1 = No, does that mean you never have an alcoholic drink nowadays, or do you have an alcoholic drink very occasionally? (3) If Q2 = Never, have you always been a non-drinker or did you stop drinking for some reason?	(1) Do you ever drink alcohol nowadays, including drinks you brew or make at home? (2) If Q1 = No, does that mean you never have an alcoholic drink nowadays, or do you have an alcoholic drink very occasionally? (3) If Q2 = Never, have you always been a non-drinker or did you stop drinking for some reason?	(1) Do you ever drink alcohol nowadays, including drinks you brew or make at home? (2) If Q1 = No, does that mean you never have an alcoholic drink nowadays, or do you have an alcoholic drink very occasionally? Questions not included
(2) Volume of alcohol consumption (past year)—CORE ITEM	Quantity frequency questions—QF (past year)	(4) If Q1 = Yes OR Q2 = Very occasionally, thinking now about all kinds of drinks how often have you had an alcoholic drink of any kind during the last 12 months?	(4) If Q1 = Yes OR Q2 = Very occasionally, Would you say: hardly drink at all, drink a little, drink a moderate amount, drink quite a lot, drink heavily (5) Thinking now about all kinds of drinks, how often have you had an alcoholic drink of any kind during the last 12 months?	(3) Thinking now about all kinds of drinks how often have you had an alcoholic drink of any kind during the last 12 months?
		Questions on usual quantity—not included	Questions on usual quantity—not included	Questions on usual quantity—not included
	Beverage-specific quantity and frequency—BSQF (past year)	IF Q1 = Yes or Q2 = Very occasionally	IF Q1 = Yes or Q2 = Very occasionally	IF Q1 = Yes or Q2 = Very occasionally
		Type 1: Normal strength beer, lager, stout, cider, shandy (5) How often have you had type 1 drink during the last 12 months? (6) How much type 1 drink have you usually drunk on any one day during the last 12 months? (Half pint, small cans, large cans, bottles) (7) How many (Q6 size) type 1 drink have you usually drunk on any one day during the last 12 months?	Type 1 :Normal strength beer, lager, stout, cider or shandy (6) How often have you had a drink of type 1 during the last 12 months? (7) How much type 1 drinks have you usually drunk on one day during the last 12 months? (Half pints, small cans, large cans, bottles) (8) How many (size Q7) of type 1 drinks have you usually drunk on any one day during last 12 months?	Type 1: Strong beer, lager, stout, cider (4) How often have you had a type 1 during the last 12 months? (5) How much type 1 drinks have you usually drunk on any one day during the last 12 months? (Half pints, cans, bottles) (6) How many (Q5 size) type 1 drink have you usually drunk on any day during the last 12 months?
		Repeat above questions for other drink types Repeat Q5–Q7 for strong beer, lager, stout or cider	Repeat above questions for other drink types Repeat Q6–Q8 for strong beer, lager, stout or cider	Repeat above questions for other drink types Repeat Q4–Q6 for normal strength beer, lager, stout, cider
		Repeat Q5 and Q6 for spirits and sherry Repeat Q5 and Q6 for wine with extra question on glass size	Repeat Q6 and Q7 for spirits and sherry Repeat Q6 and Q7 for wine with extra question on glass size	Repeat Q4 and Q5 for spirits and sherry Repeat Q4–Q6 for wine with extra questions on wine glass size
		Repeat Q5–Q7 for alcopops	Repeat Q6–Q8 for alcopops	Repeat Q4–Q6 for alcopops and other drinks

Continued

Table 2. Continued

Required measures (reference period)	Recommended survey instrument	HSE (2013)	GLF (2011)	ONS Opinions Survey (2008/2009)
(3) Frequency and volume of heavy episodic drinking (past year)—CORE ITEM	GQF questions starting with the largest number of drinks (past year)	GQF questions not included Alternative method used: This only produces the volume of consumption in the heaviest drinking day last week (8) Did you have an alcoholic drink in the 7 days ending yesterday? (9) On how many days out of the last week did you have an alcoholic drink? (10) If (Q9 > 1) Did you drink more on some days than others, or did you drink about the same on each of those days? (11) Which day last week did you (have an alcoholic drink/ have the most to drink)? (12) What types of drinks did you have that day (Q11 day)? (Type 1: Normal strength beer/lager/cider/shandy) (13) If (Q12 = Type (1) How much of type 1 drinks did you drink that day (Q11 day)? (Half pints, small cans, large cans, bottles) (14) How many (Q13 size) of type 1 drinks did you have that day? If (Q12 = Other drink types mentioned below) Repeat Q13 and Q14 for strong beer, lager, stout or cider Repeat Q13 for spirits and Sherry Repeat Q13 and Q14 for alcopops and for wine with glass size Repeat Q13 for three other types of drinks	GQF questions not included Alternative method used: This only produces the volume of consumption in the heaviest drinking day last week (9) Did you have an alcoholic drink in the 7 days ending yesterday? (10) On how many days out of the last week did you have an alcoholic drink? (11) If (Q10 > 1) Did you drink more on some days than others, or did you drink about the same on each of those days? (12) Which day (last week) did you last have the most to drink? (13) What types of drink did you have that day (Q12 day)? (Type 1: Normal strength beer/lager/cider/shandy) (14) If (Q13 = Type (1) How much of type 1 drinks did you drink that day (Q12 day)? (Half pints, small cans, large cans, bottles) (15) How many (Q14 size) of type 1 drinks did you have that day? If (Q13 = Other drink types mentioned below) Repeat Q14 and Q15 for strong beer, lager, stout or cider Repeat Q14 for spirits and sherry Repeat Q14 and Q15 for alcopops and for wine with glass size	GQF questions not included Alternative method used: This only produces the volume of consumption in the heaviest drinking day last week (7) Did you have an alcoholic drink in the 7 days ending yesterday? (8) On how many days out of the last 7 did you have a drink? (9) If (Q8 > 1) Did you drink more on some days than others, or did you drink about the same on each of those days? (10) If (Q8 = 1|Q9 = varied) On which day did you have (a drink/most to drink)? (11) If (Q9 = varied| same) Thinking about (most to drink day/most recent drinking day) what types of drink did you have? (Type 1: Strong beer, larger, stout and cider) (12) If (Q11 = Type (1) How many half pints of strong beer, lager, stout and cider did you drink that day? (13) Specify amount of type 1 you drunk that day If (Q11 = Other drink types mentioned below) Repeat Q12 and Q13 for normal strength beer, lager, stout, cider, shandy Repeat Q12 and Q13 for wine with extra questions on glass size Repeat Q12 and Q13 for alcopops, sprit and sherry
(4) Drinking context OPTIONAL ITEM	Questions on drinking context	Questions not included	Questions not included	Questions on alcohol drinking places and companion

day of the previous week might be expected to miss even more binge drinkers because of the shorter time frame. It may also be affected by seasonality due to its shorter reference period and may fail to represent respondents' overall pattern of binge drinking. Therefore, the English surveys' heaviest drinking day measure on its own cannot be used for most epidemiological research purposes. A review of data from Scotland's routine national surveys has also reported similar findings on binge drinking measures based on the shorter reference period of last week (Catto, 2008).

An individual's average volume of alcohol consumption is the other most important indicator used in alcohol epidemiology as it has a causal impact on chronic diseases such as cancers, diabetes mellitus, depressive disorder and liver cirrhosis (Rehm *et al.*, 2003, 2010). Despite its importance, the BSQF questions that provide the information on average volume of consumption in English surveys have been inconsistently included over time so that this core measure is also unavailable for some years. This has resulted in gaps in time series data on average volume of consumption and limits the potential of these data for formal time series analysis to identify trends in consumption and evaluate policy interventions.

According to the international guidelines, total alcohol consumption from surveys should be calculated by aggregating the average

volume of consumption and consumption due to binge drinking occasions (World Health Organization, 2000; Moskalewicz and Sieroslawski, 2010). This adjustment has also proved to improve prevalence estimates for heavy drinking, since respondents do not normally include heavy drinking occasions in estimates of their average consumption (Mandy Stahre *et al.*, 2006). Therefore, using the average volume of alcohol consumption generated by BSQF questions on its own can contribute towards the survey underestimation of alcohol consumption in England when comparing with sales data.

In January 2012, the GLF was ceased (Office for National Statistics, 2011b), and this has ended a unique and powerful time series of alcohol consumption data in its 35th year (Goddard, 2007). Even though alcohol consumption questions asked in the GLF have been transferred to the Opinions and Lifestyle Survey (Office for National Statistics, 2012b), they do not include the detailed beverage-specific questions asked in the GLF (Office for National Statistics, 2011a), and the Opinions and Lifestyle Survey has a relatively small sample size due to its format of monthly surveys (Office for National Statistics, 2012c). Out of the three major surveys that used to provide national estimates on alcohol consumption in England, HSE is currently the only survey that continues to measure alcohol consumption annually. However, HSE is also limited by inconsistent inclusion of questions on essential alcohol consumption measures and its small sample size when compared with GLF. Some of the limitations of England's major national surveys in measuring alcohol consumption may be addressed by more recent additions to the spectrum of surveys in this country. The Alcohol Toolkit Study (ATS) includes all essential alcohol consumption indicators including the frequency of binge drinking in a large nationally representative sample of adults in England (Beard *et al.*, 2015). This study uses the Alcohol Use Disorders Identification Test (AUDIT) to measure alcohol consumption, which includes the minimum recommended number of alcohol questions but not the detailed survey instruments shown in Table 1. Alcohol Policy Interventions in Scotland and England (APISE), which is the other recent study, represents England and Scotland's arm of the IAC (Casswell *et al.*, 2012); it covers all essential alcohol consumption measures but uses a small sample size of 3725 adults split evenly between England and Scotland (Sheffield Alcohol Research Group, 2015). Both these studies are bounded by limited funding available only for a few years (Beard *et al.*, 2015; Gateway to Research-Research Councils UK, 2015).

Therefore, future surveys should aim to use methodologies that reduce their inherent biases, but should also strive to retain consistency of core indicators of alcohol epidemiology that are essential for monitoring public health and evaluating alcohol control policies and other interventions. It is important that this includes a measure of the frequency of binge drinking. Ideally, the recommended survey instruments on all core alcohol consumption indicators should be included in the newer Integrated Household Survey, which is carried out quarterly and has a much larger sample size than HSE (Office for National Statistics, 2012a). Including more detailed alcohol questions on drinking context would be helpful in identifying the associations between drinking and its consequences (World Health Organization, 2000; Moskalewicz and Sieroslawski, 2010). For example, drinking without meals (Trevisan *et al.*, 2001), in public drinking places (Rossow, 1996), with many others (Wells and Graham, 2003) has been associated with higher rates of alcohol consequences. Ensuring that measurement of alcohol consumption in all countries adheres to the guidelines would not only provide more reliable estimates for each country to evaluate its own level of public health risk and effectiveness of national policy, but it also improve the global and regional comparability of data on alcohol use and health consequences in order to improve monitoring and to facilitate research, risk assessment and advocacy.

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CONFLICTS OF INTEREST STATEMENT

None Declared.

REFERENCES

Beard E, Brown J, West R, *et al.* (2015) Protocol for a national monthly survey of alcohol use in England with 6-month follow-up: 'the Alcohol Toolkit Study'. *BMC Public Health* **15**:230.

Bellis MA, Hughes K, Cook PA, *et al.* (2009) *Off Measure: How We Underestimate the Amount We Drink*. London: Alcohol Concern.

Boniface S, Shelton N. (2013) How is alcohol consumption affected if we account for under-reporting? A hypothetical scenario. *Eur J Public Health* **23**:1076–81.

Boniface S, Kneale J, Shelton N. (2014) Drinking pattern is more strongly associated with under-reporting of alcohol consumption than socio-demographic factors: evidence from a mixed-methods study. *BMC Public Health* **14**:1297.

Casswell S, Huckle T, Pledger M. (2002) Survey data need not underestimate alcohol consumption. *Alcohol Clin Exp Res* **26**:1561–7.

Casswell S, Meier P, MacKintosh AM, *et al.* (2012) The International Alcohol Control (IAC) Study—evaluating the impact of alcohol policies. *Alcohol Clin Exp Res* **36**:1462–7.

Catto S. (2008) *How Much are People in Scotland Really Drinking? A Review of Data From Scotland's Routine National Surveys*. Public Health Observatory Division, Health Scotland.

Dawson DA. (2003) Methodological issues in measuring alcohol use. *Alcohol Res Health* **27**:18–29.

Dawson DA, Room R. (2000) Towards agreement on ways to measure and report drinking patterns and alcohol-related problems in adult general population surveys: the SkarpoÈ Conference overview. *J Subst Abuse* **12**:1–21.

Feunekes GIJ, Veer PVT, Staveren WAV, *et al.* (1999) Alcohol intake assessment: the sober facts. *Am J Epidemiol* **150**:105–12.

Gateway to Research-Research Councils UK. (2015) Alcohol Policy Interventions in Scotland and England: APISE [Online]. http://gtr.rcuk.ac.uk/project/9D0BCFB9-621E-4606-96D2-53A2C1EACC5B# (20 May 2015, date last accessed).

Goddard E. (2007) *Estimating Alcohol Consumption From Survey Data: Updated Method of Converting Volumes to Units*. Newport: Office for National Statistics.

Gorman E, Leyland AH, McCartney G, *et al.* (2014) Assessing the representativeness of population-sampled health surveys through linkage to administrative data on alcohol-related outcomes. *Am J Epidemiol* **180**:941–8.

Greenfield TK, Kerr WC. (2008) Alcohol measurement methodology in epidemiology: recent advances and opportunities. *Addiction* **103**:1082–99.

Heeb J-L, Gmel G. (2005) Measuring alcohol consumption: a comparison of graduated frequency, quantity frequency, and weekly recall diary methods in a general population survey. *Addict Behav* **30**:403–13.

HM Government. (2007) Safe. Sensible. Social. The Next Steps in the National Alcohol Strategy. Department of Health, Home Office, Department for Education and Skills, Department for Culture, Media and Sport.

Lifestyles Statistics-Health & Social Care Information Centre. (2014) Statistics on Alcohol: England-2014. V1. http://www.hscic.gov.uk/catalogue/PUB14184/alc-eng-2014-rep.pdf (10 June 2015, date last accessed).

Livingston MJ, Callinan S. (2015) Underreporting in alcohol surveys: whose drinking is underestimated? *J Stud Alcohol Drugs* **76**:158–64.

Maclennana B, Kypri K, Langley J, *et al*. (2012) Non-response bias in a community survey of drinking, alcohol-related experiences and public opinion on alcohol policy. *Drug Alcohol Depend* **126**:189–94.

Mandy Stahre TN, Brewer R, Holt J. (2006) Measuring average alcohol consumption: the impact of including binge drinks in quantity–frequency calculations. *Addiction* **101**:1711–8.

Meier PS, Meng Y, Holmes J, *et al*. (2013) Adjusting for unrecorded consumption in survey and per capita sales data: quantification of impact on gender- and age-specific alcohol-attributable fractions for oral and pharyngeal cancers in Great Britain. *Alcohol Alcohol* **48**:241–9.

Meiklejohn J, Connor J, Kypri K. (2012) The effect of low survey response rates on estimates of alcohol consumption in a general population survey. *PLoS One* **7**: e35527.

Midanik L. (1982) The validity of self-reported alcohol consumption and alcohol problems: a literature review. *Addiction* **77**:357–82.

Moskalewicz J, Sieroslawski J. (2010) Drinking Population Surveys—Guidance Document for Standardized Approach. Warsaw: Institute of Psychiatry and Neurology.

NatCen Social Research and University College London. (2013) Health Survey for England, Series [Online]. Department of Epidemiology and Public Health, Colchester, Essex: UK Data Archive. http://discover.ukdataservice.ac.uk/series/?sn=2000021 (20 May 2015, date last accessed).

National Institute on Alcohol Abuse and Alcoholism. (2003) Recommended Alcohol Questions [Online]. http://www.niaaa.nih.gov/research/guidelines-and-resources/recommended-alcohol-questions (20 May 2015, date last accessed).

Office for National Statistics. (2009) Opinions and Lifestyle Survey, Series [Online]. Social Survey Division, Colchester, Essex: UK Data Archive. http://discover.ukdataservice.ac.uk/series/?sn=2000043 (20 May 2015, date last accessed).

Office for National Statistics. (2011a). The Future of the General Lifestyle Survey—Update on Proposed Changes. http://www.ons.gov.uk/ons/about-ons/get-involved/consultations/archived-consultations/2011/the-future-of-the-glf-survey/index.html (10 June 2015, date last accessed).

Office for National Statistics. (2011b). General Lifestyle Survey, Series [Online]. Social and Vital Statistics Division, Colchester, Essex: UK Data Archive. http://discover.ukdataservice.ac.uk/series/?sn=200019 (20 May 2015, date last accessed).

Office for National Statistics. (2012a). IHS User Guide Volume 1: Background and Methodology. http://www.ons.gov.uk/ons/guide-method/method-quality/specific/social-and-welfare-methodology/integrated-household-survey/index.html (10 June 2015, date last accessed).

Office for National Statistics. (2012b). Information paper- Quality and Methodology Information—General Lifestyle Survey. Newport: Media Office, Office for National Statistics.

Office for National Statistics. (2012c). Information Paper—Quality and Methodology Information—Opinions and Lifestyle Survey. Newport: Media Office, Office for National Statistics.

Office for National Statistics. (2013a). Chapter 2—Drinking (General Lifestyle Survey Overview—A Report on the 2011 General Lifestyle Survey). http://www.ons.gov.uk/ons/dcp171776_302636.pdf (10 June 2015, date last accessed).

Office for National Statistics. (2013b). Drinking Habits among Adults—2012. http://www.ons.gov.uk/ons/dcp171778_338863.pdf (10 June 2015, date last accessed).

Parlimentary Office of Science and Technology. (2005) Postnote: Binge Drinking and Public Health Number 244. http://www.parliament.uk/documents/post/postpn244.pdf (20 May 2015, date last accessed).

Rehm J, Greenfield TK, Walsh G, *et al*. (1999) Assessment methods for alcohol consumption, prevalence of high risk drinking and harm: a sensitivity analysis. *Int J Epidemiol* **28**:219–24.

Rehm J, Room R, Graham K, *et al*. (2003) The relationship of average volume of alcohol consumption and patterns of drinking to burden of disease: an overview. *Addiction* **98**:1209–28.

Rehm J, Baliunas D, Borges GLG, *et al*. (2010) The relation between different dimensions of alcohol consumption and burden of disease: an overview. *Addiction* **105**:817–43.

Robinson S, Harris H. (2009) Smoking and drinking among adults, 2009: A Report on the 2009 General Lifestyle Survey. Newport: Office for National Statistics.

Rossow I. (1996) Alcohol related violence: the impact of drinking pattern and drinking context. *Addiction* **91**:1651–61.

Sheffield Alcohol Research Group. (2015) APISE (Alcohol Policy Interventions in Scotland and England) project [Online]. The University of Sheffield. http://www.shef.ac.uk/scharr/sections/ph/research/alpol/research/apise (20 May 2015, date last accessed).

Shield KD, Rehm J. (2012) Difficulties with telephone-based surveys on alcohol consumption in high-income countries: the Canadian example. *Int J Methods Psychiatr Res* **21**:17–28.

Stockwell T, Zhao J, Chikritzhs T, *et al*. (2008) What did you drink yesterday? Public health relevance of a recent recall method used in the 2004 Australian National Drug Strategy Household Survey. *Addiction* **103**:919–28.

Stockwell T, Zhao J, Macdonald S. (2014) Who under-reports their alcohol consumption in telephone surveys and by how much? An application of the 'yesterday method' in a national Canadian substance use survey. *Addiction* **109**:1657–66.

Trevisan M, Schisterman E, Mennotti A, *et al*. (2001) Drinking pattern and mortality: the Italian risk factor and life expectancy pooling project. *Ann Epidemiol* **11**:312–9.

Wells S, Graham K. (2003) Aggression involving alcohol: relationship to drinking patterns and social context. *Addiction* **98**:33–42.

World Health Organization. Lexicon of Alcohol and Drug Terms Published by the World Health Organization [Online]. http://www.who.int/substance_abuse/terminology/who_lexicon/en/ (20 May 2015, date last accessed).

World Health Organization. (2000) International Guide for Monitoring Alcohol Consumption and Related Harm. http://whqlibdoc.who.int/hq/2000/who_msd_msb_00.4.pdf (10 June 2015, date last accessed).

World Health Organization. (2010) Global strategy to reduce the harmful use of alcohol. http://www.who.int/substance_abuse/msbalcstragegy.pdf (10 June 2015, date last accessed).

World Health Organization. (2014) Indicator Code Book, Global Information System on Alcohol and Health. http://www.who.int/substance_abuse/activities/gisah_indicatorbook.pdf (10 June 2015, date last accessed).

World Health Organization Regional Office for Europe. (2012) European Action Plan to Reduce the Harmful Use of Alcohol (2012–2020). http://www.euro.who.int/__data/assets/pdf_file/0008/178163/E96726.pdf (10 June 2015, date last accessed).

Zhao J, Stockwell T, Macdonald S. (2009) Non-response bias in alcohol and drug population surveys. *Drug Alcohol Rev* **28**:648–57.