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Inconsistency in Reporting Abstention and Heavy Drinking Frequency: Associations with Sex and Socioeconomic Status, and Potential Impacts

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Abstract

Aims: To describe inconsistencies in reporting past-year drinking status and heavy drinking occasions (HDOs) on single questions from two different instruments, and to identify associated characteristics and impacts.
Methods: We compared computer-presented Alcohol Use Disorder Identification Test-Consumption (AUDIT-C) with categorical response options, and mental health interview (MHI) with open-ended consumption questions, completed on the same day. Participants were 464 men and 459 women aged 38 (91.7% of surviving birth cohort members). Differences in dichotomous single-item measures of abstention and HDO frequency, associations of inconsistent reporting with sex, socio-economic status (SES) and survey order, and impacts of instrument choice on associations of alcohol with sex and SES were examined.
Results: The AUDIT-C drinking frequency question estimated higher past-year abstention prevalence (AUDIT = 7.6%, MHI = 5.4%), with one-third of AUDIT-C abstainers being MHI drinkers. Only AUDIT-C produced significant sex differences in abstainer prevalence. Inconsistencies in HDO classifications were bidirectional, but with fewer HDOs reported on the MHI than AUDIT-C question. Lower SES was associated with inconsistency in abstention and weekly+ HDOs. Abstention and higher HDO frequency were associated with lower SES overall, but sex-specific associations differed by instrument.
Conclusions: In this context, data collection method affected findings, with inconsistencies in abstention reports having most impact. Future studies should: (a) confirm self-reported abstention; (b) consider piloting data collection methods in target populations; (c) expect impacts of sex and SES on measurements and analyses.

INTRODUCTION

In order to better understand the relationships between alcohol consumption and a wide variety of alcohol-attributable outcomes, epidemiological studies have used various different measures and methods to collect information about alcohol exposure. Self-reports of past-year drinking status (i.e. abstainers versus drinkers) and frequency of heavy drinking occasions (HDOs) have commonly been used to estimate associations of alcohol consumption with health, social and economic outcomes (Grittner *et al.*, 2013). In the absence of gold standard methods for identifying abstainers and estimating HDO frequency, researchers continue to use a range of questions and

approaches to measure these variables (Gmel and Rehm, 2004; Ekholm *et al.*, 2008). As alcohol researchers often use screening instruments and diagnostic interviews to detect hazardous drinking and/or alcohol-related problems, consumption data from single questions within such instruments have sometimes been used as 'stand-alone' measures in analyses (Kypri *et al.*, 2009).

The commonly used AUDIT (Alcohol Use Disorders Identification Test) screening instrument begins with three questions about alcohol consumption level and pattern (Saunders *et al.*, 1993). The abbreviated AUDIT-C instrument is comprised of these three AUDIT questions, and has been shown to predict hazardous drinking as well as the

full AUDIT (Bush *et al.*, 1998; Reinert and Allen, 2007). Several epidemiological studies have used individual AUDIT-C questions to determine drinking status and to measure HDO frequency (Zarkin *et al.*, 2004; Rodgers *et al.*, 2005; Caamano-Isorna *et al.*, 2008). Alcohol consumption gate questions that are primarily asked to determine whether study participants meet criteria for further assessment (i.e. with a standardized diagnostic interview for alcohol use disorders) can also provide potentially useful data about drinking status and HDO frequency.

The third AUDIT-C question about HDO frequency is a well-validated measure of alcohol misuse (Bradley *et al.*, 2007; Reinert and Allen, 2007), and a gender-specific version of this AUDIT-C question (i.e. lower cut-offs for women than men) has been recommended by NIAAA (2007) and validation studies (Smith *et al.*, 2009). AUDIT-C validation studies for risky drinking have used alcohol consumption interview questions as reference standards (Bush *et al.*, 1998; Bradley *et al.*, 2007). The validity of using the first AUDIT-C question (i.e. past-year drinking frequency) as a 'stand-alone' measure of drinking status has rarely been considered in the literature to date (Broyles *et al.*, 2011), despite ongoing research and discussion about abstainer misclassification and its impacts (Klatsky 2008; Rehm *et al.*, 2008; Zeisser *et al.*, 2014).

Inaccurate measures of alcohol consumption can bias estimates of morbidity, mortality, and the social and economic outcomes attributable to alcohol. The performance of even well-established alcohol consumption instruments such as the AUDIT-C and standardized interviews requires ongoing evaluation, particularly when individual components are being used for different analytical purposes than originally intended. Considering the validity and potential biases of alcohol consumption measures for specific sociodemographic subgroups has been identified as a research agenda of some importance (Midanik and Greenfield, 2004; Greenfield and Kerr, 2008). Since alcohol consumption patterns and their impacts have been shown to differ by gender and socioeconomic status (SES) (Cheng and Furnham, 2013; Fone *et al.*, 2013; Probst *et al.*, 2014), differences in reporting by gender or socioeconomic status could be an important source of bias. A study by Rehm *et al.* (2008) found associations between inconsistent reports of lifetime abstention and sociodemographic factors including gender and ethnicity.

As part of a larger birth cohort study of associations between alcohol consumption and sexual health, this analysis estimates the magnitude and potential impacts of inconsistencies in self-reported drinking status and heavy drinking occasion (HDO) frequency in participants at 38 years of age. We compare single items from two instruments used on the same day: a self-administered computer-presented AUDIT-C survey, and open-ended alcohol consumption screening questions asked as part of a mental health interview (MHI).

For AUDIT-based and MHI-based measures of past-year abstention and HDO frequency, this study measured: (a) the prevalence of inconsistent reporting and degree of discordance; (b) associations of inconsistent reporting with sex, socioeconomic status, and survey order; and (c) impacts of instrument choice on prevalence estimates and on associations of alcohol consumption with sex and socioeconomic status.

METHODS

Participants

Participants were members of the Dunedin Multidisciplinary Health and Development Study, a longitudinal study of a complete birth cohort from Dunedin, New Zealand, born between 1 April 1972 and 31 March 1973. The sample of 1037 children (91% of 1139 eligible births) was first assessed at 3 years of age and most recently at 38 years, when 95% of the 1007 living study members were assessed in 2010–2012. Sociodemographic characteristics of the sample were generally representative of the New Zealand population for this age group, with slightly higher educational attainment and fewer people of Māori ethnicity at age 21 (Dickson *et al.*, 1996). Silva and McCann (1996) have described the early history of the birth cohort. Ethical approval was obtained from the Otago Ethics Committee.

Measures

Alcohol consumption

At the 38-year-old assessment, participants were asked about past-year alcohol consumption during two distinct sections of the assessment day: (a) Alcohol Use Disorders Identification Test-consumption (AUDIT-C) questions in the computer-presented sexual and reproductive health questionnaire, and (b) mental health interview (MHI) questions about alcohol consumption, nested within a comprehensive psychiatric diagnostic interview. AUDIT-C questions had categorical response options, whereas the MHI questions were open-ended. The mental health interviewers had tertiary degrees and clinical experience in a mental health-related field, were blinded to prior assessment results, and administered the face-to-face structured interviews in private.

AUDIT-C and MHI alcohol consumption questions are detailed in Box 1. We defined AUDIT-C abstention based on a response of 'Never' to AUD1, and MHI abstention based on a response of 'None' to MHI1. Two dichotomous measures of HDO frequency were constructed from the AUD3 and MHI3 responses: (a) less than monthly HDOs versus monthly or more HDOs (<monthly/monthly+ HDOs), and (b) less than weekly HDOs versus weekly or more HDOs (<weekly/weekly+ HDOs). For HDOs reported on the MHI, equal spacing over time was assumed, so that 12 and 52 past-year HDOs were equivalent to monthly and weekly HDOs, respectively. The clustering of responses around 6, 12 and 52 indicated that this was a fair assumption. While the operational definition of HDOs differed slightly for the AUDIT-C and MHI questions (AUD3: 6+ drinks; MHI3: 5+ drinks), we felt that comparing these two questions was acceptable given the large degree of measurement uncertainty already present in these self-reported HDO estimates. Since most people do not keep accurate counts of their drinks and the conversion of actual drinks into standard drinks is fairly complex, we felt that the potential impacts of a single-drink difference in the HDO definition were relatively minor.

Consistency of reporting abstention and HDOs

Consistency of AUDIT-C and MHI responses was categorized using the terminology shown in Box 2. A dichotomous measure of inconsistent abstention grouped those with inconsistent reporting on the two instruments (inconsistent AUDIT-C abstainers and inconsistent MHI abstainers) versus those with consistent reporting on the two instruments (consistent abstainers and consistent drinkers). Dichotomous measures of inconsistent HDO frequency were also defined. 'Inconsistent monthly+ HDOs' grouped inconsistent reporting on the two instruments (inconsistent AUDIT-C monthly+ HDOs and inconsistent MHI monthly+ HDOs) versus consistent reporting on the two instruments, and 'inconsistent weekly+ HDOs' versus consistent reports of weekly HDOs were defined similarly.

Socioeconomic status

The New Zealand Socio-Economic Index was used to classify SES at age 38 into six categories ('1' = unskilled labourer to

Box 1. AUDIT-C and mental health interview (MHI) alcohol consumption questions

Past-year drinking frequency

AUD1: 'Thinking about the *past 12 months*, how often do you have a drink containing alcohol?' [Never, Monthly or less, 2–4 times a month, 2–3 times a week, 4 or more times a week]

MHI1*: 'In the past year, how many weeks out of 52, have you had any wine, beer or other drink containing alcohol?'

Typical drinking quantity

AUD2: 'How many standard drinks (see picture in folder) do you have on a typical day when you are drinking?' [1, 2, 3–4, 5–6, 7–9, 10+]

MHI2*: **(a)** 'In a typical week when you had something to drink, how many drinks would you have, in total, from Monday to Thursday, on work days?'; **(b)** 'And how many drinks, in total, would you usually have from Friday through to Sunday, on weekends?'

Frequency of heavy drinking occasions (HDOs)

AUD3: 'How often do you have 6 or more standard drinks on one occasion?' [Never, Less than monthly, Monthly, Weekly, Daily or almost daily]

MHI3: 'In the past year, how many times did you have five or more drinks in one sitting or occasion (binged)?'

Definitions and pictures of (10 g) drinks were provided for AUDIT-C questions, while the MHI questions were prefaced with the interviewer stating, 'When I use the term 'drink' I mean a glass of wine, a can or bottle of beer, a 'shot' or 'nip' of hard liquor either alone or in a mixed drink'.

Participants responding 'Never' to AUD1 were not asked AUD2 and AUD3 questions due to the skip pattern in the computer-presented questionnaire.

*MHI1, MHI2a and MHI2b are Diagnostic Interview Schedule (DIS-IV) gate questions that determined whether to assess for alcohol abuse/dependence with DSM-IV-TR criteria (Robins *et al.*, 1981, 2000; American Psychiatric Association, 2000).

Box 2. Terminology for consistency of reporting

Abstention: AUD1 and MHI1

Consistent abstainers* and *consistent drinkers: Participants with congruent AUDIT-C and mental health interview (MHI) reports for past-year abstention or drinking, respectively.

Inconsistent AUDIT-C abstainers: AUDIT-C abstainers who reported drinking once or more in the past year during the MHI.

Inconsistent MHI abstainers: MHI abstainers who reported past-year drinking on the AUDIT-C.

Heavy drinking occasions (HDOs): AUD3 and MHI3

Consistent <monthly HDOs* and *consistent monthly+ HDOs: Participants with congruent AUDIT-C and MHI reports of less than monthly HDOs or monthly+ HDOs, respectively.

Inconsistent AUDIT-C monthly+ HDOs: Monthly+ HDOs on AUDIT-C but less than monthly on MHI.

Inconsistent MHI monthly+ HDOs: Monthly+ HDOs on MHI but less than monthly on AUDIT-C.

Equivalent terminology was used for consistency of <weekly/weekly+ HDOs.

(91.7% of the 1007 surviving cohort members). Stata Version 11.2 was used for all analyses (StataCorp, 2009). Sex-specific distributions were presented for AUDIT-C and MHI measures of typical drinking frequency and HDO frequency (Table 1).

Consistency analyses for abstention included all 464 men and 459 women (89.8 and 93.7% of male and female participants alive at age 38, respectively). Consistency analyses for HDO frequency included 446 men and 430 women, because of the exclusion of 18 men and 29 women who were consistent abstainers. Due to the survey skip pattern, AUDIT-C abstainers were not asked further AUDIT-C questions. However, since all MHI abstainers responded 'none' to the MHI3 question about HDOs, the 23 inconsistent AUDIT-C abstainers were assigned the response 'Never' to AUD3.

Cohen's kappa was used to assess the level of agreement between dichotomous measures of: (a) AUDIT-C abstention and MHI abstention; (b) AUDIT-C monthly+ HDOs and MHI monthly+ HDOs; and (c) AUDIT-C weekly+ HDOs and MHI weekly+ HDOs (Cohen, 1960). Kappa analyses were performed overall and by gender, and Altman's guidelines for interpreting kappa were used, for which kappa values of 0.81–1.00 indicate very good strength of agreement, and 0.61–0.80 good agreement (Altman, 1991).

The prevalence of each of the four possible classifications of consistency between the two instruments was described for abstention and HDO measures, both overall and by gender. For inconsistent abstainers and participants with inconsistent monthly+ or weekly+ HDOs, alcohol consumption reports from the other instrument were described. For participants with inconsistent AUDIT-C monthly+ and weekly+ HDOs, the association between gender and proportion of highly discordant MHI reports was assessed with a chi-square test and Fisher's exact test, respectively.

Chi-square tests assessed statistical significance of associations between gender and the dichotomous measures of inconsistent abstention, inconsistent monthly+ HDOs and inconsistent weekly+ HDOs. Secondary analyses were performed to examine associations between gender and inconsistent HDO reports among heavier drinkers. For

'6' = professional) (Milne *et al.*, 2013). SES score was analysed both as a continuous (6-point linear predictor) and categorical (High SES = 5/6, Mid SES = 3/4, Low SES = 1/2) variable, two methods commonly used in alcohol research (van Oers *et al.*, 1999; Jefferis *et al.*, 2007; Viner and Taylor, 2007; Melotti *et al.*, 2013; Paljärvi *et al.*, 2013). Monotonic relationships between SES categories and proportions of abstainers/heavy drinkers were confirmed with cross-tabulations.

Survey order

Approximately one-third of participants had the AUDIT-C before the MHI. Although timing varied, the two questionnaires were generally administered in the afternoon one to two hours apart, with other assessments and a short break between them.

Statistical analyses

Analyses were restricted to 923 participants who answered all AUDIT-C and MHI alcohol consumption questions at age 38

Table 1. Self-reported AUDIT-C and MHI alcohol consumption of participants at age 38

AUDIT-C questions[a]			Mental health interview (MHI) questions[b]		
AUD1: typical frequency of drinking in past year			MHI1: number of drinking weeks in past year		
Men (*n* = 464)		%	Men (*n* = 464)		%
Never		5.8	None		4.5
Monthly or less		13.8	1–12 weeks		15.3
			13–23 weeks		6.3
2–4 times a month		21.1	24–48 weeks		22.8
			49–51 weeks		4.7
2–3 times a week		30.8	52 weeks		46.3
4 or more times a week		28.4	*Range: 0–52; Median (IQR): 50 (20–52)*		
Women (*n* = 459)		%	Women (*n* = 459)		%
Never		9.4	None		6.3
Monthly or less		22.0	1–12 weeks		25.3
			13–23 weeks		6.8
2–4 times a month		23.1	24–48 weeks		20.7
			49–51 weeks		4.8
2–3 times a week		22.4	52 weeks per year		36.2
4 or more times a week		23.1	*Range: 0–52; Median (IQR): 39 (10–52)*		
AUD3: frequency of heavy drinking occasions (6+ drinks) in past year			MHI3: number of heavy drinking occasions (5+ drinks) in past year		
Men (*n* = 437)[c]		%	Men (*n* = 464)		%
Never		14.9	0 times per year		20.0
Less than monthly		32.3	1–11 times per year		31.9
Monthly		22.7	12 times per year		5.8
			13–51 times per year		17.2
Weekly		26.3	52 times per year		10.3
			53–259 times per year		11.4
Daily or almost daily		3.9	260–364 times per year		2.2
			365 times per year		1.1
			Range: 0–365; Median (IQR): 10 (2–51)		
Women (*n* = 416)[c]		%	Women (*n* = 459)		%
Never		30.5	0 times per year		34.9
Less than monthly		39.4	1–11 times per year		38.1
Monthly		16.1	12 times per year		5.7
			13–51 times per year		11.1
Weekly		11.3	52 times per year		3.9
			53–259 times per year		4.8
Daily or almost daily		2.6	260–364 times per year		0.9
			365 times per year		0.7
			Range: 0–365; Median (IQR): 3 (0–12)		

[a]AUDIT-C categories represent the options presented to participants on a computer-based questionnaire.

[b]Continuous responses to open-ended mental health interview questions have been categorized in this table.

[c]Due to the computer questionnaire skip pattern, AUDIT-C abstainers (i.e. 27 male and 43 female participants who answered 'Never' to AUD1) did not answer AUD3.

these exploratory analyses, gender associations with inconsistent monthly+ and weekly+ HDOs were calculated only for participants who reported monthly+ HDOs or weekly+ HDOs on at least one measure, respectively.

Logistic regression was used to model associations of dichotomous measures of inconsistent abstention and inconsistent HDO frequency with survey order and SES. Overall and sex-specific logistic regression models were run for inconsistent monthly+ HDOs and inconsistent weekly+ HDOs, while abstainer sample sizes were insufficient for sex-specific models.

When estimating prevalence and associations of abstention and HDO frequency by instrument, HDO analyses included only past-year drinkers as measured by the drinking frequency question for each instrument (AUDIT-C *n* = 853; MHI *n* = 873). For each instrument, chi-square tests assessed statistical significance of associations between gender and the dichotomous measures of abstention and HDO frequency.

Logistic regression was used to estimate associations of dichotomous AUDIT-C or MHI measures of alcohol consumption (i.e. past-year drinking or abstention, <monthly or monthly+ HDOs, and <weekly or weekly+ HDOs) with sex, SES score and SES categories. Statistical significance of each variable was calculated with the likelihood ratio chi-square test, and the score test for linear trend of log odds was used for inconsistency trends across SES categories. *P*-values <0.05 were considered statistically significant to mirror common practice.

RESULTS

Consistency of AUDIT-C and MHI single-item measures of alcohol consumption

Abstention

Of the 923 participants who completed the AUDIT-C and MHI, 97% of men and women consistently reported past-year abstention or

drinking. Kappa-statistics indicated a 'good' quality of agreement between the AUDIT-C and MHI items (i.e. AUD1 and MHI1), with overall and sex-specific Cohen's kappa values ranging from 0.74 to 0.79. Overall, 6.5% of men and 9.4% of women reported abstention on at least one instrument, with more than one-third of these reporting abstention on one instrument and alcohol consumption on the other (Table 2 and Fig. 1).

Among all inconsistent abstainers (men: *n* = 12; women: *n* = 14), 75% of men and 100% of women were AUDIT-C abstainers but MHI drinkers. These 9 men and 14 women (inconsistent AUDIT-C abstainers) generally reported infrequent, low-volume drinking on the MHI. Figure 1 shows how all except one of these participants reported six or fewer past-year drinking weeks on the MHI, with women generally reporting fewer weekly drinks than men. Three inconsistent AUDIT-C abstainers reported past-year HDOs on the MHI, with one woman reporting five HDOs, one man reporting a single HDO and the other man 17 HDOs. The three men who were inconsistent MHI abstainers were all infrequent 'monthly or less' AUDIT-C drinkers. Of these, two were also low-volume drinkers (i.e. one drink per drinking day) with no past-year HDOs. The remaining man reported 10+ drinks per drinking day and 'less than monthly' HDOs.

Heavy drinking occasions

For the 446 men and 430 women who reported past-year drinking on at least one instrument, kappa-statistics for monthly and weekly HDO classifications all suggested 'good agreement' between the MHI3 and AUD3 HDO frequency questions. Overall and sex-specific Cohen's kappa values ranged from 0.72 to 0.74 for dichotomous measures of monthly+ HDOs, and from 0.67 to 0.69 for weekly+ HDO measures. Monthly HDOs (<monthly or monthly+ HDOs) were consistent for 86.1% of men and 88.6% of women, while 86.5% of men and 93.3% of women were consistently classified with regard to weekly HDOs (<weekly or weekly+ HDOs). The most common inconsistency pattern was fewer HDOs reported on the MHI than AUDIT-C, particularly for inconsistent weekly HDOs where 38/60 men (63.3%) and 20/29 women (69.0%) reported fewer MHI than AUDIT-C HDOs.

For participants with inconsistent AUDIT-C monthly+ and weekly+ HDOs, many of the inconsistent classifications were due to MHI reports that were slightly below the monthly or weekly cutpoints. However, of participants with inconsistent AUDIT-C monthly+ HDOs, 13/25 women (52%) and 14/35 men (40%) had highly discordant MHI reports of 0–6 HDOs per year, while 7/20 women (35%) and 6/38 men (16%) with inconsistent AUDIT-C weekly+ HDOs had highly discordant MHI reports of 0–12 HDOs per year. These sex differences in proportions of highly discordant reports were not statistically significant.

HDO reports that bordered the monthly and weekly cutpoints were common for participants with inconsistent MHI monthly+ and weekly+ HDOs. Among the 24 women and 27 men with inconsistent MHI monthly+ HDOs, 91.7% of women and 96.3% of men reported 'less than monthly' HDOs on the AUDIT-C question, with MHI reports of 12–15 HDOs for 54.2% of women and 59.3% of men. For the 9 women and 22 men with inconsistent MHI weekly+ HDOs, 66.7% of women and 86.4% of men reported monthly AUDIT-C HDOs, with MHI reports exactly on the weekly cutpoint of 52 HDOs for 66.7% of women and 63.6% of men. Marked discordance was seen in six participants (women: *n* = 3; men: *n* = 3) who reported 52 or more past-year HDOs on MHI but 'less than monthly'

Table 2. Summary of inconsistencies between abstention and heavy drinking frequency classifications, based on AUDIT-C and MHI single-item measures

	Men		Women		Total	
	n	%	*n*	%	*n*	%
Past-year abstainers and drinkers						
Consistent abstainers	18	3.9	29	6.3	47	5.1
Consistent drinkers	434	93.5	416	90.6	850	92.1
Inconsistent AUDIT-C abstainers	9	1.9	14	3.1	23	2.5
Inconsistent MHI abstainers	3	0.6	0	0.0	3	0.3
Total	464	100.0	459	100.0	923	100.0
Total inconsistent: 2.6% men and 3.1% women (*P*-value for sex differences[a] = 0.670)						
Past-year frequency of heavy drinking occasions (HDOs) in current drinkers[b]						
Monthly HDOs						
Consistent <monthly HDOs	188	42.2	281	65.3	469	53.5
Consistent monthly+ HDOs	196	43.9	100	23.3	296	33.8
Inconsistent AUDIT-C monthly+ HDOs	35	7.8	25	5.8	60	6.9
Inconsistent MHI monthly+ HDOs	27	6.1	24	5.6	51	5.8
Total	446	100.0	430	100.0	876	100.0
Total inconsistent: 13.9% men and 11.4% women (*P*-value for sex differences[a] = 0.265)						
Weekly HDOs						
Consistent <weekly HDOs	292	65.5	363	84.4	655	74.8
Consistent weekly+ HDOs	94	21.1	38	8.8	132	15.1
Inconsistent AUDIT-C weekly+ HDOs	38	8.5	20	4.7	58	6.6
Inconsistent MHI weekly+ HDOs	22	4.9	9	2.1	31	3.5
Total	446	100.0	430	100.0	876	100.0
Total inconsistent: 13.5% men and 6.7% women (*P*-value for sex differences[a] = 0.001)						

[a]*P*-values from chi-square tests that assessed the association between sex and dichotomous measures of inconsistent abstention, inconsistent monthly+ HDOs and inconsistent weekly+ HDOs.

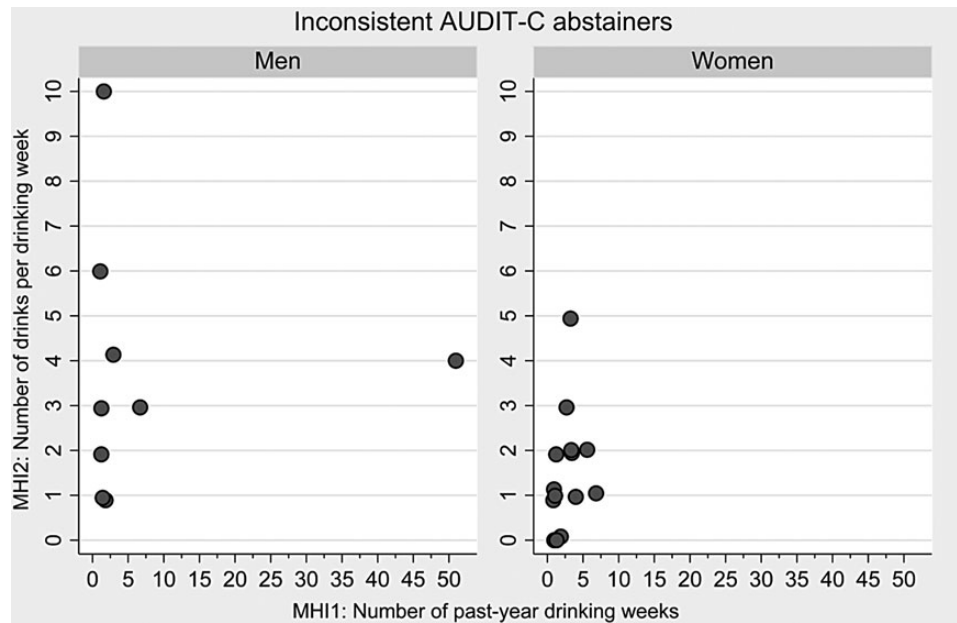[b]Participants who reported past-year alcohol consumption on at least one instrument.

Fig. 1. MHI reports of alcohol consumption frequency and quantity for inconsistent AUDIT-C abstainers ($n = 23$).

AUDIT-C HDOs. Highly discordant reports were also seen in three participants (women: $n = 2$; men: $n = 1$) with 12–36 MHI HDOs and 'never' HDOs on AUDIT, seven men with MHI reports of 100–350 HDOs and monthly AUDIT-C HDOs, and three women with 68–90 MHI HDOs and monthly AUDIT-C HDOs.

Associations of inconsistent reporting with sex, socioeconomic status and survey order

Table 2 shows that there was no association of sex with inconsistency between dichotomous AUDIT-C and MHI measures of abstinence or monthly+ HDOs, but a statistically significant difference by sex between AUDIT-C and MHI measures of weekly+ HDOs. While the proportion of current drinkers with inconsistent weekly HDOs was significantly higher in men than women, no significant sex differences were found in exploratory analyses that included only heavier drinkers. These analyses found that, among participants who reported weekly+ HDOs on at least one measure (67 women and 154 men), similar proportions of women and men were inconsistent (43.3 and 39.0%, respectively; $P = 0.547$), suggesting that the sex difference found among current drinkers was due to the higher frequency of weekly+ HDOs in men than women. Among participants who reported monthly+ HDOs on at least one instrument (149 women and 258 men), inconsistency was more common among women than men (32.9 and 24.0%, respectively; $P = 0.053$).

Lower socioeconomic status (SES) was associated with inconsistent reports of both abstention (trend $P = 0.020$) and weekly+ HDOs (trend $P = 0.013$), shown in Table 3. For abstention and weekly+ HDOs, the odds of inconsistent reports in 'low SES' participants were 4.5 and 2.2 times those of 'high SES' participants, respectively. When stratified by sex, the association of inconsistent weekly+ HDO reports with decreasing SES was only significant for women (trend $P = 0.034$). For monthly+ HDOs, there was an opposing finding of less inconsistency with decreasing SES, that was only significant for men (trend $P = 0.015$). Low abstainer numbers precluded multivariable analysis by sex.

Survey order was generally not associated with inconsistent abstention or HDO reports. However, men who answered the MHI questions first were less likely to have inconsistent monthly+ HDO classifications than men who answered the AUDIT-C questions first (OR = 0.38; $P < 0.001$).

Associations of AUDIT-C and MHI single-item measures of alcohol consumption with sex and socioeconomic status
Prevalence estimates
Table 4 shows higher past-year abstention prevalence on the AUDIT-C than MHI, with statistically significant sex differences in abstainer proportions for the AUD1 question (5.8% of men vs. 9.4% of women; $P = 0.041$) but not the MHI1 question (4.5% of men vs. 6.3% of women; $P = 0.228$). Monthly+ and weekly+ HDO prevalence was slightly higher for AUDIT-C than MHI reports (i.e. AUD3 and MHI3) in both women and men. Strong associations between sex and HDO frequency were consistently seen.

Abstention
Participants with lower SES were more likely to report past-year abstention. The magnitude and significance of overall associations of abstention with SES were similar for AUDIT-C and MHI measures, with differences only seen in sex-specific analyses. For women, only AUDIT-C data produced significant associations between abstention and SES. For men, a significant association between abstention and SES score was seen for both measures, but only the MHI data showed a significant trend with SES categories.

Heavy drinking occasions
Participants were more likely to report monthly+ and weekly+ HDOs as SES decreased. The unadjusted associations of monthly+ HDOs with sex and SES were similar in magnitude and significance for AUDIT-C and MHI measures. In contrast, the associations of weekly+

Table 3. Inconsistent self-reports of abstention and of heavy drinking occasions (HDOs) on AUDIT-C and MHI single-item measures: distributions and unadjusted associations with survey order and socioeconomic status[a]

	Men				Women				Total			
	Total[b]	n (%)	OR (95% CI)	P-value[c]	Total[b]	n (%)	OR (95% CI)	P-value[c]	Total[b]	n (%)	OR (95% CI)	P-value[c]
Inconsistent abstainers (ref: consistent abstainers/drinkers)												
Survey order												
AUDIT-C 1st									286	7 (2.4%)	1.00	0.711
MHI 1st									626	18 (2.9%)	1.18 (0.49–2.86)	
Socioeconomic status												
High SES (5/6)									283	3 (1.1%)	1.00	0.052
Mid SES (3/4)									463	14 (3.0%)	2.91 (0.83–10.2)	
Low SES (1/2)									174	8 (4.6%)	**4.50 (1.18–17.2)**	
												Trend: 0.020
Inconsistent monthly+ HDOs (ref: consistent <monthly/monthly+ HDOs)[d]												
Survey order												
AUDIT-C 1st	133	30 (22.6%)	1.00	**<0.001**	139	12 (8.6%)	1.00	0.183	272	42 (15.4%)	1.00	0.103
MHI 1st	310	31 (10.0%)	**0.38 (0.22–0.66)**		286	37 (12.9%)	1.57 (0.79–3.12)		596	68 (11.4%)	0.71 (0.47–1.07)	
Socioeconomic status												
High SES (5/6)	120	22 (18.3%)	1.00	**0.029**	152	19 (12.5%)	1.00	0.513	272	41 (15.1%)	1.00	0.209
Mid SES (3/4)	214	32 (15.0%)	0.78 (0.43–1.42)		228	22 (9.7%)	0.75 (0.39–1.43)		442	54 (12.2%)	0.78 (0.51–1.21)	
Low SES (1/2)	112	8 (7.1%)	**0.34 (0.15–0.81)**		48	7 (14.6%)	1.20 (0.47–3.04)		160	15 (9.4%)	0.58 (0.31–1.09)	
				Trend: 0.015				Trend: 0.936				Trend: 0.079
Inconsistent weekly+ HDOs (ref: consistent <weekly/weekly+ HDOs)[d]												
Survey order												
AUDIT-C 1st	133	16 (12.0%)	1.00	0.538	139	11 (7.9%)	1.00	0.539	272	27 (9.9%)	1.00	0.830
MHI 1st	310	44 (14.2%)	1.21 (0.66–2.23)		286	18 (6.3%)	0.78 (0.36–1.70)		596	62 (10.4%)	1.05 (0.65–1.70)	
Socioeconomic status												
High SES (5/6)	120	14 (11.7%)	1.00	0.608	152	6 (3.9%)	1.00	0.109	272	20 (7.4%)	1.00	**0.045**
Mid SES (3/4)	214	28 (13.1%)	1.14 (0.57–2.26)		228	17 (7.5%)	1.96 (0.75–5.09)		442	45 (10.2%)	1.43 (0.82–2.48)	
Low SES (1/2)	112	18 (16.1%)	1.45 (0.68–3.07)		48	6 (12.5%)	**3.48 (1.07–11.3)**		160	24 (15.0%)	**2.22 (1.19–4.17)**	
				Trend: 0.329				Trend: 0.034				Trend: 0.013

[a]Inconsistency categories are combined for each drinking measure as similar patterns were found in most cases.

[b]Totals differ due to missing data and eight participants for whom the two surveys were not completed in the same day.

[c]Trend P-values indicate the significance of a score test for linear trend of log odds; all other P-values indicate the statistical significance of each association using the likelihood ratio (LR) chi-square test.

[d]HDO analyses included current drinkers (i.e. 446 men and 430 women who reported past-year alcohol consumption on at least one instrument).

Bold values represents the associations that were statistically significant ($P < 0.05$).

Table 4. Unadjusted associations of past-year abstention and of heavy drinking occasions (HDOs) with sex and socioeconomic status (SES): comparison of AUDIT-C and MHI single-item measures of alcohol consumption

	AUDIT-C				MHI			
	Total[a]	n (%)	OR (95% CI)	P-value[b]	Total[a]	n (%)	OR (95% CI)	P-value[b]
Abstention	N = 923				N = 923			
Overall								
Women	459	43 (9.4%)	1.00	**0.041**	459	29 (6.3%)	1.00	0.228
Men	464	27 (5.8%)	**0.60 (0.36–0.99)**		464	21 (4.5%)	0.70 (0.39–1.25)	
SES score[c]	920		**1.29 (1.08–1.54)**	**0.004**	920		**1.26 (1.03–1.54)**	**0.025**
SES categories								
High SES (5/6)	283	14 (4.9%)	1.00	**0.039**	283	11 (3.9%)	1.00	0.053
Mid SES (3/4)	463	34 (7.3%)	1.52 (0.80–2.89)		463	22 (4.8%)	1.23 (0.59–2.58)	
Low SES (1/2)	174	20 (11.5%)	**2.50 (1.23–5.08)**		174	16 (9.2%)	**2.50 (1.13–5.53)**	
			SES trend P-value: 0.011				*SES trend P-value: 0.023*	
Women								
SES score	457		**1.32 (1.04–1.67)**	**0.021**	457		1.22 (0.92–1.60)	0.165
SES categories								
High SES (5/6)	161	10 (6.2%)	1.00	0.051	161	9 (5.6%)	1.00	0.066
Mid SES (3/4)	240	22 (9.2%)	1.52 (0.70–3.31)		240	12 (5.0%)	0.89 (0.37–2.16)	
Low SES (1/2)	56	10 (17.9%)	3.28 (1.29–8.37)		56	8 (14.3%)	2.81 (1.03–7.70)	
			SES trend P-value: 0.016				*SES trend P-value: 0.095*	
Men								
SES score	463		**1.37 (1.04–1.81)**	**0.025**	463		**1.41 (1.02–1.93)**	**0.031**
SES categories								
High SES (5/6)	122	4 (3.3%)	1.00	0.215	122	2 (1.6%)	1.00	0.119
Mid SES (3/4)	223	12 (5.4%)	1.68 (0.53–5.32)		223	10 (4.5%)	2.82 (0.61–13.1)	
Low SES (1/2)	118	10 (8.5%)	2.73 (0.83–8.97)		118	8 (6.8%)	4.36 (0.91–21.0)	
			SES trend P-value: 0.081				*SES trend P-value: 0.050*	
Monthly+ HDOs[d]	N = 853				N = 873			
Overall								
Women	416	125 (30.0%)	1.00	**<0.001**	430	124 (28.8%)	1.00	**<0.001**
Men	437	231 (52.9%)	**2.61 (1.97–3.46)**		443	223 (50.3%)	**2.50 (1.89–3.31)**	
SES score[c]	852		**1.28 (1.16–1.41)**	**<0.001**	871		**1.24 (1.13–1.37)**	**<0.001**
SES categories								
High SES (5/6)	269	86 (32.0%)	1.00	**<0.001**	272	83 (30.5%)	1.00	**<0.001**
Mid SES (3/4)	429	186 (43.4%)	**1.63 (1.18–2.24)**		441	184 (41.7%)	**1.63 (1.18–2.25)**	
Low SES (1/2)	154	83 (53.9%)	**2.49 (1.66–3.73)**		158	80 (50.6%)	**2.34 (1.56–3.50)**	
			SES trend P-value: <0.001				*SES trend P-value: <0.001*	
Women								
SES score	415		**1.26 (1.07–1.48)**	**0.004**	428		**1.26 (1.07–1.47)**	**0.004**
SES categories								
High SES (5/6)	151	36 (23.8%)	1.00	0.056	152	37 (24.3%)	1.00	0.076
Mid SES (3/4)	218	69 (31.7%)	1.48 (0.92–2.37)		228	67 (29.4%)	1.29 (0.81–2.06)	
Low SES (1/2)	46	19 (41.3%)	**2.25 (1.12–4.51)**		48	20 (41.7%)	**2.22 (1.12–4.39)**	
			SES trend P-value: 0.016				*SES trend P-value: 0.029*	

	N	n (%)	OR (95% CI)	P-value	N	n (%)	OR (95% CI)	P-value
Men								
SES score	437		**1.22 (1.07–1.39)**	**0.004**	443		**1.17 (1.03–1.33)**	**0.017**
SES categories								
High SES (5/6)	118	50 (42.4%)	1.00	**0.023**	120	46 (38.3%)	1.00	**0.008**
Mid SES (3/4)	211	117 (55.5%)	**1.69 (1.07–2.67)**		213	117 (54.9%)	**1.96 (1.24–3.09)**	
Low SES (1/2)	108	64 (59.3%)	**1.98 (1.16–3.36)**		110	60 (54.5%)	**1.93 (1.14–3.27)**	
			SES trend P-value: 0.010				*SES trend P-value: 0.012*	
Weekly+ HDOs[d]	N = 853				N = 873			
Overall								
Women	416	58 (13.9%)	1.00	**<0.001**	430	47 (10.9%)	1.00	**<0.001**
Men	437	132 (30.2%)	**2.67 (1.89–3.77)**		443	116 (26.2%)	**2.89 (2.00–4.18)**	
SES score[c]	852		**1.27 (1.13–1.42)**	**<0.001**	871		**1.36 (1.20–1.54)**	**<0.001**
SES categories								
High SES (5/6)	269	42 (15.6%)	1.00	**<0.001**	272	30 (11.0%)	1.00	**<0.001**
Mid SES (3/4)	429	98 (22.8%)	**1.60 (1.07–2.38)**		441	89 (20.2%)	**2.04 (1.31–3.18)**	
Low SES (1/2)	154	50 (32.5%)	**2.60 (1.62–4.16)**		158	44 (27.8%)	**3.11 (1.86–5.21)**	
			SES trend P-value: <0.001				*SES trend P-value: <0.001*	
Women								
SES score	415		**1.47 (1.19–1.83)**	**<0.001**	428		**1.64 (1.29–2.09)**	**<0.001**
SES categories								
High SES (5/6)	151	12 (7.9%)	1.00	**0.010**	152	6 (3.9%)	1.00	**<0.001**
Mid SES (3/4)	218	35 (16.1%)	**2.22 (1.11–4.42)**		228	32 (14.0%)	**3.97 (1.62–9.75)**	
Low SES (1/2)	46	11 (23.9%)	**3.64 (1.48–8.94)**		48	9 (18.8%)	**5.61 (1.88–16.73)**	
			SES trend P-value: 0.011				*SES trend P-value: <0.001*	
Men								
SES score	437		1.12 (0.97–1.29)	0.126	443		**1.19 (1.03–1.38)**	**0.019**
SES categories								
High SES (5/6)	118	30 (25.4%)	1.00	0.216	120	24 (20.0%)	1.00	0.117
Mid SES (3/4)	211	63 (29.9%)	1.25 (0.75–2.08)		213	57 (26.8%)	1.46 (0.85–2.51)	
Low SES (1/2)	108	39 (36.1%)	1.66 (0.94–2.93)		110	35 (31.8%)	**1.87 (1.02–3.40)**	
			SES trend P-value: 0.082				*SES trend P-value: 0.041*	

[a]Totals differ due to three participants with missing SES data.

[b]Trend *P*-values indicate the significance of a score test for linear trend of log odds; all other *P*-values indicate the statistical significance of each variable using the likelihood ratio (LR) chi-square test.

[c]SES score = 1 (lowest) to 6 (highest); OR for 1-point decrease in SES.

[d]HDO analyses included either current AUDIT-C or MHI current drinkers who reported past-year alcohol consumption on the AUDIT-C (437 men and 416 women) or MHI (443 men and 430 women).

Bold values represents the associations that were statistically significant ($P < 0.05$).

HDOs with SES differed by sex and by instrument. Associations were consistently stronger for the MHI than AUDIT-C measure, partly due to fewer women in the 'high SES' reference group reporting weekly+ HDOs on MHI3 than AUD3. Both AUDIT-C and MHI measures showed strong associations between weekly+ HDOs and lower SES for participants overall and for women. However, for men, only MHI weekly+ HDO reports were significantly associated with decreasing SES score and SES categorical trend.

DISCUSSION

In the context of this study, we found that: (a) the AUDIT-C drinking frequency question estimated higher past-year abstention prevalence than the MHI question, mostly due to inconsistent responses by infrequent, low-volume MHI drinkers; (b) the bidirectional inconsistency of heavy drinking occasion frequency was largely around category cutpoints; (c) socioeconomic status was associated with inconsistency in reporting abstention and heavy drinking frequency; and (d) the choice of measure affected the significance and magnitude of sex-specific associations of SES with abstention and weekly+ HDOs.

This inconsistency study did not intend to compare the validity of the AUDIT-C versus MHI single-item measures of past-year abstention. However, interview measures of alcohol consumption have been designated as gold standards in a variety of validation studies (Bush *et al.*, 1998; Bradley *et al.*, 2007). We consider it likely that the MHI1 interview question measured past-year drinking status more accurately than the AUD1 survey question in our study, particularly since the MHI question allowed 'non-abstinent' participants to report as infrequently as a single past-year drinking week (in comparison to the lowest possible 'non-abstinent' AUD1 response of 'monthly or less'). Since abstention was uncommon, the apparent overestimation by the AUDIT-C was small in absolute terms but large in relative terms, with a 40% increase in abstention prevalence compared with the MHI measure, and one-third of AUDIT-C abstainers reporting drinking in their mental health interview. Similar levels of inconsistency were found among infrequent drinkers in the 2000 National Alcohol Survey, with 27% of respondents who reported usually drinking 'less than once per year' (to an alcohol frequency question with eleven response categories and no timeframe) subsequently acknowledging alcohol consumption to a question that specifically asked about having at least one drink during the past year (Midanik and Greenfield, 2003). In an HIV/AIDS study, Broyles *et al.* (2011) chose not to skip participants past subsequent AUDIT-C questions when they answered 'never' to the first AUDIT-C question ('How often do you have a drink containing alcohol?'), instead adding a '0 drinks' option to the second question. They found that 2.6% of the 345 participants responded 'never' to drinking frequency, but positive amounts for typical drinking quantity and/or HDO frequency. Our study showed a similar proportion of inconsistent AUDIT-C abstainers, as 2.5% of 923 participants responded 'never' to the first AUDIT-C question but reported drinking on the MHI. In a longitudinal analysis of lifetime abstention across three US surveys, Rehm *et al.* (2008) showed that 52.9% of lifetime abstainers in the 1992 National Alcohol Survey (i.e. participants who chose the drinking frequency response option, 'I have never had any kind of beverage containing alcohol') had previously reported drinking.

The AUDIT-C and MHI measures differ, particularly the open-ended nature of MHI questions versus AUDIT's categorical responses. However, mode of administration may have also contributed to more complete ascertainment of current drinking with the MHI. Benefits of self-administered computer surveys have been documented (Couper, 2000; Kypri *et al.*, 2004; Lind *et al.*, 2013), including fuller disclosure of sensitive information, while advantages of using human interviewers have received less attention (Lind *et al.*, 2013). When Lind *et al.* (2013) unexpectedly found regular drinking reported more often to an interviewer than to an audio computer-assisted self-interviewing survey, they questioned whether the alcohol questions were actually considered sensitive. Low sensitivity in our study could help explain the higher reports of past-year drinking with the MHI, as the advantages of interviewer administration (e.g. probing or clarification) would be unmitigated. Since the MHI was administered by an interviewer and AUDIT-C by a computer for all participants, we cannot disentangle these potential contributors to inconsistent reporting. Therefore, our discussion focuses mainly on providing in-depth descriptions of the magnitude, associations and impacts of inconsistencies for specific subgroups.

There could be substantial implications if the AUDIT overestimates abstention more generally by misclassifying infrequent, low-volume ('occasional') drinkers. Studies in populations with a high proportion of occasional drinkers would be most affected, particularly if the difference between abstainers and occasional drinkers is a focus, or where perceived social desirability further increases self-identification as abstainers (i.e. pregnant women) (Goransson *et al.*, 2003). Computer-presented questionnaires may be chosen for these situations to encourage disclosure (Lind *et al.*, 2013), without recognition of the possibility that misclassification of occasional drinkers as abstainers may increase when drinking frequency questions are administered by computer instead of an interviewer. The first AUDIT question is used in some epidemiological studies to skip abstainers past the remaining questions (Kypri *et al.*, 2004, 2009) and/or exclude them from 'drinkers-only' analyses (Kypri *et al.*, 2009). It is not always reported if this has been done, but one-third of those excluded in this way could be occasional drinkers. Gender comparisons can also be affected when inconsistency varies by sex. In our sample, differences between AUDIT-C and MHI estimates of abstention prevalence were more marked in women than men, resulting in statistically significant sex differences for AUDIT-C abstention but not MHI. Gender was significantly associated with misclassification of drinking status in the 2000 National Alcohol Survey (Midanik and Greenfield, 2003), with more women than men misclassified as current drinkers when they were actually past-year abstainers (i.e. responding 'no' to a follow-up question about having at least one past-year drink, after initially reporting 'less than once a month but at least once a year', 'don't know', or 'refused' to a usual consumption question that lacked a specific timeframe). A longitudinal analysis by Rehm *et al.* (2008) found that men were more likely to be inconsistent lifetime abstainers. Finally, although abstainer misclassification would affect total AUDIT-C scores, impacts would be small if most inconsistent abstainers were occasional drinkers with low AUDIT-C scores, as in our study.

Misclassification of drinking status and its contribution to apparent protective effects of alcohol on health continues to be a heavily debated topic (Connor, 2006; Fillmore *et al.*, 2007; Chikritzhs *et al.*, 2009; Liang and Chikritzhs, 2011; Stockwell *et al.*, 2012). Misclassification of infrequent drinkers and former drinkers as abstainers is implicated in the observed 'J-shaped' protective association between alcohol consumption and health outcomes such as coronary heart disease (CHD), particularly in men (Fillmore *et al.*, 2007; Chikritzhs *et al.*, 2009). The meta-analysis of Fillmore *et al.* (2007) showed that where ex/occasional drinkers were strictly excluded from abstainer categories, low levels of drinking did not protect against all-cause or CHD mortality. Our study suggests that such misclassification may occur with a commonly used and validated instrument.

Given the importance of abstainer misclassification, we recommend that study participants who identify themselves as abstainers on the first AUDIT question about drinking frequency should be routinely prompted to confirm their response. For example, Harris *et al.* (2010) accomplished this by including 'None, I do not drink' as an additional response option to the second AUDIT question about drinking quantity. Another option that may reduce misclassification is determining past-year abstention with a separate screening question prior to administering alcohol consumption questions, a method that has been used by population health surveys (Ministry of Health, 2008) and studies based on data from the National Epidemiologic Survey on Alcohol and Related Conditions (Dawson *et al.*, 2005; Rubinsky *et al.*, 2013). Adding lower-frequency response options to the first AUDIT question (i.e. between 'monthly or less' and 'never') may reduce misclassification as abstainers, although this has not been tested. These recommendations also apply to other drinking frequency measures used to determine abstention, particularly where questions are similar to the first AUDIT question and are used as a 'gate' to further questions.

This study also lends some support to recommendations to include irregular lifetime light drinkers with lifetime abstainers as the most appropriate comparison group in alcohol epidemiology, providing a history of heavier drinking can be ruled out (Rehm *et al.*, 2008). The important distinction in most studies is between those with very low or no lifetime alcohol exposure and all others, and so inclusion reduces misclassification and, potentially, bias in findings. Moreover, our finding that SES scores were associated with both past-year abstention and inconsistent reports of abstention confirms the increased potential for confounding when small numbers of abstainers are used as the reference group (Rehm *et al.*, 2008).

HDO inconsistency was more bidirectional than abstainer inconsistency, but heavy drinking more than once a week was reported less often in the mental health interview despite the MHI definition of heavy drinking occasions requiring one fewer drink than the AUDIT ('5 or more' versus '6 or more' drinks on one occasion, respectively). It may be that this question is more sensitive for heavy drinkers in the presence of an interviewer, but it has also been shown previously that survey questions with categorical responses elicit higher HDO frequencies than open-ended questions (Ivis *et al.*, 1997).

The probability of abstainer inconsistency increased markedly as SES decreased. If generalized, this could inflate the association between low SES and abstention commonly reported from research (van Oers *et al.*, 1999; Rodgers *et al.*, 2000; Jefferis *et al.*, 2007; Holahan *et al.*, 2010) and population surveys (Ministry of Health, 2009; Australian Institute of Health and Welfare, 2011), and bias findings where SES is an inadequately-controlled confounder of alcohol's effect on health outcomes (Liang and Chikritzhs, 2012). Midanik and Greenfield (2003) found that dichotomous income and education variables were not significantly associated with misclassification of drinking status in the USA. In our study, weekly+ HDO misclassification in women increased as SES level decreased. However, monthly+ HDO misclassification in men was much less likely as SES decreased and when the MHI was given before the AUDIT-C. Interpretation can only be speculative, but these findings illustrate the importance of a sex-specific approach, and may reflect differences in sensitivity of questions by gender and SES.

In our study, choice of AUDIT-C or MHI measures had little impact on overall associations of alcohol consumption with SES, but several sex-specific associations differed in significance and magnitude. For example, MHI data showed significant associations of abstention with SES score in men but not women. For weekly+ HDOs, the use of MHI instead of AUDIT-C data resulted in SES associations of greater magnitude, and these associations were only significant for men when MHI data were used. Associations of various indicators of low SES with heavy drinking have been previously reported (van Oers *et al.*, 1999; Casswell *et al.*, 2003; Kuntsche *et al.*, 2004; Jefferis *et al.*, 2007; Huckle *et al.*, 2010; Paljärvi *et al.*, 2013), but the potential for differential misclassification of alcohol exposure to affect these associations in a sex-specific manner has not been previously noted.

A limitation of our consistency analysis is the focus on dichotomized alcohol consumption variables (Heavner *et al.*, 2010). We chose this approach for its easily interpretable results that relate directly to issues faced by the numerous studies that use such variables. We focussed on two commonly used indicators of population drinking patterns: proportions of current drinkers and heavy episodic drinkers (Dawson, 2003; Caamano-Isorna *et al.*, 2008; Livingston *et al.*, 2010; Astudillo *et al.*, 2013). Our study population was slightly unusual. Participants are representative of an historical rather than a contemporary population, and the narrow age range may restrict generalizability (while minimizing age-related confounding). Participants have been assessed intermittently throughout their lives and this could have affected responses, although the last visit to the study centre was 6 years previously. Finally, both instruments were administered during a full day of assessments, an uncommon setting for these measures. A strength of the study is the very high response rate, which means that this sample has not been affected by the substantial self-selection seen in most surveys.

CONCLUSIONS

We have shown that inconsistency in reporting of alcohol consumption on the AUDIT-C and MHI measures in this context is sufficient to alter findings, with inconsistent abstention reports having more impact than inconsistent reports of HDO frequency.

The higher level of abstention seen with the AUDIT-C measure could relate to both the range of categorical response options for drinking frequency and the lack of an interviewer to probe responses. We recommend careful consideration of both the instrument and the mode of administration for alcohol data collection, and mechanisms to confirm abstention.

Variation in responses to heavy drinking questions by instrument and subgroup may reflect differences in sensitivity to the questions and the influence of an interviewer. When heavy drinking frequency is central to the investigation, piloting the data collection methods in the target population is warranted.

Associations of SES with abstention, heavy drinking frequency, and inconsistent reporting, many of which differed for men and women, highlight the complex role of SES in alcohol epidemiology and need for a sex-specific approach.

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CONFLICT OF INTEREST STATEMENT

None declared.

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