Alcohol and Alcoholism, 2016, 51(2) 186–195
doi: 10.1093/alcalc/agv082
Advance Access Publication Date: 8 July 2015
Article

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Alcohol Consumption in Vietnam, and the Use of 'Standard Drinks' to Measure Alcohol Intake

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Received 26 October 2014; Revised 28 May 2015; Accepted 18 June 2015

Abstract

Aims: To provide nationally representative data on alcohol consumption in Vietnam and to assess whether reported numbers of 'standard drinks' consumed have evidence of validity (particularly in rural areas where home-made alcohol is consumed from cups of varying size).
Methods: A nationally representative population-based survey of 14,706 participants (46.5% males, response proportion 64.1%) aged 25–64 years in Vietnam. Measurements were made in accordance with WHO STEPS protocols. Data were analysed using complex survey methods.
Results: Among men, 80% reported drinking alcohol during the last year, and 40% were hazardous/harmful drinkers. Approximately 60% of men and <5% of women had consumed alcohol during the last week, with one-in-four of the men reporting having consumed at least five standard drinks on at least one occasion. Numbers of standard drinks reported by men were associated with blood pressure/hypertension, particularly in rural areas ($P < 0.001$ for trend). Most of the calibration and discrimination possible from self-reported information on alcohol consumption was provided by binary responses to questions on whether or not alcohol had been consumed during the reference period.
Conclusion: Alcohol use and harmful consumption were common among Vietnamese men but less pronounced than in Western nations. Self-reports of quantity of alcohol consumed in terms of standard drinks had predictive validity for blood pressure and hypertension even in rural areas. However, using detailed measures of consumption resulted in only minor improvements in prediction compared to simple measures.

INTRODUCTION

Harmful alcohol use was the fifth leading contributor to the global burden of disease behind tobacco smoking and hypertension in 2010 (Lim *et al.*, 2012). Given this burden, systematic population-based surveillance of alcohol intake is essential for quantifying harmful use and trends in use (Dans *et al.*, 2011; WHO, 2011). National data collections on production, imports, trade and retail sales provide useful information in aggregate but, particularly in countries where home-made alcohol is commonly consumed, population-based surveys are needed to provide a comprehensive assessment of alcohol intake by individuals.

Data collected on alcohol consumption in such surveys are usually by self-report of the frequency of drinking occasions, and the quantity of alcohol consumed on each occasion. The quantity of alcohol consumed on each occasion is often represented in terms of a 'standard drink'—the serving size of each type of alcohol that provides a particular number of grams of ethanol. This provides comparability and standardizes the assessment across alcohol types, brands and individual preferences. Visual aids like glasses and bottles, or photographs of them, that illustrate the actual serving size providing a particular amount of alcohol are recommended to assist respondents to estimate their standard drink consumption (Dawson, 2003). However, evidence suggests that drinkers in urbanized countries are unable to accurately judge the size of their drinks (Kaskutas and Graves, 2000; Devos-Comby and Lange, 2008). This may be even more problematic in developing countries such as Vietnam where alcohol is often 'home-made' and the serving sizes vary, making this estimation more difficult.

Whilst the types of alcohol available in the large cities of Vietnam and the methods of serving them reflect a modern Western-style lifestyle, 70% of the population lives in rural areas (General Statistics Office, 2010). The rural practice is to purchase spirits made by small-scale local producers from rice, maize, potato or fruits (Dung *et al.*, 2007). The alcohol concentration of these products can vary from 29.5 to 45% (Lachenmeier *et al.*, 2009). The alcohol is drunk from small cups of varying sizes, meaning the alcohol content of each serve varies throughout the country. The concept of a standard drink appears not well-suited to Vietnam, but no studies have assessed this issue. Indeed, alcohol use has been studied in Vietnam only in respect of its socioeconomic and psychosocial determinants (Kim *et al.*, 2005, 2008; Tran *et al.*, 2009; Pham *et al.*, 2010; Nguyen *et al.*, 2012). A comprehensive assessment of alcohol consumption by individuals has not been attempted previously.

The first objective of this study was to provide nationally representative data on alcohol consumption pattern in Vietnam. The secondary objective was to assess the accuracy and value of this information. Because a previous systematic review of prospective cohort studies (Briasoulis *et al.*, 2012) has shown that the self-reported quantity of alcohol consumption is positively associated with blood pressure, and there is some evidence (Stranges *et al.*, 2004) that the average volume of alcohol consumed has a more important role in the relationship between alcohol consumption and the risk of raised blood pressure than the frequency of drinking (Stranges *et al.*, 2004), we used this outcome to test its predictive validity. In so doing, we subjected the underlying assumption—that standard drinks are understandable to survey respondents—to a field test: would responses by Vietnamese people in rural areas (where home-made products are widely consumed) have evidence of validity?

METHODS

Study participants

Participants were from a nationally representative population-based survey of non-communicable disease risk factors in Vietnam conducted during 2009–2010 using the WHO STEPS method (WHO, 2008), with the methods elsewhere (Bui *et al.*, 2015). In brief, participants aged 25–64 years were selected by age- and sex-stratified random sampling from clusters identified from communes, towns and city wards. The clusters were selected with probability proportional to population size with replacement from strata of economic (rich/poor) and residential (urban/rural) administrative classifications. The final sample consisted of 14,706 participants recruited with a response proportion of 64.1% (14,706/22,940). The protocol of this survey was approved by the Ethics Committee of Vietnam Ministry of Health and the Tasmanian Health and Medical Human Research Ethics Committee, and informed consent was obtained from participants before collecting data.

Blood pressure and covariates

The STEPS questionnaire (WHO, 2008) was used to collect information on age, residential status (urban and rural), ethnicity (Kinh majority group, and non-Kinh minority groups including Khmer, Tay, Thai, and Chinese), years spent at school, monthly household income per adult member, tobacco smoking, alcohol intake, and fruit and vegetable consumption. The questionnaire was translated into Vietnamese and back-translated to ensure the appropriate meaning of each item was retained, and visual aids (show cards) with locally relevant examples were used for questions on alcohol and fruit and vegetable consumption. Pathophysiological measurements including weight, height, waist circumference, hip circumference and blood pressure (BP) were made according to the standardized STEPS procedures (WHO, 2008). Blood pressure (at the midpoint of the right upper arm) was measured by trained staff using an Omron HEM 907 digital automatic blood pressure monitor. For each participant, three measurements in sitting position were recorded, the first after 5 min rest and subsequent readings after 2 min intervals. Hypertension was defined as systolic BP (SBP) $\geq$140 mmHg and/or diastolic BP (DBP) $\geq$90 mmHg, or using medication for hypertension.

Self-reported alcohol consumption

The STEPS questionnaire (WHO, 2008) sought information on alcohol intake through different sets of questions, with distinct reference periods. Each subject was assessed using the following two questions: 'Have you ever consumed an alcoholic drink such as beer, wine, spirits and fermented cider?' and 'Have you consumed an alcoholic drink within the last 12 months?'. Participants who answered 'yes' to the first question were classified as ever drinkers. Those who answered 'yes' to both questions were asked two related questions: 'During the past 12 months, how frequently have you had at least one alcoholic drink?' and 'When you drank alcohol, on average, how many standard alcoholic drinks did you have in 1 day?'. Those who reported consuming at least one alcoholic beverage during the previous year were asked about their frequency of consumption (response categories <1 day/month, 1–3 days/month, 1–4 days/week, 5–6 days/week, and daily). Show cards illustrating the volume of spirits (30 ml of 40% alc/vol), wine (120 ml of 11% alc/vol) and beer (285 ml of 4.5% alc/vol) equivalent to 10 g of ethanol (a standard drink) were used to prompt reporting of the number of standard drinks usually consumed on each drinking occasion. For presentation of results, reported number of standard drinks were categorized as <2, 2–3, 3.1–6 and >6 standard drinks. This provided a distribution of responses similar to that of frequency, thereby facilitating comparison. Hazardous drinking was defined as consuming 40–59.9 g of pure alcohol (4–6 standard drinks) for men or 20–39.9 g (2–4 standard drinks) for women on average per day during the last year, while harmful drinking was defined as consuming at least 60 g of pure alcohol (6 standard drinks) for men or 40 g (4 standard drinks) for women (WHO, 2008). The frequency of consumption (the midpoint of each category scaled in terms of number of days per week) was multiplied by the number of standard drinks per occasion to calculate the average weekly intake (frequency × quantity) categorized as none, ≤1, 1.1–7, 7.1–14 and >14 drink(s)/week.

Participants were asked if they had consumed any alcohol in the past 30 days. Those who responded 'yes' to this question were asked about their consumption during the last 7 days. The quantities consumed on a drinking day during the previous week were classified in the same way as quantities consumed on a previous occasion during the previous year. Frequency of consumption during the previous week was grouped as none, 1, 2, 3–4, 5–6 or 7 days that week. This provided a distribution of responses similar to that for frequency during the past year, also assisting comparison. Binge drinking was defined as consuming at least five standard drinks (men) or four standard drinks (women) on at least one drinking occasion during the last week (WHO, 2008).

Data analysis

Linear regression was used to estimate adjusted means of SBP and DBP, and Poisson regression with robust standard errors (Zou, 2004) was used to estimate prevalence and ratios of prevalence of hypertension at levels of alcohol intake. In our sample, 2.3% of the male (3.6% urban, 1.8% rural) and 3.5% of the female (5.4% urban, 2.7% rural) subjects used blood pressure-lowering medication. Those using medication for hypertension were excluded from the linear regression analysis. Confounders including age, education levels, ethnicity, smoking status (urban areas), number of daily servings of fruit and vegetables, and waist circumference were adjusted for in each analysis. Tests of trend were undertaken by replacing multiple binary (0/1) covariates for alcohol consumption with a single ordinal covariate. Agreement and ranking stability between reported quantities of alcohol intake were assessed from differences in means, Pearson correlation coefficients. Model calibration (the fit of the predicted values produced by the model to the actual observed values of the outcome) was assessed by R-squared values in linear regression and by deviance in Poisson regression. Subject discrimination (the capacity of the model to correctly classify those who develop the outcome and those who do not) was assessed using the Youden Index (Perkins and Schisterman, 2006). Improvements in calibration and discrimination were measured as changes in these indices. For a binary classification, the change in the Youden Index is equal to the net reclassification index and twice the change in area under the curve (Perkins and Schisterman, 2006). All analyses were conducted separately for men and women, and for men from urban and rural areas, using software for complex survey analyses provided by Stata version 12.0.

RESULTS

Selected characteristics of study subjects, stratified by sex and urban/rural classification of area of residence, are presented in Table 1. Approximately 65% of the participants, who were aged 25–64 years, lived in rural areas, and these subjects had lower proportions of high school completions and lower mean household income per adult family member compared to urban people. Men had higher mean levels of blood pressure than women, and greater proportions of hypertensive individuals, but urban/rural differences were slight.

Table 1 shows that >80% of men had consumed alcohol during the last year and that almost 40% had consumed alcohol in the quantities considered hazardous or harmful to their health. Around two-thirds (slightly more in rural areas than urban areas) had consumed alcohol during the last month, and 59.8% (53.4% of urban men and 62.5% of rural men) had done so during the last week. The men had consumed alcohol on average on 1.8 days—the drinkers among them on 2.5 days (urban men 2.3, rural men 2.6)—during that week. Male drinkers consumed 4.5 drinks (urban men 4.3, rural men 4.6) on average on each day that alcohol was consumed. One-in-four men were classified as binge drinkers. Less than 5% of the women had consumed alcohol in the last week, and only 11.8% had ever consumed alcohol.

Figure 1 summarizes the distribution of standard drinks by the reported frequency of drinking occasions during the last year. It shows a generally increasing median number of standard drinks with increasing number of reported drinking occasions for men, but with a wide distribution of standard drinks in each frequency category. For women, the median number of standard drinks was either two (5–6 days/week category) or one (all other frequency categories). In consequence, the number of drinking occasions last year was only moderately correlated with the number of standard drinks consumed per occasion for both men (urban $r = 0.26$, rural $r = 0.22$) and women (urban $r = 0.46$, rural $r = 0.43$). The number of standard drinks consumed on each drinking occasion in the past year was highly correlated with standard drinks consumed per occasion in the last week among men (urban $r = 0.76$, rural $r = 0.80$) and women (urban $r = 0.82$, rural $r = 0.89$). Mean weekly intake in numbers of standard drinks by men who drank alcohol during the last year was greater when calculated from information on last year consumption [urban 10.0 (SD 15.3), rural 12.0 (SD 18.5)] than when calculated from information on last week consumption [urban 7.6 (SD 12.2), rural 10.0 (SD 16.8)]. For women who drank alcohol during the last year, mean weekly intake in numbers of standard drinks when calculated from last year information [urban 1.3 (SD 3.7), rural 2.7 (SD 6.7)] was similar to that calculated from last week information [urban 1.6 (SD 5.1), rural 2.1 (SD 5.3)].

Reported numbers of standard drinks consumed on each drinking occasion in the last year was weakly but significantly correlated with levels of education completed (men $r = -0.12$, women $r = -0.10$) and higher for current smokers [men: mean (SD) = 4.9 (3.7), women: mean (SD) = 3.5 (2.5)] than for former or never smokers [men: mean (SD) = 4.1 (3.3), women: mean (SD) = 1.5 (1.5)]. There were similar findings for quantities consumed on each drinking occasion during the last week. For both men and women, the associations were generally stronger in rural areas irrespective of reference period (data not shown).

Estimated associations of alternative measures of alcohol consumption with BP and with hypertension are presented in Tables 2 and 3, respectively, for men. Those who reported having consumed alcohol during the last year had mean BP that was greater by about 5 mmHg (SBP) or 3–4 mmHg (DBP), and with prevalence of hypertension greater by around 7 percentage points in rural areas, than those who had not. Compared with non-drinkers, the three measures (frequency, quantity and total intake) of alcohol consumption during the last year provide similar associations with BP ($P < 0.001$ for trend in each case). For last week consumption, the increases in mean BP with alcohol consumption were similarly dose-related but a little smaller in magnitude. Particularly for urban respondents, the associations with hypertension also were stronger for last year consumption than for last week consumption (Table 3). The increase in risk of hypertension was confined mostly to the heaviest drinkers in urban areas, but commenced with the lightest drinkers in rural areas and with successive increases in risk across categories ($P < 0.001$ for trend). Adjustment for BMI or waist-to-hip ratio instead of waist circumference produced similar results. The generally weaker associations of these alternative alcohol measures with BP and hypertension among women are shown in the Supplementary Table S1. For women, the lowest prevalence of hypertension occurred among those with light-to-moderate consumption.

Table 1. Characteristics of subject

	Men		Women	
	Urban	Rural	Urban	Rural
Age: mean (SD)	40.6 (10.3)	40.5 (10.2)	41.1 (10.4)	41.2 (10.6)
Minority ethnicity	4.4% (110/2359)	6.5% (1051/4428)	4.2% (142/2815)	6.0% (1141/5074)
Education completed				
Less than primary	8.3% (206/2362)	17.9% (842/4423)	13.7% (500/2813)	28.2% (1668/5072)
Primary	18.5% (425/2362)	30.9% (1405/4423)	20.2% (558/2813)	29.8% (1546/5072)
Junior secondary	23.4% (593/2362)	31.2% (1458/4423)	23.3% (650/2813)	26.2% (1291/5072)
Senior secondary	20.7% (517/2362)	11.6% (426/4423)	20.9% (537/2813)	8.9% (313/5072)
College+	29.1% (621/2362)	8.4% (292/4423)	21.9% (568/2813)	6.9% (254/5072)
Income: mean (SD)[a]	112.6 (148.4)	62.8 (73.9)	102.1 (102.6)	59.3 (64.8)
Smoking status				
Never	29.1% (643/2360)	23.4% (1080/4422)	97.4% (2728/2815)	97.4% (4823/5071)
Former	17.5% (490/2360)	17.0% (857/4422)	1.1% (32/2815)	0.8% (69/5071)
Current	53.4% (1227/2360)	59.5% (2485/4422)	1.5% (55/2815)	1.8% (179/5071)
Diet: mean (SD)[b]	3.2 (2.1)	3.1 (2.0)	3.5 (2.0)	3.1 (1.9)
Body size and fatness				
BMI: mean (SD)	22.3 (3.3)	21.2 (2.9)	22.0 (3.1)	21.3 (3.0)
Waist: mean (SD)	78.0 (9.3)	73.6 (8.5)	74.1 (8.4)	71.1 (8.5)
WHR: mean (SD)	0.9 (0.1)	0.8 (0.1)	0.8 (0.1)	0.8 (0.1)
Blood pressure (mmHg)				
Systolic: mean (SD)	124.6 (17.2)	125.0 (17.2)	115.7 (18.4)	116.8 (17.2)
Diastolic: mean (SD)	75.9 (12.4)	75.7 (12.0)	70.9 (11.9)	71.2 (11.2)
Raised blood pressure	18.9% (610/2370)	19.6% (1168/4434)	12.9% (523/2823)	10.8% (796/5079)
Ever consumed alcohol				
Yes	82.5% (1941/2368)	85.1% (3760/4434)	15.9% (430/2818)	10.0% (621/5078)
Last year consumption				
Yes	78.5% (1831/2368)	81.2% (3555/4434)	13.5% (365/2818)	7.9% (513/5078)
Frequency of drinking				
None	21.3% (528/2351)	18.6% (869/4400)	86.6% (2450/2814)	92.2% (4563/5075)
<1/month	16.1% (336/2351)	11.6% (477/4400)	8.3% (222/2814)	3.9% (254/5075)
1–3 days/month	24.6% (523/2351)	26.6% (1161/4400)	3.2% (87/2814)	2.2% (145/5075)
1–4 days/week	22.9% (530/2351)	23.4% (1015/4400)	1.6% (42/2814)	1.0% (58/5075)
5–6 days/week	4.2% (98/2351)	4.0% (213/4400)	0.0% (1/2814)	0.1% (18/5075)
Daily	10.9% (336/2351)	15.7% (665/4400)	0.2% (12/2814)	0.6% (37/5075)
Quantity per occasion[c]				
Standard drinks	4.3 (3.3)	4.6 (3.7)	1.6 (1.3)	1.7 (2.0)
Largest quantity[d]				
Standard drinks	6.4 (6.3)	7.0 (6.5)	0.4 (1.5)	0.2 (1.1)
Alcohol intake status[e]				
Low	59.8% (1509/2370)	59.1% (2638/4434)	96.2% (2727/2823)	97.9% (4916/5079)
Hazardous	20.9% (436/2370)	14.8% (668/4434)	2.6% (69/2823)	1.4% (120/5079)
Harmful	19.3% (425/2370)	26.1% (1128/4434)	1.2% (27/2823)	0.7% (43/5079)
Last month consumption				
Yes	65.2% (1523/2368)	71.4% (3069/4434)	6.9% (203/2818)	5.0% (314/5078)
Last week consumption				
Yes	53.4% (1284/2368)	62.5% (2709/4434)	4.5% (136/2818)	3.3% (221/5078)
Frequency of drinking				
Days: mean (SD)	2.3 (2.4)	2.6 (2.5)	1.2 (1.5)	1.9 (2.3)
Quantity per occasion[c]				
Standard drinks	4.3 (3.1)	4.6 (3.6)	2.3 (2.5)	1.7 (1.6)
Binge drinking[f]	22.0% (488/2368)	26.5% (1083/4434)	0.9% (20/2818)	0.5% (30/5078)

[a]Monthly household income per adult member ($US).
[b]Number of fruit and vegetable serving per day.
[c]Number of standard drinks consumed per drinking day.
[d]Largest number of standard drinks consumed per occasion when drinking alcohol during the last year.
[e]Hazardous drinking: 4–6 standard drinks (men) and 2–4 standard drinks (women) on average per day during the last year, harmful drinking: ≥6 standard drinks (men) and ≥4 standard drinks (women) on average per day during the last year.
[f]≥5 standard drinks (men) and ≥4 standard drinks (women) on at least one drinking day during the last week.

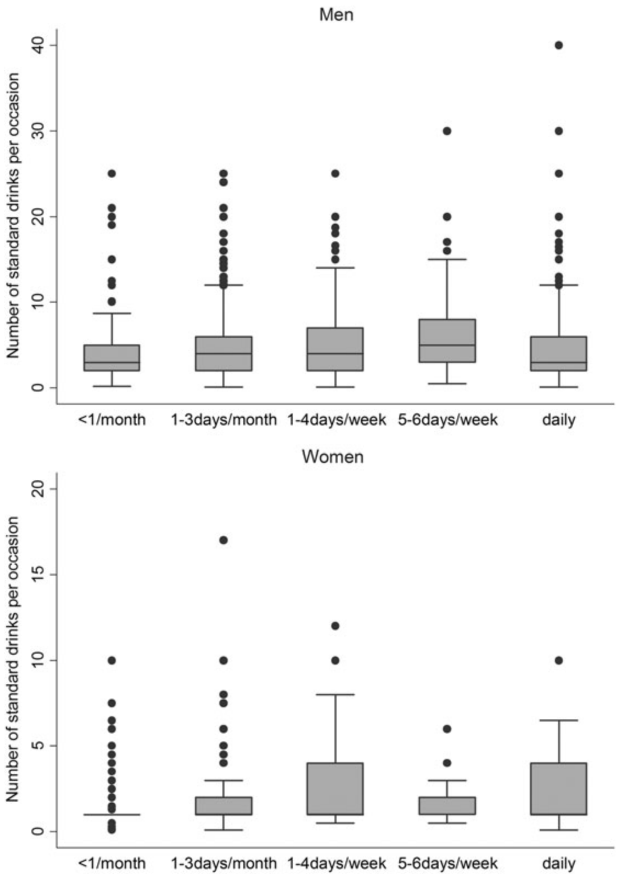

Fig. 1. Boxplots of quantity of standard drinks consumed by the frequency of consuming alcohol among men (top) and women (bottom).

In analyses of data for men, frequency of drinking occasions and quantity per occasion were not independent predictors of BP and hypertension. Across all outcomes (SBP, DBP, hypertension), urban/rural location and reference periods (last year, last week), including linear covariates for both frequency and quantity in the regression models greatly reduced the estimated coefficients of each vis-à-vis their values in models without inclusion of the other. Results were similar when total intake (frequency × quantity) was used in place of quantity. An exception was last week consumption by urban men, for whom total intake was independent of frequency.

As a more direct test of the utility of reported information on standard drinks, we investigated the contribution it made to model calibration and subject discrimination. Table 4 shows that for last year consumption and particularly for last week consumption, information on any consumption (versus none) provided the majority of improvement in model calibration and discrimination. Information on frequency of consumption provided a small further improvement in model calibration but not in discrimination. Information on quantity provided at best a minor additional improvement in calibration and discrimination. For both reference periods, the improvements in calibration were generally larger for models of rural respondents. It should be noted that all improvements in model calibration and discrimination due to additional information on frequency and quantity of consumption of alcohol were generally very small. This was particularly the case for women, for whom information on whether or not alcohol had been consumed last year provided almost all of any improvement in calibration or discrimination (Supplementary Table S2).

DISCUSSION

The key finding from these first nationally representative data on alcohol consumption in Vietnam is that almost 40% of men were hazardous/harmful users and 25% were binge drinkers, whereas only 3% of women were hazardous/harmful users and <1% were binge drinkers. The information on frequency of consumption and the number of standard drinks consumed had predictive accuracy for mean levels of BP and hypertension. Those consuming alcohol during the reference period had higher mean BP and risk of hypertension than those who had not. The increases were widened for the most frequent and heaviest drinkers, particularly for those from rural areas. However, most of the improvement in model calibration and subject discrimination were provided by binary responses to questions on whether or not alcohol had been consumed during the reference period.

The overall findings are broadly consistent with previous studies. Firstly, reflecting the cultural practice in Asian countries, alcohol use is more common among men than women (WHO, 2014a). Secondly, the prevalences of ever, current and heavy episodic drinking (defined as binge drinking in this study) were lower than those typically seen in Western countries (Wilsnack *et al.*, 2009). The estimated prevalence of male ever drinkers was similar to that of previous local surveys in Vietnam using STEPS protocols (Tran *et al.*, 2009; Pham *et al.*, 2009). The prevalence of alcohol use during the past 12 months was also comparable to that of a nationally representative sample in China (Millwood *et al.*, 2013). However, the prevalence of binge drinking among men in the present study was lower than that of previous surveys conducted in Mozambique (40%) (Padrao *et al.*, 2011) and Can Tho province, Vietnam (38.6%) (Pham *et al.*, 2009). The provincial estimates for Can Tho province in this national survey, after re-weighting our sample to match the urban/rural proportions in the earlier survey, were 31.6% for men and 0.7% for women. The earlier survey was conducted during the months of the year (July–November) that binge drinking is most prevalent, whereas surveying of the Can Tho population in this national survey was conducted during March–August. Consistent with findings from China (Li *et al.*, 2011; Millwood *et al.*, 2013), rural respondents in Vietnam had generally higher intake than urban respondents.

Our findings that alcohol consumption is positively related to BP and hypertension are consistent with previous studies in Asian (Marmot *et al.*, 1994; Nakanishi *et al.*, 2001; Ohmori *et al.*, 2002; Wildman *et al.*, 2005) and Western countries (Marmot *et al.*, 1994; Fuchs *et al.*, 2001; Stranges *et al.*, 2004; Sesso *et al.*, 2008). For men, we found no evidence of a protective effect of low-to-moderate consumption that has been reported in a previous study (Fuchs *et al.*, 2001), and which has prompted recommendations to limit alcohol consumption to ≤2 drinks per day in published guidelines on the primary prevention of hypertension (Whelton *et al.*, 2002; Appel *et al.*, 2006). For hypertension, the increase in risk was largely restricted to the heaviest drinkers (those drinking alcohol at least 5 days per week, and drinking more than three standard drinks on each drinking occasion) in urban areas. In rural areas, where home-made products with high alcohol content are consumed, a gradation in risk was more pronounced. Our results for women (see Supplementary Table S1) suggested a protective effect of light consumption for hypertension, and no increase in mean BP for light-to-moderate consumption (Taylor *et al.*, 2009; Briasoulis

Table 2. Association between alcohol consumption and mean systolic and diastolic blood pressure by residential area among men

	Urban men		Rural men	
	Systolic[a]	Diastolic[a]	Systolic[b]	Diastolic[b]
Last year consumption				
None	120.0 (118.2,121.8)	72.6 (71.3,74.0)	120.5 (118.9,122.1)	73.2 (72.0,74.3)
Any	124.9 (123.9,125.8)	76.2 (75.5,76.9)	125.7 (124.9,126.5)	76.1 (75.5,76.7)
Difference	$P < 0.001$	$P < 0.001$	$P < 0.001$	$P < 0.001$
Frequency of drinking				
None	119.9 (118.0,121.7)	72.6 (71.2,73.9)	120.3 (118.7,121.9)	72.8 (71.7,73.9)
<1/month	122.9 (120.8,125.1)	75.0 (73.3,76.7)	123.0 (120.8,125.2)	73.6 (72.0,75.3)
1–3 days/month	124.4 (122.4,126.3)	75.8 (74.3,77.3)	124.7 (123.4,125.9)	75.5 (74.6,76.4)
1–4 days/week	125.6 (124.1,127.1)	76.4 (75.3,77.5)	126.3 (124.8,127.8)	76.4 (75.3,77.5)
5–6 days/week Daily }	126.7 (124.9,128.4)	78.0 (76.6,79.3)	128.0 (126.3,129.8)	78.0 (76.8,79.3)
Linear trend	$P < 0.001$	$P < 0.001$	$P < 0.001$	$P < 0.001$
Quantity per occasion[c]				
None	119.9 (118.1,121.7)	72.6 (71.2,74.0)	120.3 (118.7,121.8)	72.8 (71.7,73.9)
<2 drinks/occasion	123.7 (121.8,125.5)	75.1 (73.6,76.6)	123.5 (121.3,125.7)	74.3 (72.7,75.9)
2–3 drinks/occasion	124.0 (122.5,125.6)	75.6 (74.5,76.7)	124.7 (123.4,126.1)	75.8 (74.8,76.8)
3.1–6 drinks/occasion	125.2 (123.6,126.9)	76.6 (75.3,77.9)	126.4 (124.9,127.9)	77.1 (76.0,78.3)
>6 drinks/occasion	126.7 (124.5,129.0)	77.6 (75.9,79.4)	127.6 (125.9,129.3)	76.5 (75.4,77.6)
Linear trend	$P < 0.001$	$P < 0.001$	$P < 0.001$	$P < 0.001$
Weekly intake[d]				
None	119.8 (118.0,121.7)	72.5 (71.1,73.9)	120.3 (118.7,121.8)	72.8 (71.7,73.9)
≤1 drink/week	122.1 (120.4,123.8)	74.3 (73.0,75.5)	123.7 (122.2,125.3)	74.5 (73.3,75.6)
1.1–7 drinks/week	126.0 (124.1,127.9)	77.1 (75.6,78.5)	124.6 (123.3,125.9)	75.4 (74.4,76.4)
7.1–14 drinks/week	125.9 (124.0,127.8)	76.3 (75.0,77.7)	126.9 (124.6,129.2)	77.3 (75.7,78.8)
>14 drinks/week	126.1 (124.4,127.8)	77.4 (76.0,78.7)	128.4 (126.9,130.0)	77.9 (76.8,79.0)
Linear trend	$P < 0.001$	$P < 0.001$	$P < 0.001$	$P < 0.001$
Last month consumption				
None	121.2 (119.9,122.6)	73.5 (72.5,74.6)	121.2 (119.9,122.5)	73.2 (72.3,74.0)
Any	125.2 (124.2,126.2)	76.5 (75.7,77.2)	126.1 (125.2,126.9)	76.5 (75.9,77.1)
Difference	$P < 0.001$	$P < 0.001$	$P < 0.001$	$P < 0.001$
Last week consumption				
None	121.7 (120.4,122.9)	73.7 (72.8,74.6)	121.5 (120.3,122.6)	73.3 (72.5,74.1)
Any	125.7 (124.6,126.8)	77.0 (76.1,77.8)	126.6 (125.6,127.5)	76.8 (76.2,77.5)
Difference	$P < 0.001$	$P < 0.001$	$P < 0.001$	$P < 0.001$
Frequency of drinking				
None	121.6 (120.4,122.9)	73.7 (72.8,74.6)	121.5 (120.3,122.6)	73.3 (72.5,74.1)
1 day	125.2 (123.4,127.1)	76.6 (75.2,78.0)	125.2 (123.9,126.5)	75.6 (74.6,76.6)
2 days	126.1 (123.9,128.4)	76.5 (74.6,78.4)	126.6 (124.3,128.9)	77.3 (75.6,78.9)
3–4 days	125.3 (122.9,127.8)	77.4 (75.6,79.2)	128.3 (125.5,131.1)	77.9 (75.6,80.2)
5+ days	126.6 (124.9,128.4)	77.9 (76.6,79.1)	128.0 (126.1,130.0)	78.2 (76.9,79.6)
Linear trend	$P < 0.001$	$P < 0.001$	$P < 0.001$	$P < 0.001$
Quantity per occasion[c]				
None	121.6 (120.4,122.9)	73.7 (72.8,74.6)	121.5 (120.3,122.6)	73.3 (72.5,74.1)
<2 drinks/occasion	123.3 (121.1,125.6)	75.3 (73.6,76.9)	125.2 (122.8,127.5)	75.2 (73.6,76.9)
2–3 drinks/occasion	125.0 (123.2,126.7)	76.3 (75.0,77.6)	126.8 (125.0,128.6)	77.7 (76.4,79.0)
3.1–6 drinks/occasion	126.6 (124.6,128.7)	77.8 (76.1,79.4)	126.7 (125.1,128.3)	76.9 (75.6,78.2)
>6 drinks/occasion	127.4 (124.8,130.0)	78.1 (76.1,80.1)	127.3 (125.5,129.1)	77.1 (75.9,78.4)
Linear trend	$P < 0.001$	$P < 0.001$	$P < 0.001$	$P < 0.001$
Weekly intake[d]				
None	121.6 (120.4,122.9)	73.7 (72.8,74.6)	121.5 (120.3,122.6)	73.3 (72.5,74.1)
≤1 drink/week	120.3 (116.8,123.8)	73.2 (70.7,75.7)	121.6 (118.1,125.2)	72.2 (69.5,74.9)
1.1–7 drinks/week	125.7 (124.0,127.5)	76.9 (75.5,78.2)	126.6 (125.3,127.9)	76.7 (75.7,77.6)
7.1–14 drinks/week	126.8 (124.5,129.2)	77.2 (75.4,79.0)	125.6 (123.8,127.5)	76.7 (75.4,78.0)
>14 drinks/week	126.2 (124.4,128.0)	78.1 (76.7,79.4)	128.6 (126.6,130.7)	78.4 (76.9,80.0)
Linear trend	$P < 0.001$	$P < 0.001$	$P < 0.001$	$P < 0.001$

Values are mean (95% CI).

[a]Adjusted for age, education, ethnicity, servings of fruit and vegetable per day, smoking and waist circumference.

[b]Adjusted for age, education, ethnicity, servings of fruit and vegetable per day, and waist circumference.

[c]Number of standard drinks consumed per occasion when drinking alcohol.

[d]Frequency × quantity.

Table 3. Association between alcohol consumption and raised blood pressure by residential area among men

	Urban men		Rural men	
	% (*n*/*N*)	PR (95% CI)[a]	% (*n*/*N*)	PR (95% CI)[b]
Last year consumption				
None	18.3 (138/537)	1.00	13.9 (196/879)	1.00
Any	19.0 (472/1831)	1.13 (0.87,1.45)	20.9 (972/3555)	1.61 (1.25,2.06)
Log difference		$P = 0.362$		$P < 0.001$
Frequency of drinking				
None	18.6 (137/528)	1.00	12.8 (192/869)	1.00
<1/month	18.7 (90/336)	1.06 (0.74,1.52)	16.3 (117/477)	1.35 (0.96,1.89)
1–3 days/month	17.1 (121/523)	1.06 (0.76,1.46)	16.7 (267/1161)	1.54 (1.16,2.04)
1–4 days/week	16.8 (125/530)	1.04 (0.76,1.42)	22.1 (286/1015)	2.06 (1.55,2.73)
5–6 days/week	25.5 (32/98)	1.33 (1.00,1.78)	17.2 (64/213)	2.06 (1.57,2.70)
Daily	26.1 (102/336)		30.7 (233/665)	
Log linear trend		$P = 0.102$		$P < 0.001$
Quantity per occasion[c]				
None	18.6 (137/528)	1.00	12.8 (192/869)	1.00
<2 drinks/occasion	19.6 (97/344)	0.97 (0.71,1.32)	19.4 (169/615)	1.50 (1.07,2.10)
2–3 drinks/occasion	17.4 (142/612)	1.02 (0.74,1.40)	19.4 (294/1117)	1.69 (1.28,2.23)
3.1–6 drinks/occasion	18.9 (152/595)	1.17 (0.86,1.59)	20.9 (297/1066)	1.87 (1.42,2.46)
>6 drinks/occasion	21.5 (78/273)	1.42 (1.02,1.98)	24.0 (206/737)	2.05 (1.55,2.72)
Log linear trend		$P = 0.047$		$P < 0.001$
Weekly intake[d]				
None	18.6 (137/528)	1.00	12.8 (192/869)	1.00
≤1 drink/week	17.0 (128/516)	0.94 (0.68,1.30)	16.5 (202/854)	1.43 (1.07,1.90)
1.1–7 drinks/week	19.4 (137/549)	1.21 (0.89,1.65)	18.9 (297/1176)	1.68 (1.27,2.21)
7.1–14 drinks/week	20.0 (90/328)	1.14 (0.82,1.58)	24.7 (167/533)	2.06 (1.48,2.88)
>14 drinks/week	19.9 (113/428)	1.23 (0.90,1.68)	25.4 (295/951)	2.13 (1.63,2.77)
Log linear trend		$P = 0.072$		$P < 0.001$
Last month consumption				
None	18.3 (214/845)	1.00	14.2 (310/1365)	1.00
Any	19.2 (396/1523)	1.13 (0.92,1.40)	21.7 (858/3069)	1.66 (1.35,2.05)
Log difference		$P = 0.246$		$P < 0.001$
Last week consumption				
None	17.2 (264/1084)	1.00	14.5 (385/1725)	1.00
Any	20.3 (346/1284)	1.27 (1.04,1.55)	22.6 (783/2709)	1.63 (1.34,1.99)
Log difference		$P = 0.019$		$P < 0.001$
Frequency of drinking				
None	17.2 (264/1084)	1.00	14.5 (385/1725)	1.00
1 day	20.1 (136/536)	1.32 (1.03,1.70)	18.2 (284/1130)	1.43 (1.12,1.81)
2 days	18.0 (51/191)	1.27 (0.90,1.79)	23.6 (122/433)	1.82 (1.31,2.54)
3–4 days	16.5 (42/171)	1.04 (0.72,1.52)	27.4 (117/368)	2.06 (1.49,2.86)
5+ days	24.7 (117/386)	1.29 (1.01,1.65)	27.2 (260/778)	1.66 (1.30,2.13)
Log linear trend		$P = 0.085$		$P < 0.001$
Quantity per occasion[c]				
None	17.2 (264/1084)	1.00	14.5 (385/1725)	1.00
<2 drinks/occasion	21.6 (78/260)	1.06 (0.80,1.42)	21.1 (147/525)	1.32 (0.96,1.81)
2–3 drinks/occasion	19.2 (102/400)	1.18 (0.91,1.52)	22.7 (235/775)	1.70 (1.32,2.19)
3.1–6 drinks/occasion	21.3 (106/415)	1.42 (1.06,1.90)	22.2 (247/870)	1.72 (1.33,2.24)
>6 drinks/occasion	19.5 (60/209)	1.41 (1.03,1.94)	24.3 (154/539)	1.72 (1.32,2.23)
Log linear trend		$P = 0.004$		$P < 0.001$
Weekly intake[d]				
None	17.2 (264/1084)	1.00	14.5 (385/1725)	1.00
≤1 drink/week	15.8 (24/94)	0.86 (0.57,1.30)	11.8 (39/165)	0.87 (0.53,1.43)
1.1–7 drinks/week	20.5 (147/582)	1.32 (1.02,1.70)	21.9 (341/1260)	1.63 (1.29,2.05)
7.1–14 drinks/week	21.4 (84/271)	1.29 (0.99,1.69)	23.3 (178/578)	1.76 (1.33,2.32)
>14 drinks/week	20.4 (91/337)	1.29 (0.98,1.71)	25.9 (225/706)	1.68 (1.31,2.16)
Log linear trend		$P = 0.010$		$P < 0.001$

[a]Adjusted for age, education, ethnicity, servings of fruit and vegetable per day, smoking and waist circumference.

[b]Adjusted for age, education, ethnicity, servings of fruit and vegetable per day, and waist circumference.

[c]Number of standard drinks consumed per occasion when drinking alcohol.

[d]Frequency × quantity.

Table 4. Calibration of regression models using information on alcohol consumption and other covariates to estimate mean levels of systolic and diastolic blood pressure and the prevalence of hypertension among men, and discrimination between male subjects by model predictions

	Urban men						Rural men					
	Calibration[a]			Discrimination[b]			Calibration[a]			Discrimination[b]		
	Systolic	Diastolic	HTN[c]	Systolic	Diastolic	HTN[c]	Systolic	Diastolic	HTN[c]	Systolic	Diastolic	HTN[c]
Last year consumption												
Base model[d]	0.139	0.147	1223.1	0.189	0.231	0.314	0.122	0.153	2451.8	0.194	0.240	0.247
Improvement due to D_{LY}[e]	+0.014	+0.014	−1.1	+0.021	+0.029	−0.005	+0.014	+0.009	−24.6	+0.022	+0.016	+0.001
Improvement due to F_{LY}[e]	+0.019	+0.021	−9.7	−0.004	+0.007	−0.008	+0.024	+0.023	−81.5	+0.019	+0.022	−0.013
Improvement due to Q_{LY}[e]	+0.017	+0.018	−11.7	+0.025	+0.025	−0.014	+0.021	+0.016	−72.5	+0.028	−0.010	+0.001
Improvement due to $(F_{LY} \times Q_{LY})$	+0.023	+0.023	−12.7	+0.004	+0.014	−0.024	+0.026	+0.022	−84.8	+0.016	+0.003	−0.016
Last month consumption												
Base model[d]	0.139	0.147	1223.1	0.205	0.244	0.325	0.122	0.153	2451.8	0.219	0.246	0.249
Improvement due to D_{LM}[f]	+0.012	+0.013	−1.6	0.000	+0.013	−0.011	+0.017	+0.016	−38.7	+0.017	+0.008	+0.017
Last week consumption												
Base model[d]	0.139	0.147	1223.1	0.205	0.244	0.325	0.122	0.153	2451.8	0.219	0.246	0.249
Improvement due to D_{LW}[g]	+0.014	+0.018	−5.9	+0.016	+0.012	−0.034	+0.021	+0.021	−42.0	+0.026	+0.022	+0.017
Improvement due to F_{LW}[g]	+0.015	+0.019	−7.1	+0.017	+0.009	−0.040	+0.025	+0.027	−51.8	+0.007	−0.003	+0.010
Improvement due to Q_{LW}[g]	+0.018	+0.021	−9.0	+0.028	−0.004	−0.015	+0.022	+0.024	−48.4	+0.029	+0.027	+0.015
Improvement due to $(F_{LW} \times Q_{LW})$	+0.019	+0.022	−8.2	+0.021	+0.003	−0.024	+0.027	+0.029	−52.2	0.000	+0.022	+0.016

[a]Indices of calibration are R^2 (systolic and diastolic BP) or deviance (hypertension), with improvement measured by partial R^2 or change in deviance, respectively.
[b]Index of discrimination is Youden Index (highest 20% of systolic and diastolic BP), with improvement measured by change in the Youden Index.
[c]HTN, hypertension defined as systolic BP ≥ 140 mmHg or diastolic BP ≥ 90 mmHg or taking medication for elevated BP.
[d]Base model includes covariates for age, education, ethnicity, number of daily servings of fruit and vegetables, smoking and waist circumference.
[e]D_{LY}, whether or not the participant drank alcohol during the last year; F_{LY}, frequency of occasions of drinking alcohol during the last year; Q_{LY}, number of standard drinks consumed on each drinking occasion during the last year.
[f]D_{LM}, whether or not the participant drank alcohol during the last month.
[g]D_{LW}, whether or not the participant drank alcohol during the last week; F_{LW}, frequency of occasions of drinking alcohol during the last week; Q_{LW}, number of standard drinks consumed on each drinking occasion during the last week.

et al., 2012), but the numbers of female drinkers in these categories were small.

We found generally similar increases in mean levels of BP and in prevalence of hypertension irrespective of whether alcohol consumption was characterized as frequency of drinking occasions, number of standard drinks per drinking occasion, or total alcohol intake. Part of our purpose was to investigate whether respondents, and particularly rural respondents, in Vietnam would be able to provide valid information about quantities expressed in terms of standard drinks. Somewhat unexpectedly, we found that reported numbers of standard drinks on each drinking occasion, as well as total intake based on frequency and quantity, were strongly associated with mean BP and the risk of hypertension in rural areas. This suggests that the concept of a standard drink was understandable for rural respondents, particularly when illustrated (as we did) with the use of visual aids depicting serving sizes for a range of alcohol drinks including spirits. The cups used to drink home-made wine in rural areas, and the alcoholic content of the home-made product drunk from them, vary somewhat according to local custom but it appears that respondents were able to convert them reasonably well to the serving sizes used to illustrate a standard drink of spirits in the visual aids. For urban respondents, the wider range of alcohol types and serving sizes may make reporting of alcohol consumption a more complex task.

There was some evidence that our estimates of quantities consumed had construct validity in terms of associations with education and tobacco smoking consistent with previous findings of studies (Tran *et al.*, 2009; Millwood *et al.*, 2013) in Asian populations. They also had stability across reference periods. The information on alcohol consumption was collected for reference periods of last year and last week with each considered to have advantages and disadvantages that impact on estimates (Dawson, 2003). Longer reference periods place the focus on usual patterns of consumption that are able to be recalled reliably if they are generally stable (Dawson, 2003; Ekholm, 2004). Consumption during shorter periods, such as last week, may be easier to recall but may not be representative of usual consumption (Dawson, 2003). These factors may explain the generally weaker results for rural men with last week rather than last year as the reference period. If their consumption pattern is relatively stable over time, any variation last week would result in a misclassification of the risk due to usual weekly consumption. Consistent with this, the agreement between usual reported intake last year and actual intake last week was higher for rural respondents than for urban respondents.

Investigation of model calibration and subject discrimination revealed that information from simple questions on whether the respondent had consumed any alcohol at all during the reference period provided most of the gain possible from information on frequency of consumption, number of standard drinks consumed on each drinking occasion, and total intake. For the most part, information on quantities consumed was not independent of frequency of consumption in prediction of outcome. This is a caveat on the inference that the concept of a standard drink was understandable to our respondents, because other research findings (Stranges *et al.*, 2004) prompt an expectation that reliable information on quantities consumed should improve prediction. Our present findings suggest it would be pointless to increase subject burden by gathering information on frequency and quantity, or on frequency alone, if the only purpose was to improve model calibration and subject discrimination. STEPS protocols emphasize that collecting smaller amounts of goodquality data is more valuable for country-by-country surveillance of non-communicable disease risk factors than is collecting large amounts of poor-quality data (WHO, 2008). Our results suggest that restricting collection of information on alcohol consumption to whether or not respondents consumed alcohol during a relevant reference period would provide the closest alignment with this principle. Elevated blood pressure is only one possible outcome of alcohol consumption, however, and we acknowledge that results may differ for other outcomes such as injury or all-cause mortality.

The present investigation has several strengths. First, the data were collected from a nationally representative survey of the Vietnamese population. The large sample allowed stratification by sex and rural/urban location, and account to be taken of putative modifying, confounding and mediating factors. The interviews were conducted by trained staff in accordance with standardized WHO protocols designed to minimize random error and bias, and using a culturally-sensitive instrument that had been translated and back-translated. The information on alcohol consumption was as comprehensive as it reasonably could be in a large-scale multiple risk factor survey. It included reports of any alcohol consumption during three reference periods, and frequency of consumption and number of standard drinks consumed during two of those reference periods. That allowed this first investigation of standard drink reporting in Asian countries, and the first with consideration of both model calibration and subject discrimination.

This study has some limitations. Whilst participation was high for a study with overnight fasting, blood sampling and nearly 2 h of on-site attendance, the possibility of non-participation bias cannot be discounted. Alcohol consumption was self-reported, but this is standard practice and information collected by this way has been shown to have some evidence of validity (Del Boca and Darkes, 2003). In our study, the self-reported data clearly had predictive validity for BP and hypertension as outcomes. It might be argued that our results are specific to those outcomes, and do not attest to validity more generally including for monitoring population levels of alcohol intake. We argue that the urban-rural and reference period comparisons produced important insights independent of those outcomes. Unmeasured factors may be responsible for the urban-rural differences, with salt intake (higher in rural areas) a possible candidate. Adjusting for self-reported information on salty diet did not remove the differences, however. We used version 2.1 of the STEPS questionnaire, and the alcohol questions have been modified in two subsequent iterations of the questionnaire. The current version 3.1 (WHO, 2014b) includes additional questions on frequency and quantity of consumption during the past 30 days. Further additional questions have been added on health impacts of drinking, binge drinking and the number of standard drinks consumed during the last 7 days from home-brewed, cross-border, non-food (medicines, perfumes, after shave) and non-taxed sources. These add considerably to subject burden and have untested validity. Finally, the questions on alcohol consumption used in all versions of the STEPS questionnaire are an adaption of the quantity/frequency approach (Dawson, 2003). We are unable to assess the comparative validity of questions based on the graduated frequency approach (Dawson, 2003).

In conclusion, alcohol use and harmful consumption was common among Vietnamese men but less pronounced than in Western countries. Self-reports of quantity of alcohol consumed in terms of standard drinks had predictive validity for BP and hypertension even in rural areas. However, using detailed measures of consumption resulted in only minor improvements in prediction compared to simple measures.

SUPPLEMENTARY MATERIAL

Supplementary material is available at *Alcohol and Alcoholism* online.

ACKNOWLEDGEMENTS

We would like to thank The Atlantic Philanthropies Inc., USA for its financial support for data collection of the survey. We thank the Ministry of Health of the Socialist Republic of Vietnam and the provincial data collection teams for their contributions. We also thank Catrina Boon and Kate Butorac for their assistance with training and supervision of data collection teams.

FUNDING

This work was supported by The Atlantic Philanthropies Inc., USA (grant number G0015338). B.V.T. is supported by a Tasmania Graduate Research Scholarship; C.L.B. is supported by a National Health and Medical Research Council Career Development Fellowship; V.S. is supported by a Heart Foundation/NHMRC Career Development Fellowship and S.G. is supported by a Heart Foundation Post-Doctoral Fellowship.

CONFLICT OF INTEREST STATEMENT

None declared.

REFERENCES

Appel LJ, Brands MW, Daniels SR, *et al.* (2006) Dietary approaches to prevent and treat hypertension: a scientific statement from the American Heart Association. *Hypertension* **47**:296–308.

Briasoulis A, Agarwal V, Messerli FH. (2012) Alcohol consumption and the risk of hypertension in men and women: a systematic review and meta-analysis. *J Clin Hypertens (Greenwich)* **14**:792–8.

Bui TV, Blizzard L, Luong KN, *et al.* (2015) Declining prevalence of tobacco smoking in Vietnam. *Nicotine Tob Res* **17**:831–8.

Dans A, Ng N, Varghese C, *et al.* (2011) The rise of chronic non-communicable diseases in southeast Asia: time for action. *Lancet* **377**:680–9.

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

Del Boca FK, Darkes J. (2003) The validity of self-reports of alcohol consumption: state of the science and challenges for research. *Addiction* **98** (Suppl 2):1–12.

Devos-Comby L, Lange JE. (2008) 'My drink is larger than yours'? A literature review of self-defined drink sizes and standard drinks. *Curr Drug Abuse Rev* **1**:162–76.

Dung NTP, Rombouts FM, Nout MJR. (2007) Characteristics of some traditional Vietnamese starch-based rice wine fermentation starters (men). *LWT Food Sci Technol* **40**:130–5.

Ekholm O. (2004) Influence of the recall period on self-reported alcohol intake. *Eur J Clin Nutr* **58**:60–3.

Fuchs FD, Chambless LE, Whelton PK, *et al.* (2001) Alcohol consumption and the incidence of hypertension: The Atherosclerosis Risk in Communities Study. *Hypertension* **37**:1242–50.

General Statistics Office. (2010) *The 2009 Vietnam Population and Housing Census: Completed Results*. Ha Noi: Statistical Publishing House.

Kaskutas LA, Graves K. (2000) An alternative to standard drinks as a measure of alcohol consumption. *J Subst Abuse* **12**:67–78.

Kim GB, Spak F, Truong DV, *et al.* (2005) The use of audit to assess level of alcohol problems in rural Vietnam. *Alcohol Alcohol* **40**:578–83.

Kim BG, Allebeck P, Spak F, *et al.* (2008) Alcohol use and alcohol consumption-related problems in rural Vietnam: an epidemiological survey using AUDIT. *Subst Use Misuse* **43**:481–95.

Lachenmeier DW, Anh PT, Popova S, *et al.* (2009) The quality of alcohol products in Vietnam and its implications for public health. *Int J Environ Res Public Health* **6**:2090–101.

Li Y, Jiang Y, Zhang M, *et al*. (2011) Drinking behaviour among men and women in China: the 2007 China Chronic Disease and Risk Factor Surveillance. *Addiction* **106**:1946–56.

Lim SS, Vos T, Flaxman AD, *et al*. (2012) A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet* **380**:2224–60.

Marmot MG, Elliott P, Shipley MJ, *et al*. (1994) Alcohol and blood pressure: the INTERSALT study. *BMJ* **308**:1263–7.

Millwood IY, Li L, Smith M, *et al*. (2013) Alcohol consumption in 0.5 million people from 10 diverse regions of China: prevalence, patterns and socio-demographic and health-related correlates. *Int J Epidemiol* **42**: 816–27.

Nakanishi N, Yoshida H, Nakamura K, *et al*. (2001) Alcohol consumption and risk for hypertension in middle-aged Japanese men. *J Hypertens* **19**:851–5.

Nguyen TM, Doran CM, Hill PS, *et al*. (2012) Alcohol reform in Viet Nam: confronting rising consumption, injury and harm. *Appl Health Econ Health Policy* **10**:285–7.

Ohmori S, Kiyohara Y, Kato I, *et al*. (2002) Alcohol intake and future incidence of hypertension in a general Japanese population: the Hisayama study. *Alcohol Clin Exp Res* **26**:1010–6.

Padrao P, Damasceno A, Silva-Matos C, *et al*. (2011) Alcohol consumption in Mozambique: regular consumption, weekly pattern and binge drinking. *Drug Alcohol Depend* **115**:87–93.

Perkins NJ, Schisterman EF. (2006) The inconsistency of 'optimal' cutpoints obtained using two criteria based on the receiver operating characteristic curve. *Am J Epidemiol* **163**:670–5.

Pham HL, Au BT, Blizzard L, *et al*. (2009) Prevalence of risk factors for non-communicable diseases in the Mekong Delta, Vietnam: results from a STEPS survey. *BMC Public Health* **9**:291.

Pham DB, Clough AR, Nguyen HV, *et al*. (2010) Alcohol consumption and alcohol-related problems among Vietnamese medical students. *Drug Alcohol Rev* **29**:219–26.

Sesso HD, Cook NR, Buring JE, *et al*. (2008) Alcohol consumption and the risk of hypertension in women and men. *Hypertension* **51**:1080–7.

Stranges S, Wu T, Dorn JM, *et al*. (2004) Relationship of alcohol drinking pattern to risk of hypertension: a population-based study. *Hypertension* **44**:813–9.

Taylor B, Irving HM, Baliunas D, *et al*. (2009) Alcohol and hypertension: gender differences in dose-response relationships determined through systematic review and meta-analysis. *Addiction* **104**:1981–90.

Tran HB, Pham TQN, La NQ, *et al*. (2009) Patterns of alcohol consumption in diverse rural populations in the Asian region. *Glob Health Action* **2**: 28–34.

Whelton PK, He J, Appel LJ, *et al*. (2002) Primary prevention of hypertension: clinical and public health advisory from The National High Blood Pressure Education Program. *JAMA* **288**:1882–8.

WHO. (2008) WHO STEPS Surveillance Manual: the WHO STEPwise Approach to Chronic Disease Risk Factor Surveillance *[Online]*. Geneva: World Health Organization. http://www.who.int/chp/steps/manual/en/ (30 June 2015, date last accessed).

WHO. (2011) *Global Status Report on Noncommunicable Diseases 2010*. Geneva: World Health Organization.

WHO. (2014a) *Global Status Report on Alcohol and Health 2014*. Geneva: World Health Organization.

WHO. (2014b) The STEPS Instrument and Support Materials *[Online]*. Geneva: World Health Organization. http://www.who.int/chp/steps/instrument/en/ (30 June 2015, date last accessed).

Wildman RP, Gu D, Muntner P, *et al*. (2005) Alcohol intake and hypertension subtypes in Chinese men. *J Hypertens* **23**:737–43.

Wilsnack RW, Wilsnack SC, Kristjanson AF, *et al*. (2009) Gender and alcohol consumption: patterns from the multinational GENACIS project. *Addiction* **104**:1487–500.

Zou G. (2004) A modified Poisson regression approach to prospective studies with binary data. *Am J Epidemiol* **159**:702–6.