HHS Public Access

Author manuscript

*Lancet Glob Health*. Author manuscript; available in PMC 2022 October 20.

Published in final edited form as:

*Lancet Glob Health*. 2022 September ; 10(9): e1268–e1280. doi:10.1016/S2214-109X(22)00273-X.

# The socioeconomic gradient of alcohol use: an analysis of nationally representative survey data from 55 low-income and middle-income countries

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Contributors

YX, CP, and SV conceived the idea for this study. PG, JM-G, MT, M-EM, RA, TB, JD, LMJ, and SV led the primary data collection. MT, M-EM, ZZ, SQ-C, OM, SSM, SK, KBK, FF, NE, AD, KKA, and KA led the data collation. YX and CP verified the underlying data and did the statistical analysis. YX and CP wrote the first draft of the manuscript with substantial revisions from PG, JM-G, MT, M-EM, LMJ, and SV. All authors provided crucial input on multiple iterations of the manuscript. All authors had full access to the data and had the final responsibility to submit for publication.

Data sharing

Many surveys contained in the HPACC dataset are publicly available. The two most common data sources are the WHO data repository (https://extranet.who.int/ncdsmicrodata/index.php/home) and the DHS website (https://dhsprogram.com/data/).[7,8] Several additional surveys have been obtained through formal requests of survey teams whose data is not already made public. The pooled, harmonised, deidentified participant-level HPACC dataset and accompanying data dictionary have been created through a partnership between Harvard University, University of Göttingen, and Heidelberg University in collaboration with all country-level survey teams. Access can be requested by contacting the corresponding author. More information about HPACC including additional contact information for the collaboration can be found on https://www.hpaccproject.org/.

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## Summary

**Background—**Alcohol is a leading risk factor for over 200 conditions and an important contributor to socioeconomic health inequalities. However, little is known about the associations between individuals' socioeconomic circumstances and alcohol consumption, especially heavy episodic drinking (HED; ≥5 drinks on one occasion) in low-income or middle-income countries. We investigated the association between individual and household level socioeconomic status, and alcohol drinking habits in these settings.

**Methods—**In this pooled analysis of individual-level data, we used available nationally representative surveys—mainly WHO Stepwise Approach to Surveillance surveys—conducted in 55 low-income and middle-income countries between 2005 and 2017 reporting on alcohol use. Surveys from participants aged 15 years or older were included. Logistic regression models controlling for age, country, and survey year stratified by sex and country income groups were used to investigate associations between two indicators of socioeconomic status (individual educational attainment and household wealth) and alcohol use (current drinking and HED amongst current drinkers).

**Findings—**Surveys from 336 287 participants were included in the analysis. Among males, the highest prevalence of both current drinking and HED was found in lower-middle-income countries (L-MICs; current drinking 49·9% [95% CI 48·7–51·2] and HED 63·3% [61·0–65·7]). Among females, the prevalence of current drinking was highest in upper-middle-income countries (U-MIC; 29·5% [26·1–33·2]), and the prevalence of HED was highest in low-income countries (LICs; 36·8% [33·6–40·2]). Clear gradients in the prevalence of current drinking were observed across all country income groups, with a higher prevalence among participants with high socioeconomic status. However, in U-MICs, current drinkers with low socioeconomic status were more likely to engage in HED than participants with high socioeconomic status; the opposite was observed in LICs, and no association between socioeconomic status and HED was found in L-MICs.

**Interpretation—**The findings call for urgent alcohol control policies and interventions in LICs and L-MICs to reduce harmful HED. Moreover, alcohol control policies need to be targeted at socially disadvantaged groups in U-MICs.

**Funding—**Deutsche Forschungsgemeinschaft and the National Center for Advancing Translational Sciences of the US National Institutes of Health.

## Introduction

Alcohol is a major risk factor for mortality and disability; for several non-communicable diseases, including cardio vascular diseases, diabetes, and cancers; communicable diseases, such as tuberculosis; and injuries.[1,2] According to the Global Status Report on Alcohol and Health published by WHO in 2018,[3] alcohol causes more than 3 million deaths every year and more than 5% of the total burden of disease and injury globally. To adequately address the burden of disease attributable to alcohol use, the pattern of consumption needs to be considered above and beyond the mere prevalence of drinking.[4] For example, heavy episodic drinking (HED) is defined as drinking five or more standard drinks on a single occasion and is associated with particularly high health risks.[4]

Alcohol use is known to be a major contributor to socioeconomic inequalities in health and mortality,[5–8] with increasing mortality risks as the socioeconomic status declines.[6] Specifically, a systematic review and meta-analysis found that socioeconomic inequalities in alcohol-attributable mortality are 1·5 to 2·0 times larger than socioeconomic inequalities in all-cause mortality.[7] A systematic review done in 2019 showed that HED particularly contributes to socioeconomic inequalities in mortality overall, and alcohol-attributable mortality specifically.[9] Previous studies, mainly done in high-income countries (HICs), have investigated the differences in alcohol use by indicators of individual-level or

household-level socioeconomic status, such as employment and housing status,[10] level of education,[11–13] social class, and income.[13,14] In these studies, the prevalence of current drinking was found to be positively associated with socioeconomic status, whereas the prevalence of HED was negatively associated with socioeconomic status. Evidence suggests that the association between socioeconomic status and HED in low-income and middle-income countries differs from that found in HICs.[11] However, the few studies using nationally representative data from low-income and middle-income countries were predominantly done in single-country settings. There are two multicountry studies[11,15] that pooled data from low-income and middle-income countries together with HICs, but these studies only included data from about 18 000 participants from 12 low-income and middle-income countries[11] and 5000 participants from three middle-income countries.[15] Additionally, although it was noted that the socioeconomic gradient of HED differed between males and females conditional on the country income level,[11,15] no study has systematically analysed whether and how the socioeconomic gradient of alcohol use differed across country income groups within low-income and middle-income countries.

Over the past decades and with economic growth, prevalence and level of alcohol use have increased in low-income and middle-income countries.[16] Estimates suggest that low-income and middle-income countries already bear the highest alcohol-attributable mortality burden in absolute terms, with age-standardised alcohol-attributable mortality rates of 42·1 deaths per 100 000 population in low-income countries (LICs), 46·2 in lower-middle-income countries (L-MICs), and 39·5 in upper-middle-income countries (U-MICs), compared with 27·1 deaths per 100 000 population in HIC.[3] Concerningly, the prevalence of HED among drinkers is suggested to be greater than 60% in some low-income and middle-income countries.[3] This knowledge has resulted in a growing concern about the alcohol-attributable disease burden in these settings. Therefore, a robust understanding of the socioeconomic patterns of alcohol use within and across low-income and middle-income countries is of vital importance for an evidence-based intervention strategy targeting those population groups at highest risk for alcohol-attributable health burden.

Using a sample of adults (aged ≥15 years) in 55 low-income and middle-income countries, this study addressed two objectives. The first objective was to investigate the association between current drinking and HED among current drinkers, and (1) the country income group (LIC, L-MIC, and U-MIC) and (2) the individual-level or household-level socioeconomic status (educational attainment and household wealth, respectively). The second objective was to test whether and how the socioeconomic gradient of alcohol use differed across country income groups.

## Methods

### Data sources

We did a pooled analysis of individual-level data from nationally representative population-based surveys in low-income and middle-income countries. We first identified all countries in which a WHO Stepwise Approach to Surveillance (STEPS) survey had been carried out. We used all eligible STEPS surveys available on the WHO NCD Microdata Repository[17] and systematically requested the remaining eligible STEPS surveys that are listed on the

website but not available publicly from countries that met our inclusion criteria. The requirements for inclusion of a country survey in this study were: (1) the survey was conducted in or after 2005 and in cases whereby two or more surveys were available for a particular country, the most recent survey was used; (2) the survey data were made available at the individual level; (3) the survey contained current drinking information (whether the individual has consumed alcohol in the past 12 months or the past 30 days); (4) the survey was conducted in a low-income or middle-income country according to the World Bank classification at the time of the survey; (5) the survey was nationally representative; and (6) the survey had a response rate of 50% or more. Of the remaining countries that did not respond to our request for data, declined our request for data, did not have valid contact information, or did not have STEPS data, we carried out a systematic online search to identify potentially eligible surveys (appendix pp 2–3).

In total, we had access to 55 eligible nationally representative surveys in low-income and middle-income countries, including 48 STEPS surveys and seven non-STEPS surveys (table 1). All surveys used a multistage cluster random sampling design and conducted face-to-face interviews (appendix pp 4–28). The population of interest was adults aged 15 years or older.

Ethical approval for the included population-based surveys was sought from the respective country's ethics review committee before data collection. All surveys followed standardised ethics procedures, such as asking for participants' informed consent to participate in the respective survey. The final collated Global Health and Population Project on Access to Care for Cardiometabolic Diseases (HPACC) dataset is deidentified and no investigator can contact nor reidentify participants. The HPACC dataset was designated as Non-Human Subjects Research by the Harvard T H Chan School of Public Health in 2018 under protocol IRB16–1915.

## Definitions of alcohol use

Current drinking was defined as having used any type of alcohol in the past 12 months. However, in three countries, current drinking was assessed for the 30 days preceding the survey. HED was either derived from questions on the number of occasions whereby five or more drinks were consumed, or the maximum number of drinks consumed per occasion within the past 30 days.[3] Six surveys (Belize, Brazil, Iran, Iraq, Kazakhstan, and Sudan) did not include information on the number of drinks consumed in the past 30 days.

Heavy drinking and daily drinking were two additional drinking patterns that were used for sensitivity analyses. Heavy drinking was defined as an average of five or more drinks consumed per day in the week preceding the survey. Daily drinking was assessed through self-reported drinking frequency.

## Socioeconomic indicators and covariables

We used the World Bank country income classification (low-income, lower-middle-income, and upper-middle-income) at the time the survey was conducted as the country-level indicator. Individual-level socioeconomic status was measured using educational attainment and household-level socioeconomic status was measured using household wealth. Educational attainment was classified as no formal schooling, lower than primary school,

primary school completed, some high school, and high school completed or higher. We used local categorical variables on educational attainment when available, and if not available, years of education completed (a continuous variable), to classify all participants according to these categories. Household wealth quintiles were constructed based on one or two measures of the four different measures of wealth: continuous income, income categories, income quintiles, or an asset index (appendix pp 29–30). Information on household wealth was not available in nine surveys (Belarus, Belize, Burkina Faso, Chile, Costa Rica, Iraq, Mozambique, Sierra Leone, and Viet Nam).

At the individual level, alcohol use has been shown to vary with some demographic characteristics, including sex[11,16] and age.[3,11,18] Age was therefore included as a continuous variable and as a squared term. To account for a larger trend in alcohol use over time, the survey year was included as a covariate. The survey year was the year when the survey data were collected. If the survey was conducted over several years, then the mean of the beginning and the ending year was calculated as the survey year.

## Statistical analysis

We first performed descriptive analyses by estimating the prevalence of the two main indicators of alcohol use (current drinking and HED among current drinkers) by country income group and individual's socioeconomic status (individual educational attainment and household wealth). In each estimation only one of the indicators of alcohol use and one of the socioeconomic status variables were used at a time. Afterwards, multivariable logistic models were used to estimate the overall association between socioeconomic status and current drinking and HED among current drinkers in low-income and middle-income countries. The final logistic multivariable models were stratified by country income group to analyse the association between socioeconomic status and alcohol use within each country income group. All analyses were stratified by sex. All models were adjusted for age, age squared, and survey year using continuous variables, as well as country using fixed effects. Variance was adjusted for within-country clustering.

Additionally, logistic multivariable models were used to examine the socioeconomic gradient of alcohol use within each country, and the relative differences (odds ratios [OR]) in current drinking and HED among participants with a low socioeconomic status relative to participants with a high socioeconomic status were estimated.

To test whether the association between socioeconomic status and alcohol use differed across country income groups, interaction terms between socioeconomic status and country income group were introduced in the logistic models. In each model, one socioeconomic status indicator, country income group, and the interaction between them were included as predictors. Afterwards, the prevalence of current drinking and HED at each level of socioeconomic status were predicted in each country income group.

A series of sensitivity analyses were performed. Current drinking was assessed in the past 12 months in 52 surveys and the past 30 days in three surveys due to data availability. To evaluate the differences between the assessment in the past 12 months and in the past 30 days, the prevalence of current drinking was estimated using both measures in the 47

surveys that assessed both. Moreover, the results could be biased if drinkers from particular social groups were less likely to report information on drinking patterns. To test this potential bias, logistic multivariable models were used to examine the association between socioeconomic status and missing information on HED among current drinkers from the 49 surveys that assessed information on drinking patterns, stratified by country income group and sex. Lastly, the socioeconomic gradients of heavy drinking and daily drinking were analysed to confirm the association of HED with country income group and socioeconomic status.

To obtain population-weighted point estimates across multiple countries (eg, within income groups), sample weights were scaled to represent the adult population in 2015 in each country. When sample weights were missing for an observation within a country, the mean sample weight for all observations in that country was assigned. The sample weights were adjusted for non-response in variables related to alcohol use and socioeconomic status. All analyses were conducted in Stata (version 15.0) and accounted for the sample design, particularly the sample weights, the first stage of the cluster design (ie, primary sampling unit), and, where applicable, stratification.

### Role of the funding source

The funders of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report.

## Results

Our final sample included 55 nationally representative population-based surveys conducted in low-income and middle-income countries (14 LICs, 22 L-MICs, and 19 U-MICs) between 2005 and 2017. An overview of all surveys and country-level characteristics is shown in table 1, and additional descriptive statistics of the total sample are shown in the appendix (p 31). In total, the sample comprised 336 287 adults (aged 15 years or older) with alcohol use information. The population-weighted average age was 40·8 years (95% CI 40·4–41·1) and 51·0% (49·9–52·1) of the population-weighted sample were female. The population-weighted prevalence of current drinking was 36·6% (34·6–38·5). Among current drinkers, 46·0% (42·6–49·4) engaged in HED. The country-level prevalence of current drinking ranged from 0·6% (unable to estimate the 95% CI) in Niger to 82·2% (80·0–84·4) in Belarus, and the prevalence of HED among current drinkers ranged from 0·0% (unable to estimate the 95% CI) in Niger to 89·2% (80·7–94·2) in Kiribati.

By country income group, the highest population-weighted prevalence of both current drinking and HED among current drinkers was found in L-MICs among males (current drinking 49·9% [95% CI 48·7–51·2]; HED 63·3% [61·0–65·7]; figure 1). Among females, the prevalence of current drinking was highest in U-MICs (29·5% [26·1–33·2]), and the prevalence of HED was highest in LICs (36·8% [33·6–40·2]). Regarding individual and household-level socioeconomic status across all country income levels, the prevalence of current drinking increased with increasing levels of educational attainment. The same was seen for wealth quintiles for females; however, among males, there were no clear differences in the prevalence of current drinking observed across household wealth quintiles. The

prevalence of HED was higher among male and female drinkers with low educational attainment, and, for males, in participants with lower household wealth. However, for female drinkers there were no strong differences in the prevalence of HED observed across the five categories of educational attainment.

Similar to the descriptive results, the results of logistic models adjusting for age, age squared, survey year, and country fixed effects showed statistically significant differences in the prevalence of current drinking by individual and household level socioeconomic status (appendix p 32). A clear positive association between socioeconomic status and current drinking was observed among both males and females, with higher prevalence estimates for current drinking among individuals with higher socioeconomic status. However, there was no association between socioeconomic status and HED among male or female drinkers. Inclusion of the interaction terms between country income groups and socioeconomic status indicators into the models indicated that the association between socioeconomic status and alcohol use was heterogeneous across country income groups (appendix pp 36–37).

On stratifying the regression models both by country income group and sex and by controlling for age, age squared, survey year, and country (table 2), a positive association between socioeconomic status and current drinking was observed in all country income groups, with a steeper gradient in U-MICs. The association between socioeconomic status and HED varied across country income groups. In LICs, relative to drinkers from the wealthiest households, the odds of HED were lower among participants from the least wealthy households (males OR 0·74 [95% CI 0·55–1·00]; females 0·60 [0·50–0·74]). In L-MICs, the odds of HED did not differ among male and female drinkers with low socioeconomic status, relative to participants with high socioeconomic status. However, in U-MICs, the odds of HED were higher among the drinkers from the least wealthy households compared with participants from the wealthiest households among males (3·21 [1·64–6·29]) and females (2·33 [1·35–4·01]). A similar association between educational attainment and HED was observed.

Lastly, we estimated the association between individual educational attainment and the two indicators of alcohol use in each country using multivariable logistic regression models. We found that in most countries, participants with no formal schooling were less likely to be current drinkers than participants with high school or higher education (figure 2). However, no clear difference of engagement in HED among drinkers with no formal schooling compared with participants with high school or above education was observed in most countries (figure 3). Nevertheless, relative to drinkers with high school or higher schooling, participants with no formal schooling were less likely to engage in HED in four L-MICs (Moldova, Ghana, Laos, and Zambia), but were more likely to be heavy episodic drinkers in one LIC (Cambodia) and three U-MICs (Ecuador, Costa Rica, and Chile).

In the sensitivity analysis, we assessed the prevalence of current drinking using information from the past 12 months and the past 30 days, using data from 47 surveys that assessed both. The estimated prevalence of current drinking using the past 12 months as the reference time frame was around 35% higher than when using the past 30 days (appendix pp 34–35). Moreover, we tested whether drinkers from particular demographic groups were less likely

to report HED using data from 49 surveys that assessed information on HED. We found that relative to participants with high school or higher education, female drinkers with lower educational attainment were more likely to have missing information on HED in LICs. Moreover, in U-MICs, relative to participants from the 20% wealthiest households, female drinkers from less wealthy households were less likely to report drinking patterns as well (appendix p 33). Finally, we analysed socioeconomic gradients of heavy drinking and daily drinking, and we observed similar gradients to those of HED. We found that drinkers with a low relative to a high socioeconomic status were more likely to engage in heavy drinking and daily drinking overall (appendix p 40), and also in L-MICs and U-MICs but not in LICs (appendix pp 41–42). Moreover, the highest prevalence of both heavy drinking and daily drinking among current drinkers was observed in LICs, and the lowest prevalence was found in U-MICs (appendix p 39).

## Discussion

We present the largest multicountry study to investigate the association between alcohol use and country income group and socioeconomic status using individual-level data from low-income and middle-income countries currently available. The analysis included 336 287 adult participants from 55 low-income and middle-income countries with information on both current drinking, HED, and two alternative drinking patterns, as well as detailed socioeconomic status information that enabled us to investigate the role of two different individual and household-level indicators of socioeconomic status, country income group, and their interplay in explaining differences in alcohol use.

Overall, we found that individuals with a low socioeconomic status were less likely to be current drinkers than participants with a high socioeconomic status across all country income groups, as has been found in other, smaller studies.[11,15] However, we also found that the association between socioeconomic status and HED differed systematically across country income groups. Our findings showed that in U-MICs, current drinkers with a low socioeconomic status were more likely to engage in HED compared with current drinkers with a high socioeconomic status, whereas the opposite was true for LICs; no socioeconomic differences were observed in L-MICs.

Published studies on the socioeconomic gradient of alcohol use have largely focused on HICs.[10–14] Earlier studies that used data from low-income and middle-income countries were either carried out in single-country or in subnational contexts, including Chile,[19] Brazil,[20] Russia,[21] or pooled data with a larger number of HICs.[8,11,15] The largest study available before our study included data from 12 low-income and middle-income countries and 21 HICs.[11] Additionally, earlier studies only noted that socioeconomic gradients of HED differed with country income.

Our findings regarding the prevalence of current drinking in different socioeconomic status groups are in line with those from HICs, which found a higher prevalence of current drinking among participants with higher socioeconomic status.[10,11,13,14] Conversely, there was a higher prevalence of HED among drinkers with a lower socioeconomic status in U-MICs, a finding that is consistent with that from HICs.[11]

With increasing alcohol use[14] and high alcohol-attributable mortality in low-income and middle-income countries, alcohol use constitutes a major obstacle for development. Several targets of the Sustainable Development Goals (SDGs), such as good health and wellbeing (SDG 3), quality education (SDG 4), gender equality (SDG 5), and reduced inequalities (SDG 10), are unlikely to be reached given the rising levels of alcohol use in low-income and middle-income countries.[22] Highly cost-effective policies aiming at reducing alcohol consumption and the harm related to alcohol use were included in WHO's best-buys and the SAFER initiative.[23] The SAFER initiative includes policies such as increasing alcohol prices, bans or restrictions on alcohol advertising, and reduction of physical availability of alcohol.[23,24] Less than half of all low-income and middle-income countries have written national alcohol policies or have introduced taxes for alcoholic beverages.[3] Moreover, very few of them have adjusted taxes for inflation or had a ban on below-cost selling of alcoholic beverages. Additionally, only a few low-income and middle-income countries restricted alcohol advertisement on television and radio, and restrictions on internet and social media were mostly absent.[3]

The design of alcohol policies also needs to take into account the socioeconomic inequalities in alcohol use and alcohol-attributable harm.[5,6,25] There is some evidence that minimum unit pricing (setting a fixed minimum price for a unit of pure alcohol) might be effective in reducing HED and alcohol consumption among individuals or households with a low income.[26,27] Our study indicates that such policies might be particularly important as countries transition from low to middle and upper-middle income status to prevent increasing levels of HED among some of the most vulnerable groups. However, targeted interventions on individuals with low socioeconomic status and minimum unit pricing were absent in most of the low-income and middle-income countries.[3]

The findings in this study shed light on the variation of socioeconomic gradients of alcohol use across different country income groups in low-income and middle-income countries, which are essential for targeting the vulnerable groups to achieve high cost-effectiveness of policies and interventions. Specifically, the findings of this study have the following policy implications for low-income and middle-income countries. First, we found a high prevalence of HED among current drinkers in low and middle-income countries. This finding indicates that countries in with low prevalence of current drinking, such as the Middle East and north Africa as well as Azerbaijan, Kiribati, Tonga, and Tuvalu should focus on preventing the initiation of alcohol use. Possible interventions include introducing or increasing minimum legal age for alcohol purchase and consumption. Second, the prevalence of HED among current drinkers in LICs is extremely high. Phone ownership is high in LICs, and governments could raise the awareness of harms related to alcohol and encourage people to participate in screening and brief intervention programmes by sending SMS-based information to the population.[28,29] Additionally, unrecorded alcohol use is highly prevalent in LICs and L-MICs,[30] especially among lower socioeconomic status populations. Countries could aim to integrate unrecorded production into the legal market through legalisation and quality control of homemade alcohol to improve its regulation from a public health perspective in the long run.[31] Lastly, our finding of high prevalence of HED among individuals with low socioeconomic status in U-MICs highlights the importance of policies specifically targeting socially disadvantaged groups. For example,

introducing and increasing minimum unit pricing could disproportionally reduce alcohol use among individuals with low socio economic status. Other policies targeting individuals from low socioeconomic status groups, including reducing alcohol outlets and venues in disadvantaged areas,[25,32] could also be done in U-MICs.

There are several limitations to this study. First, the study included 55 countries out of a total of about 140 low-income and middle-income countries, and information on HED was not available in one out of 22 L-MICs and five out of 19 U-MICs, limiting the generalisability to all low-income and middle-income countries. Second, female drinkers with low education were less likely to report drinking patterns relative to participants with high education in LICs, and participants from less wealthy households were less likely to report information on HED compared with participants from the 20% wealthiest households in U-MICs. However, this reporting would not alter the socioeconomic gradient of HED found in these two country income groups, because there was a negative association between wealth and HED among female drinkers in LICs, as well as a positive association between educational attainment and HED among female drinkers in U-MICs. Third, 52 country surveys asked about alcohol use in the past 12 months; however, in three countries alcohol use was assessed for the past 30 days only. The prevalence of current drinking is likely to be underestimated in these three countries from L-MICs and U-MICs. However, this underestimation would not affect the finding that the prevalence of current drinking was high in L-MICs and U-MICs, or the positive association observed between socioeconomic status and the prevalence of current drinking. Finally, the data on household wealth were constructed from four different measures, depending on the data availability in each survey, which might have resulted in measurement error in this predictor due to reduced comparability across surveys.

Given the relatively high numbers of missing values for HED and the low coverage observed in alcohol surveys overall,[33] future research should focus on the development of novel, digital alcohol assessment tools that can account for cultural contexts, reduce the potential impact of stigma, and show high accuracy across all socioeconomic groups.[34]

Our findings provide new evidence to enable the design and development of targeted policies and actions to reduce harmful effects of alcohol consumption on health, wellbeing, human capital, and economic productivity, and to bolster efforts aimed at achieving the SDGs.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

## Acknowledgments

YX acknowledges funding by the Deutsche Forschungsgemeinschaft (German Research Foundation), project research training group 1723. PG was supported by the National Center for Advancing Translational Sciences of the National Institutes of Health under Award Number KL2TR003143. CP was supported by the National Institute on Alcohol Abuse and Alcoholism of the National Institutes of Health under Award Number R01AA028009. TB was supported by the Alexander von Humboldt Foundation through the Alexander von Humboldt Professor award, funded by the German Federal Ministry of Education and Research; the German Research Foundation;

the European Union (Horizon Europe and Horizon 2020), the Wellcome Trust; and the US National Institutes of National Health (R01-HD084233, P01-AG041710, R01-AI124389, R01-AI112339, and U2R TW012140-01).

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**Declaration of interests**

RA reports grants or contracts from Novo Nordisk, Roche, Novartis, and UICC; and payment or honoraria from Merck & Co, Novartis, and F Hoffmann-La Roche. TB is a board member of the Virchow Foundation for Global Health, Berlin; is a co-chair for Global Health Hub Germany; is a representative of the United Nations Western European and Others Group on the UNAIDS, Global Evaluation Expert Advisory Committee; is a standing review panel member in the National Institutes of Health section on Population and Public Health Approaches to HIV/AIDS; is a board member for the UNAIDS Unified Budget, Results and Accountability Framework; is a council member for the World Health Summit; is member of the Governing Council, Berlin, Germany; is a committee member on the German National Committee on the Future of Public Health Research and Education. All other authors declare no competing interests.

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## Research in context

### Evidence before this study

We systematically searched PubMed from database inception until April 16, 2020, for "alcohol" or "drinking", and "socio-economic" or "country income", and "low- and middle-income countries" or "developing countries". No language restrictions were applied to the search. Previous studies that have analysed the socioeconomic gradient of alcohol use were focused on high-income countries, including multicountry and single-country studies. Studies focusing on the relationship between individuals' alcohol intake and socioeconomic status in low-income and middle-income countries are predominantly from single countries or subnational contexts. Two multicountry studies have aimed to address these relationships using data from high-income, middle-income, and low-income countries, but the numbers of participants and low-income or middle-income countries included were low. These studies have noted that the socioeconomic gradient of alcohol use differed with country-level income, but no previous study has systematically analysed whether and how the socioeconomic gradient of alcohol use differed across country income groups and individuals' socioeconomic status within a large sample of low-income and middle-income countries.

### Added value of this study

This is the largest multicountry study using nationally representative data from low-income and middle-income countries specifically to analyse the role of country income group, individual-level (education) and household-level socioeconomic status (wealth), as well as their interplay in explaining differences in alcohol use, including current drinking, heavy episodic drinking (HED), heavy drinking, and daily drinking. We provide the first evaluation of the socioeconomic gradient of alcohol use in low-income and middle-income countries overall and within each country income group. In general, we found that the prevalence of drinking increased with country income group and with individuals' socioeconomic status within each country income group. However, there were clear differences between sexes, and in upper-middle income countries (U-MICs) people who are socioeconomically disadvantaged were more likely to engage in HED. Among males, the prevalence of current drinking and HED among current drinkers was found to be highest in lower-middle income countries (L-MICs). Among females, the prevalence of current drinking was found to be highest in U-MICs and the prevalence of HED among current drinkers was highest in low-income countries (LICs). This evidence is of vital importance for targeting policies and interventions to the population groups with high alcohol use in low-income and middle-income settings to effectively reduce alcohol use and alleviate disease burden, where there is little previous evidence regarding socioeconomic gradient of alcohol use in low-income and middle-income countries.

### Implications of all the available evidence

The available evidence suggests that there are strong associations between alcohol use and country income groupings and that, within those country income groupings, usage varies between individuals' socioeconomic status and sex. Policies need to be directed towards both moderating and preventing alcohol use that is detrimental to health. We

have shown that as the country income level increases, so does alcohol use, suggesting that policies need to be implemented in LICs that are transitioning to higher income status to prevent the associated increase in alcohol intake. Moreover, there are clear inequalities in heavy alcohol usage requiring progressive policies such as minimum unit pricing, to reduce use in socially disadvantaged individuals in U-MICs. In LICs, a clear gradient in the prevalence of current drinking and HED increasing from low to high socioeconomic status was observed, indicating that for the poorer segments of society alcohol is still largely not affordable. However, heavy alcohol users with low socioeconomic status in resource-poor settings constitute a particularly vulnerable population that might require particular attention and directed interventions. Our findings provide new evidence to enable the design and development of targeted policies to reduce the harmful effects of alcohol use in low-income and middle-income countries.

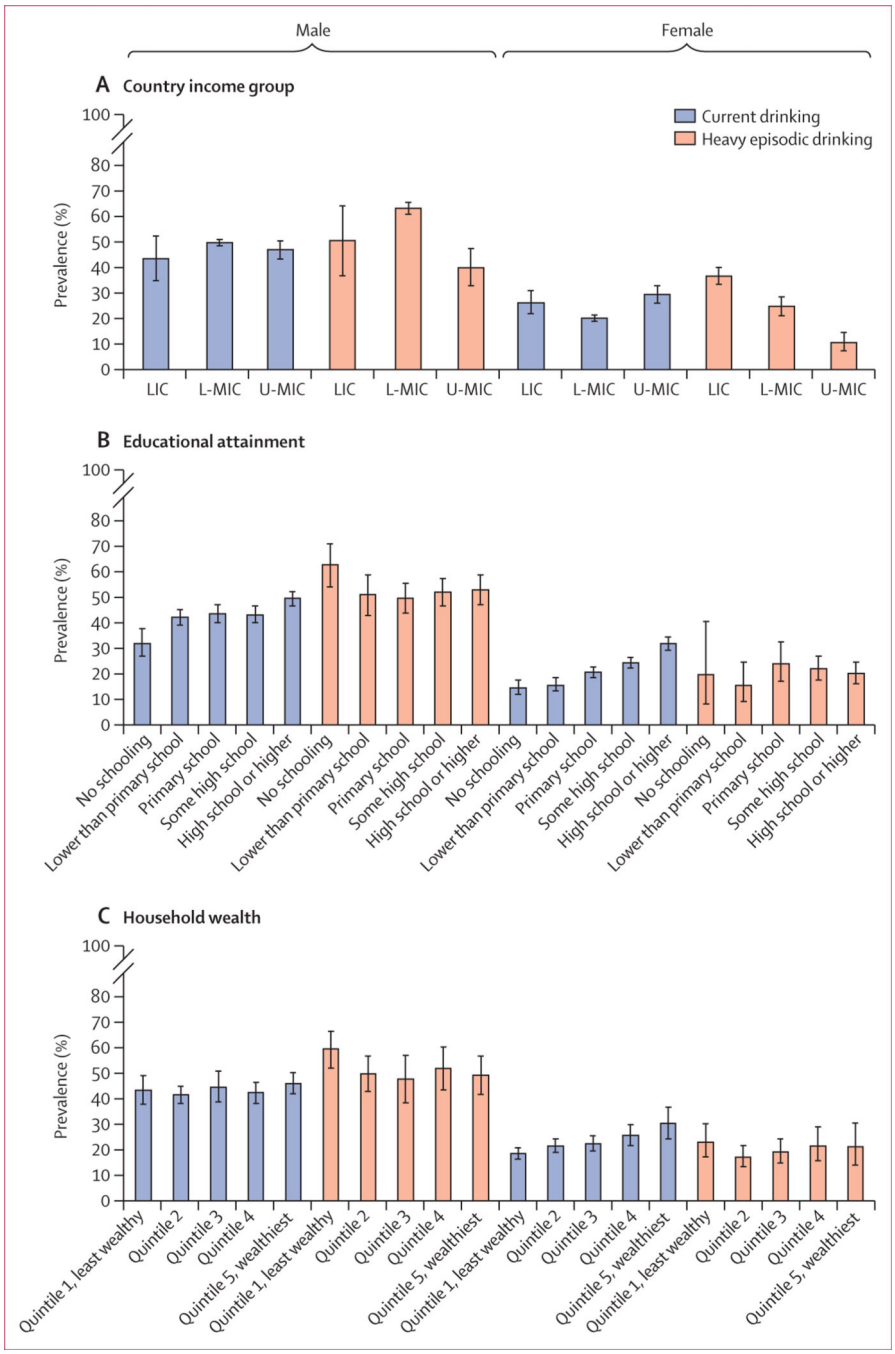


**Figure 1:**

Population-weighted prevalence of alcohol use by country income groups (A), level of education (B), and household wealth quintile (C), and sex

LIC=low-income country. L-MIC=lower-middle-income country. U-MIC=upper-middle-income country.

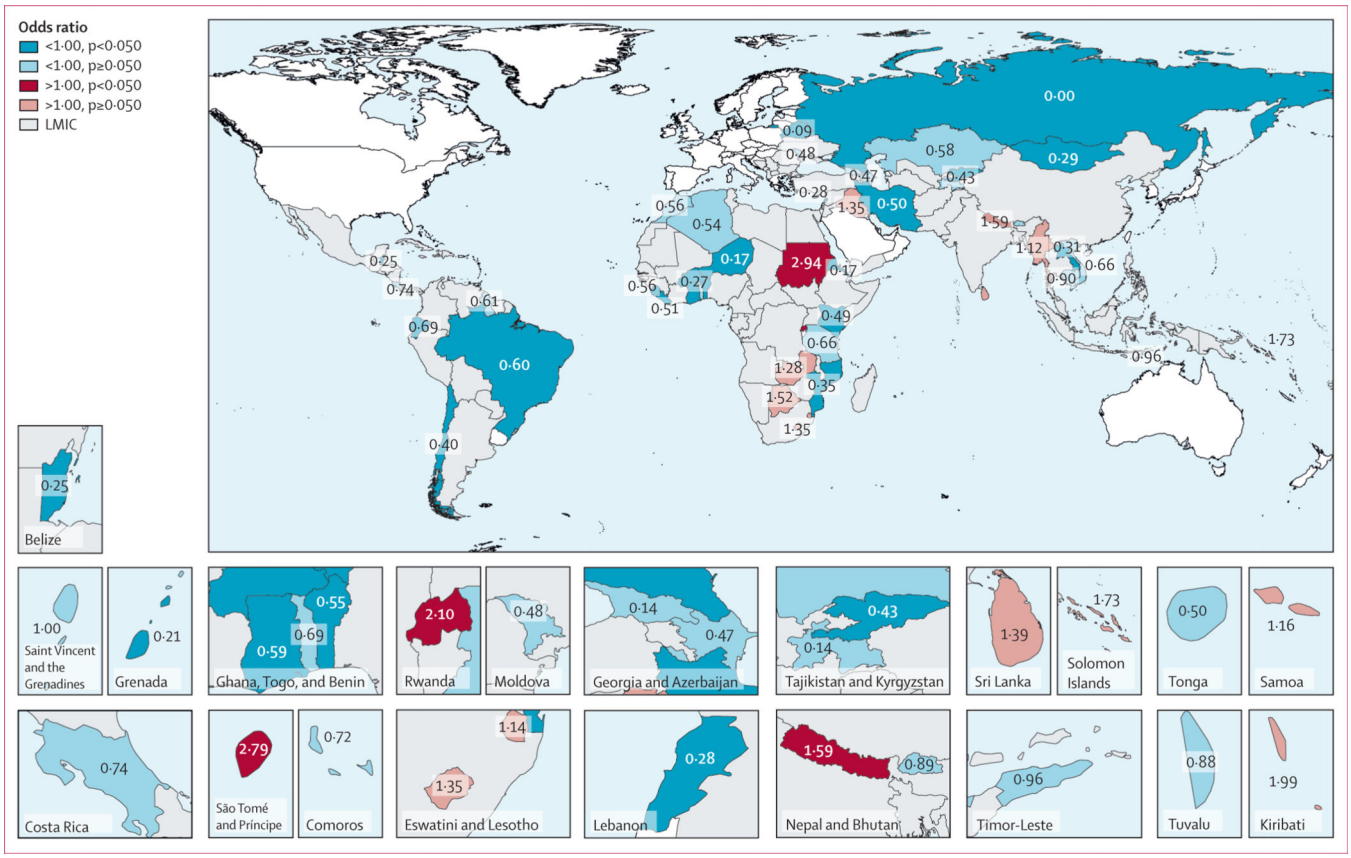


**Figure 2:**

Country-level odds ratio of current drinking among participants with no formal schooling relative to participants with high school or higher schooling

LMIC=low-income and middle-income countries.

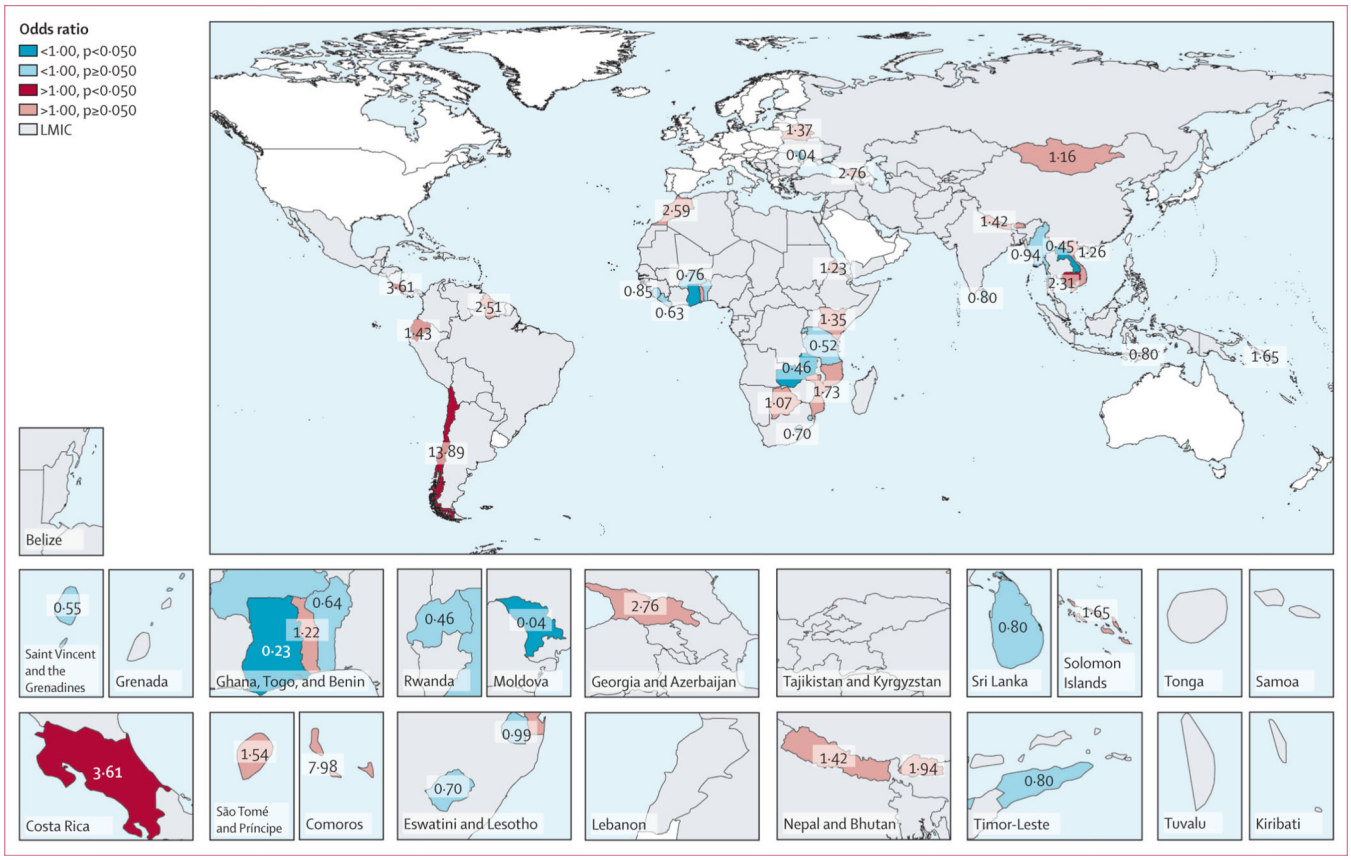


**Figure 3:**

Country-level odds ratio of heavy episodic drinking among individuals with no formal schooling relative to participants with high school or higher schooling

LMIC=low-income and middle-income countries.

**Table 1:**

Summary of nationally representative population-based surveys conducted in 55 low-income and middle-income countries between 2005 and 2017 and country-level characteristics

| | Year | Survey type | Survey overall response rate, % | Sample size | Mean age, years (95% CI)* | Female, % (95% CI)* | Current drinking information† | Prevalence of current drinking, % (95% CI)* | Prevalence of heavy episodic drinking, % (95% CI)*‡ | Prevalence of heavy drinking, % (95% CI)*‡ | Prevalence of daily drinking, % (95% CI)*‡ | WHO regional office classification |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Overall** | | | | | | | | | | | | |
| Overall total | NA | NA | NA | 336 287 | 40·8 (40·4–41·1) | 51·0% (49·9–52·1) | NA | 36·6% (34·6–38·5) | 46·0% (42·6–49·4) | 9·4% (8·4–10·6) | 7·6% (6·8–8·5) | NA |
| **Low-income countries** | | | | | | | | | | | | |
| Benin | 2015 | STEPS | 98·6% | 4883 | 34·6 (34·0–35·2) | 47·6%% (45·4–49·8) | Both | 37·3% (34·0–40·7) | 22·7% (19·1–26·7) | 3·1% (2·1–4·6) | 14·8% (11·3–19·0) | AFR |
| Burkina Faso | 2013 | STEPS | 97·8% | 4551 | 39·2 (38·8–39·7) | 52·8% (50·7–54·9) | Both | 31·3% (28·3–34·4) | 31·0% (26·8–35·6) | 5·5% (3·6–8·2) | 21·5% (17·3–26·3) | AFR |
| Cambodia | 2010 | STEPS | 96·3% | 5346 | 40·4 (40·0–40·8) | 50·6% (49·1–52·1) | Both | 64·0% (61·9–66·0) | 47·5% (44·6–50·4) | 10·8% (9·3–12·5) | 13·4% (11·9–15·2) | WPR |
| Comoros | 2011 | STEPS | 96·5% | 5166 | 40·7 (40·2–41·2) | 69·6% (67·0–72·1) | Both | 1·0% (0·7–1·4) | 50·0% (27·7–72·3) | 10·0% (3·4–25·8) | 20·8% (10·2–37·9) | AFR |
| Eritrea | 2010 | STEPS | 97·0% | 6032 | 43·4 (43·0–43·9) | 81·0% (79·6–82·3) | Both | 43·7% (39·8–47·8) | 9·5% (9·1–11·1) | 0·6% (0·3–1·4) | 0·7% (0·4–1·0) | AFR |
| Liberia | 2011 | STEPS | 87·1% | 2408 | 38·3 (37·7–39·0) | 55·8% (53·1–58·5) | Both | 29·0% (25·9–32·3) | 27·9% (22·9–33·5) | 3·9% (2·4–6·3) | 13·7% (10·6–17·6) | AFR |
| Mozambique | 2005 | STEPS | 98·4% | 3191 | 39·8 (39·0–40·5) | 55·3% (52·9–57·6) | Past 12 months | 42·9% (36·2–49·8) | 74·9% (69·0–80·1) | 1·6% (0·9–2·9) | ·· | AFR |
| Nepal | 2013 | STEPS | 98·6% | 4108 | 35·3 (34·5–36·0) | 50·4% (47·8–53·0) | Both | 22·2% (19·8–24·9) | 54·8% (48·7–60·7) | 17·2% (13·1–22·3) | 17·8% (14·3–22·1) | SEAR |
| Niger | 2007 | STEPS | 91·3% | 2662 | 37·3 | 45·9 | Both | 0·6§ | 0·0§ | 0·0§ | 0·0§ | AFR |
| Rwanda | 2012 | STEPS | 99·0% | 6999 | 31·6 (31·1–32·1) | 51·3% (49·8–52·8) | Both | 47·2% (44·8–49·6) | 14·8% (12·1–16·7) | 2·1% (1·5–3·1) | 8·4% (7·4–9·6) | AFR |

| | Year | Survey type | Survey overall response rate, % | Sample size | Mean age, years (95% CI)* | Female, % (95% CI)* | Current drinking information† | Prevalence of current drinking, % (95% CI)* | Prevalence of heavy episodic drinking, % (95% CI)*‡ | Prevalence of heavy drinking, % (95% CI)*‡ | Prevalence of daily drinking, % (95% CI)*‡ | WHO regional office classification |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sierra Leone | 2009 | STEPS | 90·0% | 4693 | 39·8 (39·0–40·6) | 50·0% (46·6–53·4) | Both | 22·5% (18·5–27·2) | 28·4% (22·9–34·6) | 9·7% (6·3–14·8) | 28·6% (23·9–33·9) | AFR |
| Tanzania (excluding Zanzibar) | 2012 | STEPS | 94·7% | 5472 | 38·6 (39·0–39·2) | 49·2% (46·7–51·7) | Both | 38·2% (35·5–40·8) | 70·3% (64·5–75·5) | 20·3% (17·4–23·6) | 11·4% (8·8–14·7) | AFR |
| Togo | 2010 | STEPS | 91·0% | 4164 | 32·6 (32·1–33·2) | 51·2% (48·8–53·5) | Both | 63·2% (60·5–65·8) | 27·3% (24·4–30·5) | 4·5% (3·4–5·8) | 8·9% (7·5–10·5) | AFR |
| Zanzibar | 2011 | STEPS | 99·6% | 2388 | 38·8 (38·2–39·4) | 50·5% (47·5–53·5) | Both | 3·4% (2·0–5·7) | 56·0% (35·4–74·6) | 7·0% (2·0–21·2) | 5·5% (2·1–13·6) | AFR |
| **Lower-middle-income countries** | | | | | | | | | | | | |
| Bhutan | 2014 | STEPS | 96·9% | 2752 | 37·6 (37·0–38·3) | 42·9% (39·6–46·3) | Both | 50·3% (47·2–53·3) | 61·6% (56·6–66·3) | 18·5% (14·4–23·3) | 17·2% (13·7–21·3) | SEAR |
| Georgia | 2016 | STEPS | 75·7% | 4165 | 42·8 (42·2–43·4) | 51·6% (49·4–53·7) | Both | 69·6% (67·4–71·7) | 53·7% (48·8–58·5) | 4·1% (3·0–5·7) | 1·9% (1·2–3·2) | EUR |
| Ghana | 2007–2008 | SAGE | 94·6% | 5090 | 44·3 (43·7–45·0) | 49·2% (45·9–52·6) | Past 30 days | 42·4% (38·9–46·0) | 8·6% (6·2–11·8) | 3·9% (2·3–6·6) | 0·0 | AFR |
| Kenya | 2015 | STEPS | 95·0% | 4336 | 34·9 (34·0–35·7) | 49·6% (46·9–52·2) | Both | 25·6% (22·7–28·8) | 73·2% (67·3–78·4) | 10·0% (6·9–14·3) | 9·5% (6·8–13·2) | AFR |
| Kiribati | 2015 | STEPS | 55·0% | 2118 | 38·6 (37·0–40·1) | 53·8% (50·5–57·1) | Both | 22·6% (14·7–33·3) | 89·2% (80·7–94·2) | 26·8% (21·2–33·2) | 3·0% (0·9–10·0) | WPR |
| Kyrgyzstan | 2013 | STEPS | 100·0% | 2549 | 40·8 (40·1–41·5) | 48·1% (45·1–51·2) | Both | 44·0% (38·6–49·5) | 43·8% (38·9–48·8) | 4·0% (2·6–6·1) | 1·8% (0·8–3·9) | EUR |
| Laos | 2013 | STEPS | 99·2% | 2484 | 38·2 (36·9–39·5) | 57·1% (52·5–61·6) | Both | 73·2% (68·8–77·2) | 35·6% (30·3–41·3) | 2·3% (1·6–3·3) | 1·0% (0·6–1·7) | WPR |
| Lesotho | 2012 | STEPS | 80·0% | 2266 | 38·0 (37·3–38·7) | 49·4% (46·0–52·7) | Both | 41·3% (38·5–44·1) | 53·7% (48·2–59·0) | 3·5% (1·9–6·5) | 5·1% (3·1–8·1) | AFR |
| Moldova | 2013 | STEPS | 83·5% | 4722 | 39·5 (38·8–40·2) | 47·3% (45·3–49·3) | Both | 79·2% (77·0–81·2) | 31·5% (28·6–34·4) | 3·0% (2·6–3·9) | 6·2% (5·1–7·4) | EUR |

| | Year | Survey type | Survey overall response rate, % | Sample size | Mean age, years (95% CI)* | Female, % (95% CI)* | Current drinking information† | Prevalence of current drinking, % (95% CI)* | Prevalence of heavy episodic drinking, % (95% CI)*‡ | Prevalence of heavy drinking, % (95% CI)*‡ | Prevalence of daily drinking, % (95% CI)*‡ | WHO regional office classification |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mongolia | 2013 | STEPS | 97·4% | 5901 | 38·7 (38·4–39·1) | 49·7% (47·8–51·6) | Both | 64·9% (60·6–68·9) | 65·6% (62·4–68·6) | 7·9% (5·4–11·3) | 0·2% (0·1–0·5) | WPR |
| Morocco | 2017 | STEPS | 89·0% | 5307 | 41·9 (41·4–42·4) | 49·9% (48·3–51·4) | Both | 2·7% (2·1–3·4) | 81·4% (67·3–90·3) | 18·8% (10·2–31·9) | 5·0% (2·0–11·7) | EMR |
| Myanmar | 2014 | STEPS | 94.0% | 8188 | 41.8 (41.0–42.6) | 49.1% (46.8–51.5) | Both | 27.9% (24.2–31.8) | 54.0% (49.2–58.8) | 21.5% (16.3–27.9) | 24.5% (20.1–29.4) | SEAR |
| Samoa | 2013 | STEPS | 64.0% | 1720 | 36.8 (35.1–38.5) | 46.4% (42.8–50.0) | Both | 18.4% (15.3–21.8) | 61.1% (53.0–68.7) | 6.0% (1.9–17.3) | 8.2% (3.6–17.8) | WPR |
| São Tomé and Príncipe | 2008 | STEPS | 95.0% | 2373 | 39.7 (38.2–41.1) | 51.1% (48.6–53.7) | Both | 86.9% (83.7–89.6) | 20.2% (14.5–27.2) | 6.8% (4.8–9.5) | 26.5% (22.0–31.5) | AFR |
| Solomon Islands | 2015 | STEPS | 58.4% | 2490 | 36.9 (35.9–37.8) | 52.7% (49.9–55.4) | Both | 30.4% (27.4–33.5) | 87.7% (83.0–91.2) | 16.3% (10.7–24.2) | 0.3% (0.1–0.9) | WPR |
| Sri Lanka | 2014 | STEPS | 72.0% | 5108 | 39.2 (38.6–39.8) | 48.4% (46.7–50.2) | Both | 26.7% (24.9–28.6) | 48.4% (43.7–53.1) | 5.1% (3.6–7.3) | 5.5% (4 2–7.2) | SEAR |
| Sudan | 2016 | STEPS | 88.0% | 7295 | 34.3 (33.8–34.8) | 43.3% (41.1–45.3) | Past 12 months | 2.7% (2.1–3.4) | .. | .. | .. | EMR |
| Eswatini | 2014 | STEPS | 81.8% | 3189 | 31.6 (31.0–32.2) | 53.0% (50.0–55.9) | Both | 18.2% (16.0–20.6) | 60.2% (53.1–67.0) | 6.3% (3.9–10.1) | 4.7% (3.0–7.3) | AFR |
| Tajikistan | 2016 | STEPS | 94.0% | 2668 | 32.0 (31.4–32.6) | 46.5% (43.2–49.9) | Both | 6.7% (5.3–8.5) | 51.9% (40.6–63.1) | 5.7% (2.1–14.3) | 1.0% (0.2–4.1) | EUR |
| Timor Leste | 2014 | STEPS | 96.3% | 2547 | 41.2 (40.4–42.0) | 57.6% (55.1–60.1) | Both | 27.4% (25.0–29.9) | 40.1% (34.8–45.6) | 6.3% (4.4–9.1) | 0.7% (0.3–1.8) | SEAR |
| Viet Nam | 2015 | STEPS | 79.8% | 3715 | 39.1 (38.4–39.7) | 49.8% (47.7–51.9) | Both | 66.9% (64.9–68.8) | 64.9% (61.8–67.9) | 10.8% (0.1–12.8) | 25.7% (23.4–28.1) | WPR |
| Zambia | 2017 | STEPS | 74.3% | 4125 | 33.7 (33.2–34.2) | 49.2% (47.5–51.0) | Both | 27.4% (25.5–29.4) | 56.8% (52.6–60.9) | 12.3% (9.4–16.0) | 9.6% (7.4–12.2) | AFR |
| **Upper-middle-income countries** | | | | | | | | | | | | |

| | Year | Survey type | Survey overall response rate, % | Sample size | Mean age, years (95% CI)* | Female, % (95% CI)* | Current drinking information† | Prevalence of current drinking, % (95% CI)* | Prevalence of heavy episodic drinking, % (95% CI)*‡ | Prevalence of heavy drinking, % (95% CI)*‡ | Prevalence of daily drinking, % (95% CI)*‡ | WHO regional office classification |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Algeria | 2016 | STEPS | 93 2% | 6791 | 38.2 (37.8–38.6) | 48.4% (47.0–49.7) | Both | 3.4% (2.8–4.2) | 60.0% (50.0–69.3) | 14.8% (9.5–22.3) | 7.5% (4.7–11.7) | AFR |
| Azerbaijan | 2017 | STEPS | 97.3% | 2778 | 39.6 (38.9–40.3) | 50.4% (48.0–52.9) | Both | 21.5% (19.0–24.1) | 35.0% (28.9–41.7) | 2.1% (0.9–5.0) | 1.6% (0.8–3.1) | EUR |
| Belarus | 2016 | STEPS | 87.1% | 4986 | 43.0 (42.3–43.7) | 52.2% (50.4–54.0) | Both | 82.2% (80.0–84.4) | 50.3% (47.0–53.6) | 1.8% (1.3–2.6) | 0.7% (0.4–1.0) | EUR |
| Belize | 2005–2006 | CAMDI | 66.8% | 2427 | 39.3 (38.9–39.7) | 49.7% (49.4–49.9) | Past 12 months | 34.6% (28.5–41.3) | .. | .. | 3.6% (1.8–7.2) | AMR |
| Botswana | 2014 | STEPS | 64.0% | 3971 | 33.0 (32.4–33.7) | 48.2% (45.7–50.6) | Both | 34.7% (32.2–37.3) | 72.1% (66.6–77.0) | 12.7% (9.6–16.6) | 10.6% (7.2–15.4) | AFR |
| Brazil | 2013 | PNS | 86.0% | 59402 | 43.1 (42.8–43.4) | 52.4% (51.7–53.2) | Past 12 months | 40.7% (39.8–41.5) | .. | .. | 0.0 | AMR |
| Chile | 2009–2010 | NHS | 85.0% | 4878 | 41.4 (40.4–42.4) | 51.2% (48.5–53.9) | Both | 75.2% (72.4–77.8) | 22.2% (17.0–28.3) | 18.5% (13.8–24.4) | | AMR |
| Costa Rica | 2010 | STEPS | 87.8% | 3627 | 42.9 (41.8–44.0) | 49.2% (44.2–54.3) | Past 12 months | 38.1% (34.6–41.7) | 36.0% (28.3–44.5) | .. | 0.6% (0.3–1.2) | AMR |
| Ecuador | 2012 | ENSANUT | 81.5% | 36280 | 31.9 (31.6–32.3) | 58.0% (57.4–58.5) | Past 30 days | 33.3% (32.6–34.0) | 38.3% (26.9–39.6) | 15.3% (14.4–16.3) | 0.1% (0.0–0.1) | AMR |
| Grenada | 2009–2011 | STEPS | 85.0% | 1116 | 41.2§ | 48·7§ | Both | 55.0%§ | 35.1%§ | 7.6%§ | 9.3%§ | AMR |
| Guyana | 2016 | STEPS | 66.7% | 2645 | 37.5 (36.9–38.1) | 48.0% (45.4–50.6) | Both | 57.3% (54.7–59.9) | 53.9% (48.5–59.3) | 3.6% (2.4–5.1) | 2.6% (1.8–3.7) | AMR |
| Iran | 2016 | STEPS | 98.4% | 29 528 | 44.6 (44.3–44.8) | 51.5% (51.1–51.9) | Both | 4.2% (3.9–4.5) | .. | .. | 1.9% (12–2.9) | EMR |
| Iraq | 2015 | STEPS | 93.0% | 3934 | 36.5 (35.8–37.2) | 46.5% (44.4–48.6) | Both | 0.9%.. (0.5–1.6) | .. | .. | 16.2% (5.0–41.2) | EMR |

| | Year | Survey type | Survey overall response rate, % | Sample size | Mean age, years (95% CI)* | Female, % (95% CI)* | Current drinking information† | Prevalence of current drinking, % (95% CI)* | Prevalence of heavy episodic drinking, % (95% CI)*‡ | Prevalence of heavy drinking, % (95% CI)*‡ | Prevalence of daily drinking, % (95% CI)*‡ | WHO regional office classification |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kazakhstan | 2012 | HHS | 93.0% | 12 195 | 44.5 (44.2–44.9) | 57.0% (56.2–57.8) | Both | 20.7% (19.8–21.6) | .. | .. | .. | EUR |
| Lebanon | 2017 | STEPS | 65.9% | 1886 | 40.9 (39.9–41.9) | 51.3% (46.5–56.0) | Both | 13.8% (10.6–17.7) | 31.5% (19.5–46.8) | 8.5% (2.5–25.4) | 6.0% (2.4–14.4) | EMR |
| Russia | 2007–2008 | SAGE | 71.8% | 4310 | 47.3 (44.7–49.8) | 53.9% (45.8–61.7) | Past 30 days | 68.6% (60.6–75.6) | 19.0% (12.4–28.0) | 1.5% (0.4–5.1) | 0.0 | EUR |
| Saint Vincent and the Grenadines | 2013 | STEPS | 67·8% | 3436 | 35·5 (34·7–36·3) | 49·9% (47·2–52·5) | Both | 65·5% (59·5–71·0) | 35·0% (30·2–40·2) | 2·0% (1·3–2·9) | 4·0% (3·2–4·9) | AMR |
| Tonga | 2017 | STEPS | 85·7% | 3782 | 40·6 (40·0–41·2) | 63·5% (60·5–66·4) | Both | 21·9% (18·8–25·5) | 8·8% (7·7–10·0) | 6·1% (2·4–10·9) | 3·7% (1·4–9·7) | WPR |
| Tuvalu | 2015 | STEPS | 76·0% | 1144 | 37·7 (34·5–40·9) | 51·7% (48·9–54·5) | Both | 26·1% (18·9–34·8) | 80·4% (68·5–88·5) | 24·4% (13·0–40·9) | 4·0% (2·3–6·8) | WPR |

Except for the missing outcome variable, all values were calculated in those with outcome data (ie, no missing current drinking, heavy episodic drinking, heavy drinking, and daily drinking information). The response rate includes both the household and the individual response rate. AFR=African Region, AMR=American Region. CAMDI=Central America Diabetes Initiatives. ENSANUT=Nacional de Salud y Nutritión in Ecuador. EUR=Europe. HHS=Household Survey Health Module. NA=not applicable. NHS=National Health Survey. PNS=Pesquisa Nacional de Saúde. SAGE=Study on global ageing and adult health. SEAR=South-East Asia Region. STEPS=Stepwise Approach to Surveillance. WPR=West Pacific Region.

*Data weighted with sampling weights.

†Both indicates information from the past 12 months and the past 30 days.

‡Missing if not current drinker.

§Stata unable to estimate the 95% CI.

**Table 2:**

Multivariable logistic regression analysis showing associations between socioeconomic status and current drinking, and heavy episodic drinking among current drinkers stratified by country income group and sex

| | Low-income countries | | Lower-middle-income countries | | Upper-middle-income countries | |
|---|---|---|---|---|---|---|
| | **Male** | **Female** | **Male** | **Female** | **Male** | **Female** |
| **Outcome variable: current drinking** | | | | | | |
| Educational attainment | | | | | | |
| No formal schooling | 0·72 (0·47–1·12) | 0·56 (0·39–0·80) | 0·84 (0·54–1·29) | 0·63 (0·54–0·73) | 0·43 (0·26–0·68) | 0·35 (0·17–0·73) |
| Lower than than primary school | 0·94 (0·59–1·50) | 0·70 (0·51–0·96) | 0·97 (0·74–1·28) | 0·47 (0·32–0·70) | 0·85 (0·68–1·05) | 0·41 (0·33–0·52) |
| Primary school completed | 0·90 (0·56–1·45) | 0·74 (0·59–0·93) | 0·78 (0·63–0·98) | 0·55 (0·41–0·74) | 0·93 (0·87–0·99) | 0·60 (0·52–0·69) |
| Some high school | 0·86 (0·57–1·29) | 0·80 (0·69–0·93) | 0·95 (0·75–1·19) | 0·68 (0·58–0·79) | 0·84 (0·65–1·08) | 0·70 (0·61–0·81) |
| High School or higher | Ref | Ref | Ref | Ref | Ref | Ref |
| Household wealth quintile | | | | | | |
| 1, least wealthy | 0·98 (0·88–1·11) | 0·66 (0·55–0·79) | 0·99 (0·79–1·24) | 0·70 (0·52–0·98) | 0·71 (0·55–0·92) | 0·45 (0·43–0·48) |
| 2 | 0·93 (0·75–1·15) | 0·75 (0·60–0·93) | 0·88 (0·66–1·17) | 0·53 (0·39–0·72) | 0·74 (0·63–0·88) | 0·62 (0·55–0·70) |
| 3 | 1·18 (0·97–1·44) | 0·84 (0·69–1·03) | 0·94 (0·79–1·12) | 0·66 (0·51–0·86) | 0·82 (0·66–1·03) | 0·62 (0·59–0·65) |
| 4 | 1·05 (0·75–1·47) | 0·89 (0·74–1·08) | 0·86 (0·65–1·14) | 0·76 (0·56–1·02) | 0·70 (0·58–0·84) | 0·69 (0·54–0·88) |
| 5, wealthiest | Ref | Ref | Ref | Ref | Ref | Ref |
| **Outcome variable: heavy episodic drinking** | | | | | | |
| Educational attainment | | | | | | |
| No formal schooling | 0·97 (0·70–1·34) | 1·17 (0·59–2·32) | 0·95 (0·64–1·40) | 1·24 (0·67–2·31) | 4·35 (0·88–21·45) | 2·71 (1·58–4·64) |
| Lower than than primary school | 0·86 (0·58–1·26) | 1·08 (0·57–2·07) | 0·96 (0·72–1·28) | 0·76 (0·42–1·40) | 1·25 (0·77–2·01) | 0·75 (0·18–3·05) |
| Primary school completed | 0·81 (0·64–1·02) | 1·28 (0·68–2·41) | 0·66 (0·50–0·86) | 0·84 (0·37–1·93) | 1·42 (0·69–2·93) | 1·33 (1·06–1·67) |
| Some high school | 0·94 (0·79–1·12) | 1·68 (1·19–2·38) | 0·83 (0·67–1·04) | 0·69 (0·48–0·99) | 1·04 (0·51–2·13) | 1·43 (0·93–2·18) |
| High School or higher | Ref | Ref | Ref | Ref | Ref | Ref |
| Household wealth quintile | | | | | | |
| 1, least wealthy | 0·74 (0·55–1·00) | 0·60 (0·50–0·74) | 0·65 (0·23–1·84) | 0·64 (0·37–1·14) | 3·21 (1·64–6·29) | 2·33 (1·35–4·01) |
| 2 | 0·85 (0·69–1·04) | 0·60 (0·51–0·72) | 0·87 (0·42–1·79) | 0·47 (0·27–0·84) | 1·36 (0·60–3·09) | 1·35 (1·18–1·55) |
| 3 | 0·72 (0·50–1·04) | 0·83 (0·69–0·99) | 0·75 (0·50–1·12) | 0·79 (0·43–1·46) | 1·22 (0·27–5·63) | 0·99 (0·81–1·20) |
| 4 | 0·90 (0·55–1·46) | 1·08 (0·92–1·26) | 1·16 (0·81–1·66) | 0·80 (0·56–1·15) | 1·05 (0·38–2·89) | 1·80 (1·25–2·59) |
| 5, wealthiest | Ref | Ref | Ref | Ref | Ref | Ref |

Data are odds ratio (95% CI). Each regression included one socioeconomic status indicator, and controlled for the following variables: age, age squared, and survey year using continuous variables, as well as country using fixed effects.