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The socioeconomic profile of alcohol use in Europe: Findings from a cross-sectional survey of 33 European countries

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Abstract

Background: Alcohol's detrimental health effects do not affect everyone equally, but accumulate in people with low socioeconomic status (SES). This has been posited as partly due to differences in consumption patterns, and previous studies have provided evidence of such SES-linked differences, with low-SES individuals being more likely to abstain or drink heavily than their high-SES counterparts. Using data from the 2021 Standard European Alcohol Survey, we explore gender- and SES-specific alcohol consumption patterns, as well as COVID-19-related changes in alcohol consumption, in the largest and most recent pan-European alcohol study.

Methods: Cross-sectional population-based survey data from 54,354 adults in 33 European countries, were analysed. Five alcohol indicators were of interest: prevalence of past-year alcohol use; and—among past-year alcohol users only—prevalence of monthly/more frequent risky single-occasion drinking (monthly+ RSOD); prevalence of high-risk alcohol use (40+/60+ grams pure alcohol daily for women/men); mean daily grams of pure alcohol consumed; and self-reported consumption changes during COVID-19. Alcohol indicators were weighted and stratified by gender and SES (educational attainment), and analysed using logistic and linear regression models with location-specific random intercepts.

Results: Across jurisdictions, we observed distinct gender-specific socioeconomic profiles of alcohol use. While high-SES men and women were generally more likely to report past-year alcohol use compared to those with low/mid-SES (odds ratio [*OR*]: 1.37, 95% *CI* [1.29, 1.46]), monthly+ RSOD (*OR*: 0.91, 95% *CI* [0.86, 0.96]) and high-risk drinking (*OR*: 0.83, 95% *CI* [0.77, 0.91]) were less prevalent among currently drinking high-SES men. No such SES differences were observed among women (all $p > .5$), however, mean daily drinking levels were on average 13% higher (95% *CI* [0.09, 0.18]) in high-SES than low/mid-SES female alcohol users. High-SES women (but not men) were more likely to have either increased or decreased their drinking during COVID-19 compared to low/mid-SES counterparts.

Conclusions: High consumption levels and distinct socioeconomic profiles among men and women highlight the need for nuanced, effective alcohol policies to reduce European health inequalities.

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Declaration of interest: Unrelated to the present work, JM, CK and FB have worked as consultants for public health agencies, JM has received honoraria by public health agencies, and HLP has received financial support from Lundbeck to attend meetings; all other authors declare no conflict of interest.

Keywords: alcohol, drinking, socioeconomic status, education, gender, COVID-19

Introduction

Alcohol use is a major risk factor for disease and mortality, both globally and in Europe in particular (Shield et al., 2020), with Europe being the region with the highest per capita consumption (World Health Organization [WHO], 2022). Importantly, alcohol's detrimental health effects are not equally distributed across socioeconomic groups, but fall disproportionately on individuals with lower socioeconomic status (SES; Probst et al., 2021). These inequalities in alcohol-attributable mortality can be partly, but not fully, explained by patterns and prevalence of alcohol use (Probst et al., 2020). For example, socioeconomic health inequalities were found to be considerably more pronounced in countries where alcohol use is more prevalent, such as Eastern European countries (Pechholdová & Jasilionis, 2020). To better understand and address socioeconomic inequalities in alcohol-attributable harms, it is important to study alcohol consumption patterns across different socioeconomic groups. Moreover, as both alcohol consumption patterns and socioeconomic differences in alcohol-attributable mortality differ by gender, with riskier consumption and more pronounced inequalities observed in men (Probst et al., 2015), a gender-specific perspective needs to be taken.

Population surveys from high-income countries suggest that individuals with low SES are more likely to either abstain from drinking alcohol, or to engage in heavy/high-risk drinking, compared to those with high SES (Beard et al., 2019; Calling et al., 2019; Garnett et al., 2022; Huckle et al., 2010). However, these differential consumption patterns appear to differ between women and men. For instance, higher consumption levels have been repeatedly reported by women with high SES compared to their female counterparts with low SES (Wood & Bellis, 2017). This is noteworthy, given that high alcohol consumption levels contribute to the socioeconomic gap in male life expectancy, with high-SES men living longer, but not in women; given that risky alcohol consumption is more prevalent among women with higher SES (Mackenbach et al., 2019).

Research on socioeconomic differences in alcohol consumption patterns among women and men has become even more important in the last three years as the COVID-19 pandemic has placed a unique strain on people, with those with low SES, and especially women, suffering the most from the adverse economic consequences of the global pandemic (Bambra et al., 2020; Flor et al., 2022; Patel et al., 2020). Increased levels of distress, as well as changes in social drinking opportunities and the availability of alcoholic beverages, are considered to be drivers of the observed changes in alcohol use (Gonçalves et al., 2020; Rehm et al., 2020); that is, a decrease in population-level consumption and increases in drinking among high-risk alcohol users (Acuff et al., 2021; Anderson et al., 2022; Kilian et al., 2022).

Using comparable alcohol consumption data collected as part of the EU-funded contract DEEP SEAS ('Developing and Extending Evidence and Practice from the Standardized European Alcohol Survey'), we studied socioeconomic differences in alcohol consumption patterns among women and men in a large European sample. As our survey study took place in 2021, we provide a European-wide assessment of socioeconomic differences in self-reported alcohol use in European women and men during the COVID-19 pandemic period and further analysed whether self-reported changes in alcohol consumption during the COVID-19 pandemic were conditional on gender and SES.

Methods

To describe alcohol consumption patterns by gender and SES in Europe, we have analysed cross-sectional survey data collected as part of the DEEP SEAS project. Alcohol surveys remain the primary source for studying consumption patterns, and comparable alcohol surveys across European Union (EU) Member States, such as the DEEP SEAS survey, serve as an important resource for alcohol surveillance. The DEEP SEAS survey is a pan-European survey that was deployed in 33 countries, including all EU Member States and affiliated countries, as well as the Spanish Autonomous Community of Catalonia (henceforth: Spain-Catalonia) from January to March 2021. The adult sample (18–64 years) was drawn from existing panels of the market research company Kantar (Kantar Group and Affiliates, 2022), matching the distribution of the location's target population by gender, age, and subnational regions (i.e., quota sampling). The survey was administered via computer-assisted web interviews (online survey) in most study locations, with a few exceptions (see Table 1). The DEEP SEAS questionnaire is available online: https://www.deep-seas.eu/standard-eu-alcohol-survey/. This study's research plan was preregistered on the Open Science Framework platform (Kilian, 2022), with this publication focusing on the first part of our proposal only, ; and is reported in accordance to the STROBE statement (Table A1).

Assessment of Alcohol Indicators

Past-year alcohol use was defined as drinking alcohol on at least one day in the past 12 months. The level of alcohol use in grams of pure alcohol per day, among past-year alcohol users only, was calculated using the reported beverage-specific consumption per drinking day and the past-year drinking frequency. As alcohol consumption above 0.5 litres of pure alcohol *per drinking day* is considered to be lethal for around 50% of humans with 100kg body weight (extrapolated based on animal studies; Lachenmeier & Rehm, 2015), consumption levels for each type of alcoholic beverage were capped at 0.5 litres pure alcohol. When volumes ranged between 0.5 to 0.8 litres pure alcohol *per drinking day*, and in cases where quantities exceeded 0.8 litres pure alcohol *per drinking day*, consumption levels were recorded as missing values, given the unlikeliness of any alcohol intake at this level (n = 1,595; 2.9% of the full sample). Daily consumption was then calculated based on the total annual consumption of pure alcohol, capped again at 182.5 litres of pure alcohol, and divided by 365. Respondents with daily drinking levels of pure alcohol above 40g (women) or 60g (men) were considered to be high-risk alcohol users (European Medicines Agency, 2010). At least monthly risky single-occasion drinking (monthly+ RSOD) was defined as reporting at least one episode of drinking more than 40g (women) or 60g (men) of pure alcohol on a single drinking occasion at least once per month within the past year, which was assessed in gender-specific questions.

Finally, respondents were asked whether their consumption decreased, increased, or did not change during the COVID-19 pandemic. Respondents were also able to indicate that they do not know whether the pandemic affected their drinking, resulting in the exclusion of 2,000 respondents (4.1% of past-year alcohol users). Pandemic-related changes in alcohol use among past-year alcohol users were indicated by the share of respondents with an increase minus the share of those with a decrease in alcohol use, with larger values indicating a greater number of persons reporting increases rather than decreases.

Assessment of Gender and Socioeconomic Status

We distinguished between women, men, and other gender. Given the small number of respondents indicating other gender (*n* = 65), we have focused our analysis on women and men.

Educational attainment was taken as a proxy for SES, based on previous research identifying education as the strongest indicator in relation to alcohol-attributable mortality (Probst et al., 2021). Given the small number of respondents with no or only primary education (*n* = 2,320, < 5.0% of the total sample), only two SES groups were constructed: low/mid (no formal education, primary, secondary, and post-secondary non-tertiary education) and high (higher education/university studies). In sensitivity analyses, we used income as an alternative SES indicator (see Tables A6, A7).

Statistical Analysis

In a first step, we computed descriptive statistics for the DEEP SEAS sample, alcohol consumption patterns, and COVID-19 related changes in alcohol use for each study location. We started with a comparison of the DEEP SEAS sample with the actual 2020 location-specific population distributions by gender, age, and educational attainment (Eurostat, 2020; for exceptions see Table A2). Then, gender- and SES-specific proportions and means were calculated for each alcohol indicator and for COVID-19 related changes in alcohol use by study location using the R package “Hmisc” (version 5.0-1; Harrell, 2023). For this aggregation, we included sampling weights designed to match the sample distribution to that of the population in terms of gender, age, and region. As we aimed to compare different SES groups, and the weights were not informed by the SES distribution in the target population, we adjusted the sampling weights for this specific analysis: within each location-gender-SES-strata, the sampling weights were rescaled to match the distribution in the target population. We further calculated population-weighted averages for each alcohol indicator across study locations and within the gender- and SES-specific groups. To better illustrate changes in alcohol use during the COVID-19 pandemic, we calculated differences in the weighted prevalence of self-reported increases minus decreases for each location-gender-SES stratum, so that positive values indicate higher shares of respondents increasing their drinking, and negative values indicate higher shares of respondents decreasing their drinking.

In a second step, to test for socioeconomic differences in alcohol indicators, we analysed the individual-level data in regression models using the R package “lme4” (version 1.1-33; Bates et al., 2015). To account for the clustered nature of our data, that is, that individuals were geographically grouped within study locations, this variable (i.e., study location) was used as random intercept in all regression models. We have conducted regression models for each alcohol indicator, with SES serving as the independent variable. A linear regression model was used for the continuous outcome variable of mean daily drinking levels (logarithmised), with one unit change in the exponentiated beta coefficient describing the percentage change in the outcome. For all other alcohol indicators (i.e., any alcohol use, monthly+ RSOD, high-risk alcohol use), which were dichotomous, logistic regression models were performed. All models were further controlled for gender and age group. In cases where gender-specific SES patterns were observed in the descriptive statistics, gender-stratified models were also computed. In sensitivity analyses, these regression models were repeated with income as an alternative SES indicator (see Table A6, A7). Finally, to quantify gender-specific socioeconomic differences in self-reported decreases and increases in alcohol use during COVID-19, similar logistic regression models were generated, applying a Bonferroni correction for multiple testing (Abdi, 2007). All analyses were done in R version 4.1.1 (R Core Team, 2023).

Results

Sample Characteristics

The selection of the analytic sample, comprising 5,273 past-year alcohol abstainers and 49,081 past-year alcohol users, is depicted in Figure 1, and sample characteristics are compiled in Table 1. Comparing the sample distribution with that of the population reveals an overrepresentation of high-SES men and 18–44-year-old high-SES women in most study locations; while men of all ages and 45–64-year-old women with low/mid SES were underrepresented (Table A2).

Figure 1

Flow Chart on the Selection of the Analytic Sample

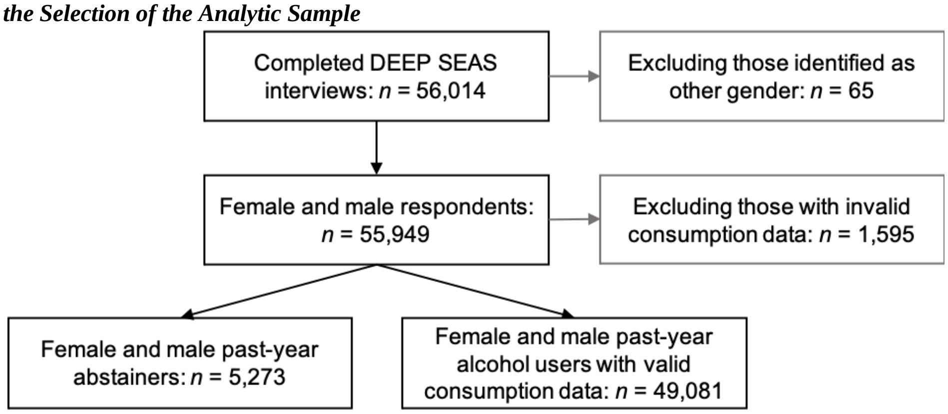


Table 1

Sample Characteristics of the DEEP SEAS Sample

Study location	Sample size	Women, %	18-34 years, %	35-44 years, %	45-64 years, %	No or primary education, %[a]	Secondary education, %[a]	Higher education, %[a]
Austria	3,089	51.1 (49.3, 52.9)	33.9 (32.2, 35.6)	21.0 (19.6, 22.4)	45.1 (43.3, 46.8)	1.0 (0.6, 1.3)	75.2 (73.7, 76.7)	23.8 (22.3, 25.3)
Belgium	1,501	51.1 (48.6, 53.6)	35.0 (32.6, 37.4)	21.0 (19.0, 23.1)	44.0 (41.4, 46.5)	2.5 (1.7, 3.3)	42.4 (39.9, 44.9)	55.1 (52.6, 57.6)
Bosnia-Herzegovina*	1,500	52.0 (49.5, 54.5)	35.0 (32.6, 37.4)	32.0 (29.6, 34.4)	33.0 (30.6, 35.4)	18.5 (16.6, 20.5)	64.6 (62.2, 67.0)	16.8 (14.9, 18.7)
Bulgaria	3,003	51.0 (49.2, 52.8)	31.0 (29.4, 32.7)	24.0 (22.4, 25.5)	45.0 (43.2, 46.8)	0.4 (0.2, 0.7)	40.1 (38.4, 41.9)	59.4 (57.6, 61.2)
Croatia	1,500	52.1 (49.5, 54.6)	33.0 (30.7, 35.4)	22.0 (19.9, 24.1)	45.0 (42.5, 47.5)	1.3 (0.7, 1.8)	55.9 (53.4, 58.4)	42.8 (40.3, 45.3)
Cyprus*	1,500	51.0 (48.5, 53.5)	41.0 (38.5, 43.5)	22.0 (19.9, 24.1)	37.0 (34.6, 39.4)	2.0 (1.3, 2.7)	39.2 (36.7, 41.7)	58.8 (56.3, 61.3)
Czechia	1,500	51.0 (48.5, 53.6)	32.0 (29.6, 34.3)	26.0 (23.8, 28.2)	42.0 (39.5, 44.5)	5.2 (4.1, 6.3)	67.3 (64.9, 69.6)	27.6 (25.3, 29.8)
Denmark	1,574	50.2 (47.7, 52.7)	35.8 (33.4, 38.2)	20.1 (18.1, 22.1)	44.1 (41.7, 46.6)	13.6 (11.9, 15.3)	53.8 (51.3, 56.3)	32.6 (30.3, 34.9)
Estonia	2,150	53.2 (51.1, 55.3)	33.8 (31.8, 35.8)	23.1 (21.3, 24.9)	43.1 (41.0, 45.2)	6.7 (5.6, 7.7)	52.2 (50.1, 54.3)	41.2 (39.1, 43.2)
Finland	1,494	51.3 (48.8, 53.8)	35.2 (32.7, 37.6)	21.3 (19.2, 23.3)	43.6 (41.0, 46.1)	8.1 (6.7, 9.5)	55.6 (53.1, 58.2)	36.3 (33.8, 38.7)
France	1,708	52.0 (49.6, 54.4)	34.0 (31.8, 36.2)	21.0 (19.1, 22.9)	45.0 (42.6, 47.4)	0.7 (0.3, 1.0)	43.8 (41.4, 46.1)	55.6 (53.2, 57.9)
Germany	1,508	51.1 (48.6, 53.6)	32.6 (30.3, 35.0)	19.8 (17.7, 21.8)	47.6 (45.1, 50.1)	6.3 (5.1, 7.5)	66.3 (63.9, 68.7)	27.4 (25.1, 29.6)
Greece	1,521	51.0 (48.5, 53.5)	30.0 (27.7, 32.3)	24.0 (21.8, 26.1)	46.0 (43.5, 48.5)	0.1 (-0.1, 0.3)	40.1 (37.7, 42.6)	59.7 (57.3, 62.2)
Hungary	2,005	52.1 (49.9, 54.3)	32.0 (29.9, 34.0)	25.0 (23.1, 26.9)	43.0 (40.9, 45.2)	4.6 (3.7, 5.5)	60.3 (58.2, 62.5)	35.0 (33.0, 37.1)
Iceland*	1,500	49.0 (46.5, 51.5)	40.0 (37.5, 42.5)	22.0 (19.9, 24.1)	38.0 (35.5, 40.5)	5.1 (4.0, 6.2)	25.3 (23.1, 27.5)	69.7 (67.3, 72.0)
Ireland	1,497	50.1 (47.6, 52.7)	34.6 (32.2, 37.0)	25.7 (23.5, 28.0)	39.6 (37.2, 42.1)	1.4 (0.8, 2.0)	42.6 (40.1, 45.1)	56.0 (53.5, 58.5)
Italy	1,503	51.0 (48.5, 53.6)	29.0 (26.7, 31.2)	22.0 (19.9, 24.1)	49.0 (46.5, 51.6)	2.1 (1.4, 2.8)	46.3 (43.7, 48.8)	51.7 (49.1, 54.2)
Latvia	1,503	54.0 (51.5, 56.6)	33.0 (30.6, 35.4)	22.0 (19.9, 24.1)	45.0 (42.4, 47.5)	5.0 (3.9, 6.1)	48.8 (46.3, 51.3)	46.2 (43.7, 48.8)
Lithuania	1,517	54.0 (51.5, 56.5)	33.7 (31.3, 36.0)	19.8 (17.8, 21.8)	46.5 (44.0, 49.0)	4.2 (3.2, 5.2)	43.9 (41.4, 46.4)	51.9 (49.3, 54.4)
Luxembourg†	1,506	50.0 (47.5, 52.5)	36.0 (33.6, 38.4)	23.0 (20.9, 25.1)	41.0 (38.5, 43.5)	5.7 (4.5, 6.8)	48.7 (46.2, 51.3)	45.6 (43.1, 48.1)
Malta*	1,500	49.0 (46.5, 51.5)	39.4 (36.9, 41.9)	23.2 (21.1, 25.4)	37.4 (34.9, 39.8)	3.5 (2.6, 4.5)	57.1 (54.6, 59.6)	39.4 (36.9, 41.9)
Moldova*	1,500	53.0 (50.5, 55.5)	42.0 (39.5, 44.5)	28.0 (25.7, 30.3)	30.0 (27.7, 32.3)	2.7 (1.9, 3.6)	63.1 (60.7, 65.6)	34.1 (31.7, 36.5)
Netherlands	1,504	50.0 (47.5, 52.5)	35.0 (32.6, 37.4)	19.0 (17.0, 21.0)	46.0 (43.5, 48.5)	1.6 (1.0, 2.2)	40.5 (38.0, 43.0)	57.9 (55.4, 60.4)
Norway	1,496	50.2 (47.6, 52.7)	36.8 (34.4, 39.3)	21.1 (19.0, 23.1)	42.1 (39.6, 44.6)	6.4 (5.2, 7.7)	45.0 (42.4, 47.5)	48.6 (46.1, 51.1)
Poland	1,560	52.0 (49.5, 54.5)	34.0 (31.6, 36.4)	25.0 (22.8, 27.2)	41.0 (38.6, 43.4)	10.4 (8.8, 11.9)	44.7 (42.2, 47.1)	45.0 (42.5, 47.5)
Portugal	1,502	53.0 (50.5, 55.5)	30.0 (27.7, 32.3)	24.0 (21.8, 26.2)	46.0 (43.5, 48.5)	1.5 (0.9, 2.1)	43.1 (40.6, 45.6)	55.4 (52.9, 58.0)
Romania	1,503	51.0 (48.5, 53.6)	32.0 (29.6, 34.3)	24.0 (21.9, 26.2)	44.0 (41.5, 46.5)	1.6 (1.0, 2.2)	37.2 (34.8, 39.7)	61.2 (58.7, 63.6)
Serbia	1,501	51.0 (48.5, 53.6)	32.6 (30.2, 35.0)	22.8 (20.7, 24.9)	44.6 (42.1, 47.1)	1.4 (0.8, 2.0)	61.3 (58.8, 63.8)	37.3 (34.8, 39.7)
Slovakia	1,504	51.0 (48.5, 53.6)	34.0 (31.6, 36.4)	25.0 (22.8, 27.2)	41.0 (38.5, 43.5)	4.1 (3.1, 5.2)	63.3 (60.8, 65.7)	32.6 (30.2, 34.9)
Slovenia	1,502	50.0 (47.5, 52.6)	30.0 (27.6, 32.3)	24.0 (21.9, 26.2)	46.0 (43.5, 48.6)	4.1 (3.1, 5.1)	65.6 (63.2, 68.0)	30.3 (28.0, 32.7)
Spain	1,651	51.1 (48.7, 53.5)	28.9 (26.7, 31.1)	25.0 (22.9, 27.1)	46.1 (43.7, 48.5)	2.0 (1.3, 2.6)	43.1 (40.7, 45.5)	54.9 (52.5, 57.3)
Spain-Catalonia	1,514	51.1 (48.6, 53.6)	29.0 (26.7, 31.3)	25.0 (22.8, 27.2)	46.0 (43.5, 48.5)	2.9 (2.0, 3.7)	43.6 (41.1, 46.1)	53.5 (51.0, 56.0)
Sweden	1,627	50.0 (47.6, 52.5)	37.0 (34.6, 39.3)	21.0 (19.0, 23.0)	42.0 (39.6, 44.4)	6.5 (5.3, 7.8)	52.4 (50.0, 54.8)	41.1 (38.7, 43.4)
United Kingdom	1,506	51.0 (48.5, 53.5)	36.0 (33.6, 38.4)	21.0 (18.9, 23.1)	43.0 (40.5, 45.5)	1.6 (1.0, 2.2)	50.5 (48.0, 53.1)	47.9 (45.3, 50.4)
Population-weighted average	55,949	51.3 (51.0, 51.5)	32.8 (31.8, 33.8)	22.2 (21.4, 23.1)	45.0 (43.7, 46.2)	3.6 (2.4, 4.7)	50.5 (47.0, 54.0)	46.0 (41.9, 50.0)

Note: 95% confidence intervals are given in brackets. [a] Indicator for socioeconomic status (SES), no, primary, secondary education grouped into low/mid SES. * Computer-assisted telephone interviews were conducted in Bosnia-Herzegovina, Cyprus, Iceland, Malta, and Moldova. † Both, computer-assisted web interviews and computer-assisted telephone interviews were conducted in Luxembourg. For computer-assisted telephone interviews, response rates ranged between 9% to 15%. For computer-assisted web interviews, the information about those who refused to participate, which is relevant for the calculation of response rates, was not collected, as data collection took place until a priori defined quotas were completed by the panellists.

Figure 1

Alcohol Use Patterns by Gender, Socioeconomic Status (SES), and Study Location; Weighted Data

	Past-year alcohol use in %				Daily alcohol intake in grams pure alcohol				Monthly RSOD in %				High-risk alcohol use in %			
	Men low/mid SES	Men high SES	Women low/mid SES	Women high SES	Men low/mid SES	Men high SES	Women low/mid SES	Women high SES	Men low/mid SES	Men high SES	Women low/mid SES	Women high SES	Men low/mid SES	Men high SES	Women low/mid SES	Women high SES
Austria	93.3	92.8	90.9	91.2	17.60	17.40	6.70	8.40	35.6	32.7	25.2	27.0	6.7	6.7	2.5	4.3
Belgium	93.6	94.2	83.7	86.1	32.00	30.60	15.20	17.60	43.4	44.6	34.9	42.5	15.7	15.1	11.1	9.9
Bosnia and Herzegovina	68.9	74.4	51.5	70.3	8.90	9.80	5.60	4.60	13.2	13.2	4.8	5.7	2.2	3.9	1.3	1.0
Bulgaria	99.0	97.9	94.9	96.7	49.40	51.20	20.50	22.00	61.4	65.4	38.6	45.2	27.1	23.1	13.3	16.2
Croatia	93.8	97.1	94.9	95.4	29.60	24.70	12.80	11.10	44.5	36.2	22.7	28.8	11.1	8.6	6.1	5.0
Cyprus	89.8	95.4	87.3	91.5	5.60	4.80	5.90	3.70	10.3	5.0	10.9	5.8	0.3	0.9	3.0	1.1
Czechia	95.1	93.1	93.3	96.0	32.00	29.90	17.00	14.50	52.3	51.8	41.2	41.9	13.4	10.0	10.5	7.3
Denmark	93.9	95.8	87.6	91.1	33.00	31.90	11.00	15.70	40.0	40.6	22.1	20.0	14.7	13.8	6.4	8.0
Estonia	86.3	87.9	88.8	88.6	29.70	27.20	11.70	8.50	50.5	43.4	29.2	29.9	13.2	12.2	5.6	4.0
Finland	94.8	93.8	88.0	94.5	30.90	26.60	13.60	8.80	52.2	43.4	34.7	26.2	15.0	8.6	9.5	2.3
France	91.8	93.6	83.3	90.5	21.30	14.80	9.30	10.20	30.9	25.5	24.1	21.4	7.2	3.8	5.2	6.6
Germany	89.2	95.1	82.3	87.1	20.00	18.90	8.60	11.80	41.0	35.8	26.0	27.6	8.5	6.7	4.2	6.3
Greece	97.9	99.3	98.0	98.0	20.60	18.00	12.60	14.90	53.1	43.5	36.4	45.1	8.0	5.8	4.8	6.7
Hungary	93.7	96.7	91.3	93.6	20.00	15.80	8.40	7.10	43.1	35.3	22.0	25.8	7.2	4.7	4.0	2.6
Iceland	87.7	91.0	87.6	88.8	9.70	5.00	7.40	4.30	19.8	20.4	15.4	10.5	4.4	0.5	4.9	1.1
Ireland	91.5	92.4	92.4	92.7	41.70	44.00	17.90	16.10	61.1	58.2	43.5	44.0	20.5	19.1	9.2	8.7
Italy	97.0	97.3	93.8	96.8	33.00	29.20	17.90	17.70	42.0	43.9	43.0	35.7	12.8	12.8	12.9	9.8
Latvia	90.6	96.1	89.9	94.6	26.60	22.10	11.10	7.80	46.0	45.6	24.8	29.2	13.3	9.0	5.4	4.0
Lithuania	90.7	95.1	92.8	93.9	28.00	23.20	7.90	8.80	45.7	41.8	26.8	31.3	15.1	9.0	3.8	4.1
Luxembourg	76.2	82.1	74.2	66.2	12.70	9.80	12.40	10.60	14.3	9.6	16.8	9.4	3.9	2.2	6.2	5.6
Malta	83.9	86.7	77.0	81.4	13.30	9.40	14.40	6.20	23.1	23.7	16.2	20.2	4.1	1.2	7.6	2.1
Moldova	78.3	87.6	74.1	81.2	6.70	5.30	10.40	5.70	15.4	11.6	13.9	11.7	1.5	0.8	4.6	2.2
Netherlands	90.5	92.6	77.7	86.0	26.50	23.60	8.40	16.20	54.2	49.7	38.3	44.5	11.8	7.6	2.4	8.4
Norway	89.1	91.0	84.2	88.4	18.60	17.00	6.80	7.70	38.7	33.9	28.6	28.1	6.9	5.9	4.8	2.8
Poland	96.0	97.1	98.4	95.7	39.70	34.70	15.10	16.60	60.7	64.2	43.4	49.4	18.4	14.9	8.1	10.2
Portugal	94.6	97.7	94.0	93.5	27.80	23.70	9.10	10.10	40.0	29.8	22.8	23.3	12.3	9.7	4.6	4.6
Romania	94.0	98.5	94.7	97.2	40.70	37.00	7.90	13.00	48.9	48.8	23.7	26.5	20.2	18.1	5.0	6.9
Serbia	95.1	97.8	94.2	94.6	23.00	28.20	8.10	9.00	37.6	44.2	26.0	28.0	8.6	11.4	4.8	5.3
Slovakia	93.8	96.4	94.7	96.6	30.00	30.40	8.30	9.00	53.1	47.0	30.1	33.5	12.6	11.5	3.1	4.2
Slovenia	90.7	95.0	87.4	91.5	15.30	11.50	4.60	3.70	32.0	28.0	17.0	14.2	5.7	3.2	1.4	0.9
Spain	97.2	97.9	92.8	95.5	38.20	43.20	22.60	23.10	42.6	43.9	38.5	41.2	18.1	22.1	16.6	13.7
Spain-Catalonia	92.5	94.5	84.6	89.7	31.80	31.50	12.20	12.90	33.5	27.4	24.8	24.0	13.9	13.7	8.1	8.4
Sweden	87.8	94.6	85.9	90.1	24.10	26.90	11.40	11.70	34.2	39.5	25.1	21.3	10.7	10.5	5.9	5.1
United Kingdom	88.8	90.5	87.3	87.0	42.10	36.60	21.70	22.70	50.0	44.2	39.6	41.1	20.9	17.6	14.8	14.2
Population-weighted average	92.8	94.5	88.7	91.2	30.10	27.60	13.60	15.50	43.7	40.6	32.5	33.8	13.2	11.7	8.4	8.9

Note: Low/mid SES: no, primary or secondary education, high SES: higher education. RSOD (risky single-occasion drinking): reporting monthly or more frequent drinking occasions with more than 40/60 grams of pure alcohol in women/men. High-risk alcohol use: daily drinking levels above 40/60 grams of pure alcohol in women/men. The degree of prevalence/mean daily drinking levels within each alcohol indicator is reflected by colour intensity, with light yellow indicating the lowest values and dark red indicating the highest values.

Alcohol Consumption Patterns in 2021

A location-gender-SES stratified illustration of the four alcohol indicators is given in Figure 2 (for estimates with 95% *CI*: Table A3, A4). On average, past-year alcohol use was reported by 92.8% (95% *CI*: [91.2, 94.4]) low/mid-SES men and 94.5% (95% *CI* [93.3, 95.6]) high-SES men, and by 88.7% (95% *CI* [86.2, 91.1]) low/mid-SES women and 91.2% (95% *CI* [89.6, 92.7]) high-SES women. Minor variations in past-year alcohol use prevalence were observed between study locations, with reported prevalence being substantially lower in Bosnia-Herzegovina, Luxembourg, and Moldova than in other study locations.

Mean daily drinking levels varied widely across study locations, with an average amount of pure alcohol of 30.1 grams per day (95% *CI* [26.5, 33.6]) in low/mid-SES men, and 27.6 grams (95% *CI* [23.8, 31.5]) in high-SES men; 13.6 grams (95% *CI* [11.5, 15.6]) in low/mid-SES women and 15.5 grams (95% *CI* [13.1, 17.8]) in high SES women. The highest mean daily drinking levels were observed among both men and women from Bulgaria, Spain, and the UK, as well as among men from Ireland, Poland, and Romania.

Monthly+ RSOD was on average reported by 43.7% (95% *CI* [40.3, 47.2]) of past-year drinkers in low/mid-SES men, 40.6% (95% *CI* [36.8, 44.5]) in high-SES men, 32.5% (95% *CI* [28.9, 36.0]) in low/mid-SES women, and 33.8% (95% *CI* [29.8, 37.8]) in high-SES women. RSOD prevalence among past-year drinkers ranged from around 5% and 13% in Bosnia-Herzegovina and Cyprus, to 38% to 64% in Bulgaria, Ireland, and Poland.

Finally, we estimated the prevalence of high-risk alcohol use among past-year drinkers. On average, this pattern of alcohol use was seen in 13.2% (95% *CI* [11.2, 15.2]) of low/mid-SES men, and 11.7% (95% *CI* [9.4, 14.1]) of high-SES men; and in 8.4% (95% *CI* [6.6, 10.2]) of low/mid-SES women and 8.9% (95% *CI* [7.2, 10.6]) of high-SES women reporting past-year alcohol use. Particularly high prevalence estimates among past-year alcohol users were observed in Bulgaria, Ireland, Romania, Spain, and the UK, where about one in five men who had consumed alcohol in the past year reported high-risk alcohol use.

Socioeconomic Differences in Alcohol Consumption Patterns

In subsequent analyses, we explored socioeconomic differences (based on educational attainment) in alcohol indicators at the individual level (Table 2). Compared to low/mid-SES men and women, those with high SES had 37% increased odds of having consumed alcohol in the past year. Among past-year alcohol users, mean daily drinking levels were 6% higher in high-SES respondents compared to their low/mid-SES counterparts. Gender-stratified analyses revealed that among women, but not among men, mean daily drinking levels were 13% higher in high-SES compared to low/mid-SES past-year alcohol users (Coef. = 0.13, 95% *CI* [0.09, 0.18]; $p < .001$; men: $p = .686$; models adjusted for age group).

Table 1

Socioeconomic Differences (Based on Educational Attainment) in Alcohol Indicators: Results from Individual-Level Regression Analysis

	Past-year alcohol use	Mean daily drinking levels[a]	Monthly+ RSOD[a]	High-risk alcohol use[a]
SES (ref: low/mid SES)				
High SES	1.37 (1.29, 1.46) ***	0.06 (0.03, 0.10) ***	0.97 (0.93, 1.01)	0.87 (0.81, 0.93) ***
Gender (ref: men)				
Women	0.65 (0.61, 0.69) ***	-0.96 (-0.99, -0.93) ***	0.58 (0.56, 0.70) ***	0.56 (0.53, 0.60) ***
Age group (ref: 18 to 34 years)				
35 to 44 years	1.05 (0.97, 1.14)	0.05 (0.01, 0.09) *	0.86 (0.81, 0.91) ***	1.07 (0.99, 1.17)
45 to 64 years	0.85 (0.80, 0.91) ***	-0.06 (-0.10, -0.03) ***	0.65 (0.62, 0.68) ***	0.86 (0.80, 0.93) ***

Note: Displayed are odds ratios and the regression coefficient for mean daily drinking levels with 95% confidence interval in brackets. Logistic multi-level regression models were run for past-year alcohol, monthly risky-single occasion drinking (RSOD), and high-risk alcohol. For daily drinking levels, a linear multi-level regression model was used, with the logarithm of daily drinking levels as the dependent variable; the exponentiated coefficient can be interpreted as percentage change in the outcome variable comparing the test with the reference category of the independent variable. Random intercept: study location. Ref: reference.
[a] only past-year alcohol users were included in the model: $n = 49{,}081$. * $p < .050$, *** $p < .001$.

For at-risk drinking, among those reporting past-year alcohol use, SES patterns also differed by gender, and were therefore analysed separately. In gender-stratified models, the odds of reporting monthly+ RSOD and high-risk alcohol use were 9% lower ($OR = 0.91$, 95% *CI* [0.86, 0.96]; $p < .001$) and 17% lower ($OR = 0.83$, 95% *CI*: [0.77, 0.91]; $p < .001$), respectively, in high-SES men compared to low/mid-SES, while no significant SES differences were found for women (monthly+ RSOD: $p = .182$, high-risk alcohol use: $p = .169$; all models adjusted for age group).

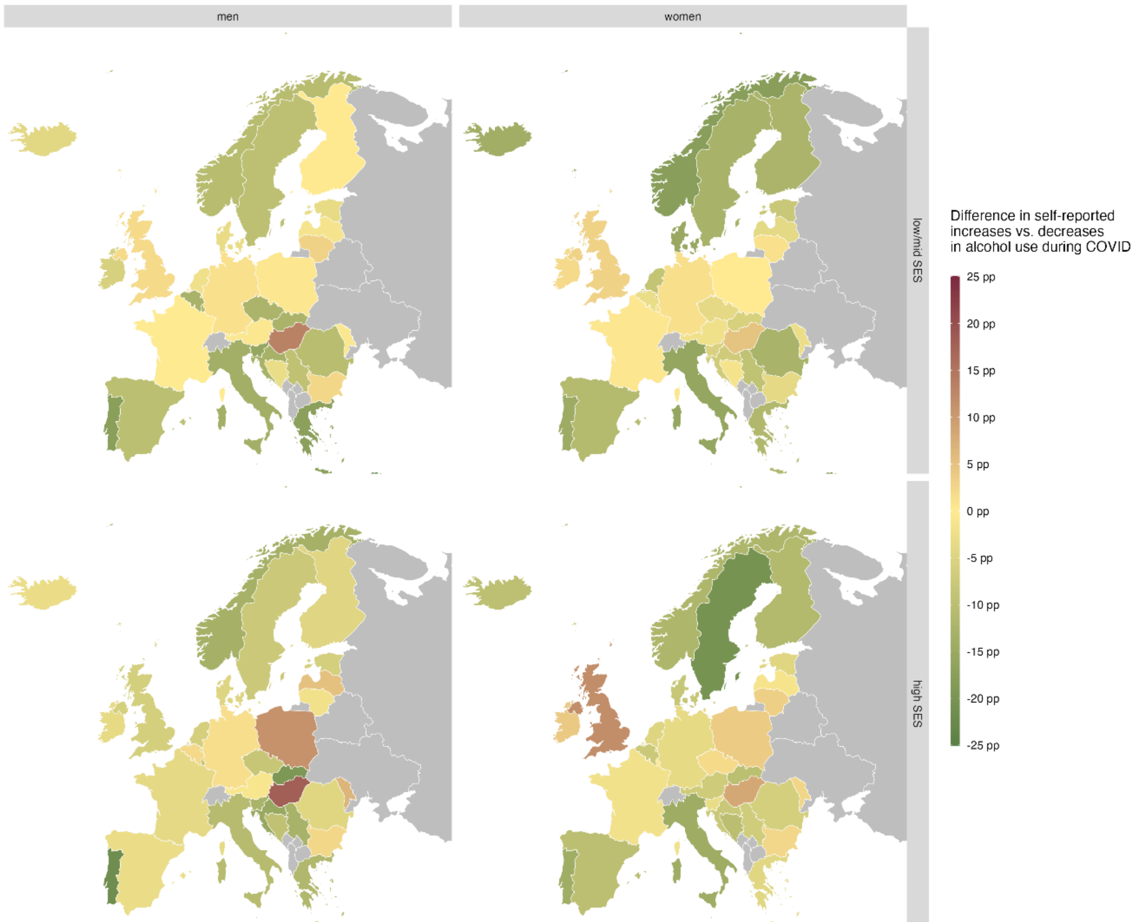
The sensitivity analyses using income as the SES indicator provide additional information on the socioeconomic gradient: with higher incomes, men and women were more likely to report *any* alcohol use and higher mean daily drinking levels, and men were less likely to report high-risk alcohol use (Table A6, A7). In contrast to the gender-stratified analysis using education as SES measure, the odds of reporting monthly+ RSOD increased with higher incomes among women, while there was no association of monthly+ RSOD with income among men.

Alcohol Consumption Changes during the COVID-19 Pandemic

Among past-year alcohol users who provided information on alcohol consumption changes during the COVID-19 pandemic ($n = 47{,}081$), roughly half indicated some change in their alcohol use, with variations across countries and sociodemographic groups (see Table A5). Comparing the proportions of respondents whose alcohol use decreased versus those whose use increased reveals that, in most study locations, a higher share of respondents lowered their alcohol use (Figure 3).

Figure 3

Differences in the Weighted Prevalence of Self-Reported Increases minus Decreases in Alcohol Use during the COVID-19 Pandemic among Past-Year Alcohol Users



Note: *n* = 47,081; full data available in Table A5
Positive values indicate a higher share of respondents reporting an increase than a decrease, while negative values indicate a higher share of respondents reporting a decrease than an increase in their alcohol use. PP = percentage points.

No significant socioeconomic differences were observed among men who reported increases or decreases in drinking during the pandemic (see Table A8). However, high-SES female past-year drinkers were more likely to change their alcohol use in either direction compared to their low/mid-SES counterparts. Specifically, high-SES women had 27% higher odds of increasing and 12% higher odds of decreasing alcohol use during the COVID-19 pandemic than low/mid-SES women. It is worth noting that sensitivity analyses revealed that past-year alcohol users who did not report pandemic-related changes in consumption were more likely to be low/mid-SES men and women (see Table A9).

Discussion

This research contributes to a deeper understanding of gendered socioeconomic variations in alcohol consumption. In the DEEP SEAS sample, past-year alcohol use was very common, as was frequent (monthly+) RSOD and high-risk alcohol use among past-year alcohol users. While respondents with low/mid SES were, in general, less likely to report past-year alcohol use, men in this group were at higher risk of reporting monthly+ RSOD and high-risk drinking compared to their high-SES counterparts. Among women, however, the gradient was reversed, with high-SES women indicating higher mean daily drinking levels. High-SES female drinkers were also more likely to report changing their alcohol use during the COVID-19 pandemic in either direction.

Before discussing these results, we would like to address this study's caveats. First, the statistical representativeness of the panel sampling cannot be assumed (Rehm et al., 2021). In fact, we observed an overrepresentation of high-SES individuals in the DEEP SEAS sample, while those with low/mid SES were underrepresented (Table A2); an observation not unique to this survey (Rehm et al., 2021). Poor representation of low/mid-SES individuals in our sample may have led to an underestimation of SES disparities, as the underrepresented SES group is likely to show greater alcohol-related harms due to heavier drinking patterns (Probst et al., 2021). In addition, alcohol users were overrepresented in the sample (see the comparison with the European Health Interview Survey, Table A10), which may have led to higher mean daily drinking levels and prevalence of risky consumption patterns in our sample. Second, it is widely considered that data on self-reported alcohol use, including those capturing changes in alcohol use during the COVID-19 pandemic, are affected by several biases, including non-response, social desirability, and cognitive biases, resulting in low estimates of alcohol consumption compared to recorded consumption data from other sources (e.g., sales and taxation data; Kilian et al., 2020). In the DEEP SEAS survey, response rates were only available for study locations using CATI and where available, these were very low (9%–15%). We therefore expect that our consumption estimates underestimate the actual consumption of the populations. The group-specific analyses may be unaffected by these biases, if we can adopt the assumption that the underestimation of alcohol consumption is the same across sociodemographic groups. Third, we found relatively high alcohol consumption levels with the DEEP SEAS survey compared to other surveys (Eurostat, 2021). We will have to systematically explore whether such consumption levels will come to be seen as more normal in the era of web-based surveys, of which the DEEP SEAS survey is one example, as this relatively anonymous administration mode may yield more accurate responses on sensitive topics such as alcohol use and alcohol-attributable harm (Jones et al., 2016; Krumpal, 2013). Finally, we used education as a proxy for SES and tested income as a secondary SES indicator in sensitivity analyses. We chose to do this because we expect that educational attainment was only marginally affected by the COVID-19 pandemic, while the economic downturn and workplace closures during this period may have had a more profound impact on individuals' income. It should be noted, however, that young adult respondents may not yet have completed higher education at the time of survey completion, leading to a misrepresentation of their SES, but we are confident that this number is very low.

In line with prior research (e.g., Beard et al., 2019; Calling et al., 2019), we found a significantly higher prevalence of past-year alcohol use among high-SES respondents and those high-SES drinkers consumed more on average. On the other hand, high-risk drinking was significantly less prevalent in this group. In other words, consumption patterns were more polarised in the low/mid SES group, with more abstention reported, as well as more high-risk drinking. However, these results were gender-specific, with high-SES women indicating higher mean daily drinking levels and monthly+ RSOD, while low/mid-SES men were more likely to report monthly+ RSOD and high-risk alcohol use. Opposing SES disparities in alcohol consumption for women and men have also been reported in other studies (e.g., Mackenbach et al., 2019; Wood & Bellis, 2017) and underline the need for taking a gendered perspective when investigating and tackling socioeconomic inequalities in alcohol-related harms. Given the fact that alcohol-attributable harm inequalities are more visible in men, our results can further contribute to explanations of the alcohol harm paradox (e.g., Bellis et al., 2016; Probst et al., 2021), as gender-specific patterns may cancel each other out when looking at SES differences within the total population. Interestingly, in our analysis, socioeconomic differences in RSOD differed between the two SES measures employed (education and income), highlighting the relevance of studying and considering different SES facets (Beard et al., 2019; Probst et al., 2021).

Our findings may also challenge Skog/Lederman's hypothesis which underlies many alcohol control policies; that is, the mean of a population can predict the proportion of heavy drinkers (Skog, 1985). This theory stipulates a uniform alcohol distribution pattern, albeit with different means, by gender and SES among alcohol users, best described by functions such as the log-normal or Gamma distribution (Kehoe et al., 2012). However, our results by SES group challenge this: whereas individuals with high SES had a significantly higher level of consumption, low/mid SES had a significantly higher proportion of heavy alcohol use. Therefore, the mean does not predict the proportion of heavy alcohol users in the population group, which is a contradiction of the basic assumption of Skog (1985). As almost all upshifting algorithms for estimating alcohol-attributable harm use the assumption of such uniform distributions (e.g., Rehm et al., 2010), the field may be in need of more differentiated ways to describe the distribution of drinking; a need made even more salient by diverging consumption trends observed in the course of the COVID-19 pandemic (Acuff et al., 2021; Kilian et al., 2022; Rossow et al., 2021). However, the different distributions by SES and/or gender which our data suggests first need to be replicated and verified by other studies.

Finally, our research suggests that self-reported consumption changes during the COVID-19 pandemic clustered within gendered SES groups, with high-SES women having higher odds of changing their drinking in either direction. While differential consumption changes by gender and SES have been reported previously (for a review, see Acuff et al., 2021), we are not aware of any study looking at gender-specific SES responses. Importantly, women were unequally affected by the pandemic, with working women in particular facing a double burden of working from home while being responsible for home-schooling and additional care work (Czymara et al., 2021; Johnston et al., 2020); a situation that may have contributed to the observed pattern of polarisation. Among men, no SES pattern in pandemic-related consumption changes was observed in our sample of past-year alcohol users. This finding was, however, limited by a systematic discrepancy of low/mid-SES respondents indicating more frequently to not know whether their alcohol use changed during COVID compared to their high-SES counterparts.

Conclusion

The level of alcohol use in Europe is high, in fact the highest worldwide (WHO, 2022); and, given the considerable documented harms related to alcohol use, and available effective alcohol policies such as taxation, availability restrictions, and alcohol marketing bans (Chisholm et al., 2018), such high levels should not be normalised or tolerated. Taking into account the identified gender- and SES-specific consumption patterns, and the socioeconomic inequalities seen in alcohol-related harm (Bellis et al., 2016; Probst et al., 2021), reducing consumption among low-SES men and tackling consumption trends among high-SES women is particularly important. Alongside the implementation of effective alcohol policies and accurate information campaigns, tackling the root causes of socioeconomic disparities through social and economic strategies, are required, such as carefully crafted minimum living wage, taxation and social protection policies, to promote more evenly spread resources and protective factors to reduce health inequity (Probst & Kilian, 2021).

Declaration

The information and views set out in this paper are those of the authors, and the accuracy and veracity of these are the author's responsibility, and cannot be considered to reflect the views of the Commission and/or HaDEA or any other body of the European Union. The European Commission and the Agency do not accept any responsibility for use that may be made of the information contained therein.

Research Ethics Approval Statement

This study was approved by the ethics committee of the Hospital Clínic de Barcelona (reference ID: HCB/2020/1424).

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Authors Contributions

Conceptualization: C.K., J.Ma., J.R.; Methodology: C.K.; Validation: J.Ma., J.R.; Formal analysis: C.K.; Investigation: all authors; Data Curation: C.K., J.Mo.; Writing – Original Draft: C.K., J.R.; Writing – Review & Editing: all authors; Visualisation: C.K.; Supervision: J.R.; Project administration: S.M., F.B.; Funding acquisition: J.R., J.Ma., S.M., F.B.

Data Availability Statement

The owner of the SEAS-2 data is the Health and Digital Executive Agency (HaDEA) of the European Commission. The DEEP SEAS group, as contractors of the tendered service contract number 20177113, are authorised to share this data publicly in line with HaDEA's policy to provide open access to documents and data created with EU funding. Researchers interested in using the data can receive the public file from the DEEP SEAS website (https://www.deep-seas.eu/standard-eu-alcohol-survey), and should request permission to use the data, prior to any publication, via email to: hadea-hp-tender@ec.europa.eu. The syntax used in the statistical analyses is available in the Figshare repository, https://doi.org/10.6084/m9.figshare.23091308.

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