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Alcohol consumption patterns across Europe and adherence to the European guidelines in coronary patients: Findings from the ESC-EORP EUROASPIRE V survey

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ABSTRACT

Background and aims: Alcohol consumption is an important risk factor for cardiovascular morbidity and mortality worldwide. The highest levels of alcohol consumption are observed in Europe, where alcohol as contributing cause of coronary heart disease (CHD) is also most significant. We aimed to describe alcohol consumption patterns across European regions and adherence to the current guidelines in patients with a recent CHD event.
Methods: The ESC-EORP survey (EUROASPIRE V) has been conducted in 2016–2017 at 131 centers in 27 European countries in 7350 patients with a recent CHD. Median alcohol consumption, as well as the proportion of abstainers and excessive drinkers (i.e. >70 g/week for women and >140 for men, as recommended by the European guidelines on cardiovascular prevention), was calculated for each region. To assess adherence to guidelines, proportions of participants who were advised to reduce excessive alcohol consumption and participants who were incorrectly not advised were calculated per region.
Results: Mean age was 64 years (SD: 9.5), 75% were male. Abstention rates were 53% in males and 77% in females, whereas excessive drinking was reported by 9% and 5% of them, respectively. Overall, 57% of the participants were advised to reduce alcohol consumption. In the total population, 3% were incorrectly not advised, however, this percentage differed per region (range: 1%–9%). In regions where alcohol consumption was highest, participants were less often advised to reduce their consumption.
Conclusion: In this EUROASPIRE V survey, the majority of CHD patients adhere to the current drinking guidelines, but substantial heterogeneity exists between European regions.

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1. Introduction

According to the most recent Global Burden of Disease Study, alcohol consumption is the seventh leading risk factor for both deaths and disability-adjusted life years (DALYs) [1], accounting for 5.3% of all deaths and 5.1% of all DALYs worldwide [2]. For cardiovascular disease (CVD), including coronary heart disease (CHD), specifically - the leading cause of mortality globally - the alcohol-attributable burden was estimated at 593,000 deaths (3.3% of all CVD deaths) and 13 million CVD DALYs (3.2% of all CVD DALYs). Alcohol consumption was particularly a factor of interest in Europe, where alcohol as contributing cause of CVD was highest and accounted for 10.5% of all CVD deaths and 11.0% of CVD DALYs [2].

Estimating the total alcohol-attributable CVD burden is complex since it is a composition of detrimental and protective effects: heavy alcohol consumption is always a risk factor for disease [3], however, low to moderate alcohol consumption is associated with lower mortality from ischemic CVD, but not from hemorrhagic stroke and hypertensive cardiac disease [4,5]. The association of moderate alcohol intake appears to be similar among individuals at both low and high cardiovascular risk and also among those with prevalent CVD [6,7]. The potential beneficial effects of low to moderate alcohol consumption are still debated in the scientific literature [3,8].

The European guidelines on cardiovascular prevention in clinical practice of 2016 discourage the consumption of alcoholic beverages in general and otherwise advise to limit consumption to two units of alcohol a day for men and one unit of alcohol a day for women [9]. The guidelines additionally provide a comprehensive overview on how to reduce excessive alcohol consumption by population-based strategies. However, previous research on physicians' perceptions on alcohol screening has shown that knowledge of the guidelines still needs improvement [10,11].

Implementation of the European guidelines on cardiovascular prevention has been repeatedly evaluated by the ESC-EORP (European Society of Cardiology – EurObservational Research Program) EUROASPIRE (European Action on Secondary and Primary Prevention by Intervention to Reduce Events) surveys [12–16]. However, to date, no information on alcohol consumption specifically in coronary patients has been published from these surveys, while it has been demonstrated that alcohol consumption patterns in CVD patients differ from those of the general population [17,18]. This report describes patterns of alcohol consumption across different European regions and adherence to the current guidelines in patients with a recent acute coronary event or revascularization procedure based on the EUROASPIRE V survey.

2. Patients and methods

2.1. Study population

The EUROASPIRE V survey has been conducted in 2016–2017 at 131 centers in 27 European countries. In each country, up to three geographical areas with a population greater than half a million inhabitants were selected and all hospitals in the area were identified, to ensure representativeness. The interview response rate was 56%. Details of this study have been described elsewhere [14]. In short, 8261 CHD patients aged between 18 and 80 years were interviewed six months up to two years after a first or recurrent clinical diagnosis or treatment of (i) elective or emergency coronary artery bypass grafting (CABG), (ii) elective or emergency percutaneous coronary intervention (PCI), (iii) acute myocardial infarction (MI) (ICD-10 I21) or (iv) acute myocardial ischemia (ICD-10 I20). The visit included an interview, a physical examination and a blood sample collection. National coordinators for EUROASPIRE V obtained approvals from local ethics committees. Informed consent was obtained from each participant by means of a signed declaration.

In the present analysis, participants with insufficient data on alcohol consumption were excluded (n = 205). Furthermore, participants from countries not classified as European territory according to the United Nations Geoscheme [19] (i.e. Egypt, Kyrgyzstan) were excluded from further analyses (n = 706). The analytical sample included 7350 participants. Data on adherence were missing for 190 (2.6%) participants, therefore, the assessment of adherence to guidelines was performed in 7160 participants.

2.2. Assessment of alcohol consumption

Current or former alcohol consumption since the index event was self-reported using a beverage specific quantity-frequency questionnaire, in which participants had to report the frequency of drinking (monthly, weekly or daily) and the number of beverages they consumed during this time period separately for beer, wine, spirits and "other" (country-specific) beverages. The volume of one drink was defined as 30 ml of spirits (which is equivalent to 10 g of alcohol), 125 ml of wine (12 g of alcohol) and 375 ml of beer (15 g of alcohol). The "other beverages" category contained volumes equivalent to 10 g of alcohol. We calculated the total and beverage-specific alcohol consumption in grams/week. Based on this weekly alcohol consumption, we defined consumption categories for men and women separately, as the guidelines provide sex-specific recommendations. In the European guidelines, a standard serving of an alcoholic beverage contains 10 g of alcohol [9]. We categorized male drinkers into: lifetime abstention, former drinkers or current drinkers (light (0–70 g/week), moderate (70–140 g/week) or heavy (>140 g/week)). For women the categories for current drinkers were: light (0–35 g/week), moderate (35–70 g/week) or heavy (>70 g/week).

Adherence to guidelines was assessed by the question: "Since the index event, were you offered any personal advice by a doctor or other health professional on reducing excessive alcohol intake?" (yes/no). Excessive intake is interpreted as > 140 g/week for men, > 70 g/week for women, in line with the European guidelines. Consecutively, to evaluate whether this recommendation was followed, participants were asked whether they had reduced excessive alcohol intake since the index event to decrease their risk of recurrent coronary events (yes/no).

2.3. Covariates

Information on personal and demographic details and the type of index event or procedure was obtained from medical records. Smoking status was defined as self-reported smoking and/or a breath carbon monoxide exceeding 10 ppm by means of Smokerlyzer® (Bedfont Scientific, Model Micro+) [20]. Education level was self-reported and categorized into the following categories: low (primary school completed), middle (high/secondary school completed or intermediate between secondary school and university) and high (college/university completed or post-graduate degree). The physical activity target was defined by the following question: "Do you take regular physical activity of at least 30 min' duration on average five times a week?'' Finally, participants were asked whether they had been hospitalized for other cardiovascular events before the index event (yes/no).

During the examination, height and weight were measured in light indoor clothes without shoes (SECA scales 701 and measuring stick model 220). Body mass index (BMI) was calculated as measured weight in kilograms divided by the square of height in meters. Blood pressure was measured twice using an automatic digital sphygmomanometer (Omron M6) and the mean was used for the analyses.

A venous blood sample was drawn for serum total cholesterol, high-density cholesterol (HDL-C), triglycerides, glycated haemoglobin (HbA1c) and creatinine. All measurements were performed on a clinical chemistry analyzer (Architect c8000; Abbott Laboratories, Abbott Park, Illinois, USA). Total cholesterol, HDL-C, and creatinine were analyzed in serum, and HbA1c in whole blood. Low-density cholesterol (LDL-C) was calculated by Friedewald's formula [21]. Estimated glomerular filtration rate was calculated using the Chronic Kidney Disease Epidemiology Collaboration equation (CKD-EPI) [22].

We defined hypertension as either previously diagnosed hypertension as described in medical records or a blood pressure at the examination $\geq$ 140/90 mmHg ($\geq$ 140/85 mmHg in people with diabetes) [9]. Similarly, diabetes was defined as either a documented diagnosis of diabetes or an HbA1c $\geq$ 6.5% [9]. Finally, hypercholesterolemia was defined as documented dyslipidemia or an LDL-C $\geq$ 1.8 mmol/L. If LDL-C was not available, a total cholesterol > 6.5 mmol/L was regarded as hypercholesterolemia.

2.4. Statistical analysis

All statistical analyses were performed using IBM SPSS 25.0 for Windows and R version 3.5.1. We tabulated demographic and lifestyle factors, as well as the presence of comorbidities and prior cardiovascular events, stratified by alcohol consumption category.

Furthermore, we examined alcohol consumption per European region, both as a continuous outcome (median alcohol consumption in grams/week in current drinkers only) and as a categorical outcome, using the previously defined consumption categories. Countries were allocated to one of the four subregions of Europe, according to the United Nations Geoscheme [19]: Western Europe (Netherlands, Belgium, Germany), Northern Europe (United Kingdom, Ireland, Sweden, Finland, Latvia, Lithuania), Southern Europe (Spain, Portugal, Italy, Greece, Bosnia & Herzegovina, Croatia, Serbia, Slovenia, Turkey) and Eastern Europe (Russian federation, Ukraine, Bulgaria, Czech Republic, Poland, Romania, Kazakhstan) (Supplementary Fig. 1).

To assess adherence to the European guidelines on cardiovascular prevention in clinical practice 2016, we calculated the proportion of participants who adhered to the guidelines per European region and used the Pearson chi-square test to test for differences between regions. Secondly, we examined the proportion that was advised by a health professional to reduce their excessive alcohol consumption. We calculated this proportion both for participants who indicated to adhere to the

Table 1
Patient characteristics of 5502 male EUROASPIRE V participants, by alcohol consumption category.

	Alcohol consumption category				
	Never drinker	Former drinker	0–70 g/week	70–140 g/week	>140 g/week
Total number of participants	2601 (47.3)	314 (5.7)	1480 (26.9)	628 (11.4)	479 (8.7)
Age > 65 years	1165 (44.8)	133 (42.4)	668 (45.1)	360 (57.3)	265 (55.4)
BMI > 30 kg/m^2	871 (34.3)	128 (41.2)	565 (38.3)	200 (32.2)	159 (33.3)
Type of index event					
CABG	271 (10.4)	44 (14.0)	201 (13.6)	96 (15.3)	79 (16.5)
PCI	1984 (76.3)	216 (68.8)	1112 (75.1)	480 (76.6)	358 (74.7)
Acute MI without procedure	151 (5.8)	33 (10.5)	69 (4.7)	29 (4.6)	25 (5.2)
Unstable angina without procedure	195 (7.5)	21 (6.7)	98 (6.6)	22 (3.5)	17 (3.6)
Smoking status					
Never smoker	762 (29.3)	53 (16.9)	357 (24.1)	145 (23.1)	87 (18.2)
Former smoker	1351 (51.9)	184 (58.6)	820 (55.4)	368 (58.6)	278 (58.0)
Current smoker	488 (18.8)	77 (24.5)	303 (20.5)	115 (18.3)	114 (23.8)
Education					
Low	336 (13.4)	33 (10.6)	151 (10.3)	103 (16.5)	89 (18.7)
Middle	1567 (62.3)	210 (67.5)	852 (58.2)	358 (57.3)	254 (53.4)
High	612 (24.3)	68 (21.9)	462 (31.5)	164 (26.2)	133 (27.9)
Physical activity					
Regular physical activity	861 (33.1)	89 (28.3)	555 (37.5)	248 (39.5)	153 (31.9)
Prior CVD event	1018 (39.1)	161 (51.3)	616 (41.6)	245 (39.0)	167 (34.9)
Advised to reduce alcohol consumption	1505 (57.9)	187 (59.6)	889 (60.1)	375 (59.7)	286 (59.8)
Indicated to have reduced alcohol consumption	1328 (51.1)	198 (63.1)	783 (52.9)	319 (50.8)	225 (47.1)
Comorbidities					
Diabetes	738 (28.4)	84 (26.8)	337 (22.8)	152 (24.2)	115 (24.0)
Hypertension	1823 (70.1)	252 (80.3)	1032 (69.7)	429 (68.3)	326 (68.1)
Hypercholesterolemia	1660 (63.8)	201 (64.0)	932 (63.0)	359 (57.2)	289 (60.3)
Measurements at examination					
SBP (mmHg)	133 ± 17	135 ± 20	134 ± 18	136 ± 19	137 ± 19
DBP (mmHg)	80 ± 10	82 ± 11	81 ± 11	80 ± 11	80 ± 11
Total cholesterol (mmol/L)	4 ± 1	4 ± 1	4 ± 1	4 ± 1	4 ± 1
HDL (mmol/L)	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0
Hba1c (%) in participants with diabetes	6.9 [6.3, 7.9]	6.8 [6.0, 8.0]	6.7 [6.1, 7.7]	6.8 [6.2, 7.7]	6.4 [5.9, 7.2]
Hba1c (%) in participants without diabetes	5.5 [5.3, 5.8]	5.6 [5.3, 5.8]	5.5 [5.3, 5.7]	5.5 [5.3, 5.7]	5.4 [5.2, 5.7]
eGFR (mL/min/1.73m^2)	79 ± 20	78 ± 19	79 ± 17	78 ± 19	78 ± 18

Values represent numbers (percentages); means ± standard deviations; medians [interquartile ranges].
BMI (body mass index), CABG (coronary artery bypass graft), PCI (percutaneous coronary intervention), MI (myocardial infarction), CVD (cardiovascular disease), SBP (systolic blood pressure), DBP (diastolic blood pressure), HDL (high-density cholesterol), Hba1c (glycated haemoglobin), eGFR (estimated glomerular filtration rate).

Table 2
Patient characteristics of 1848 female EUROASPIRE V participants, by alcohol consumption category.

	Alcohol consumption category				
	Never drinker	Former drinker	0–35 g/week	35–70 g/week	>70 g/week
Total number of participants	1389 (75.2)	39 (2.1)	270 (14.6)	64 (3.5)	86 (4.7)
Age > 65 years	820 (59.0)	25 (64.1)	149 (55.2)	37 (57.8)	49 (57.0)
BMI > 30 kg/m^2	615 (45.6)	22 (56.4)	115 (42.8)	27 (42.2)	28 (33.7)
Type of index event					
CABG	120 (8.6)	7 (17.9)	25 (9.2)	8 (12.5)	6 (7.0)
PCI	999 (71.9)	28 (71.8)	196 (72.6)	52 (81.3)	62 (72.1)
Acute MI without procedure	113 (8.2)	3 (7.7)	15 (5.6)	2 (3.1)	10 (11.6)
Unstable angina without procedure	157 (11.3)	1 (2.6)	34 (12.6)	2 (3.1)	8 (9.3)
Smoking status					
Never smoker	823 (59.3)	18 (46.2)	132 (48.9)	25 (39.1)	35 (40.7)
Former smoker	368 (26.5)	15 (38.5)	103 (38.1)	30 (46.9)	35 (40.7)
Current smoker	198 (14.2)	6 (15.3)	35 (13.0)	9 (14.0)	16 (18.6)
Education					
Low	241 (17.7)	0 (0.0)	34 (12.6)	10 (15.9)	15 (17.4)
Middle	803 (58.9)	28 (71.8)	164 (60.7)	36 (57.1)	46 (53.5)
High	319 (23.4)	11 (28.2)	72 (26.7)	17 (27.0)	25 (29.1)
Physical activity					
Regular physical activity	334 (24.0)	8 (20.5)	82 (30.4)	21 (32.8)	27 (31.4)
Prior CVD event	514 (37.0)	15 (38.5)	97 (35.9)	14 (21.9)	20 (23.3)
Advised to reduce alcohol consumption	727 (52.3)	24 (61.5)	131 (48.5)	35 (54.7)	42 (48.8)
Indicated to have reduced alcohol consumption	679 (48.9)	21 (53.8)	131 (48.5)	29 (45.3)	42 (48.8)
Comorbidities					
Diabetes	491 (35.3)	12 (30.8)	64 (23.7)	13 (20.3)	20 (23.3)
Hypertension	1133 (81.6)	30 (76.9)	184 (68.1)	37 (57.8)	61 (70.9)
Hypercholesterolemia	1208 (87.0)	32 (82.1)	215 (79.6)	51 (79.7)	73 (84.9)
Measurements at examination					
SBP (mmHg)	135 ± 20	131 ± 18	133 ± 18	131 ± 18	137 ± 19
DBP (mmHg)	79 ± 12	80 ± 11	79 ± 11	78 ± 10	79 ± 11
Total cholesterol (mmol/L)	5 ± 1	5 ± 2	5 ± 1	4 ± 1	5 ± 1
HDL (mmol/L)	1 ± 0	1 ± 0	1 ± 0	1 ± 0	1 ± 0
Hba1c (%) in participants with diabetes	7.1 [6.3, 8.3]	7.8 [6.4, 10.5]	6.8 [6.1, 8.6]	7.4 [6.6, 8.8]	6.8 [5.7, 7.8]
Hba1c (%) in participants without diabetes	5.6 [5.4, 5.8]	5.7 [5.5, 5.9]	5.5 [5.3, 5.7]	5.5 [5.3, 5.7]	5.4 [5.2, 5.6]
eGFR (mL/min/1.73m^2)	72 ± 20	74 ± 19	72 ± 19	76 ± 20	75 ± 17

Values represent numbers (percentages); means ± standard deviations; medians [interquartile ranges].
BMI (body mass index), CABG (coronary artery bypass graft), PCI (percutaneous coronary intervention), MI (myocardial infarction), CVD (cardiovascular disease), SBP (systolic blood pressure), DBP (diastolic blood pressure), HDL (high-density cholesterol), Hba1c (glycated haemoglobin), eGFR (estimated glomerular filtration rate).

guidelines, and for participants who were still non-adherent (i.e. excessive drinkers) at the time of report, stratified by European region. Moreover, we calculated the proportion of participants that was incorrectly not advised (i.e. the excessive drinkers who were not advised to reduce alcohol consumption) per region. Lastly, we examined what kind of participants were more often advised to reduce excessive alcohol consumption, by analyzing which determinants independently contributed to the chance of being advised. We performed multivariable logistic regression analysis with "being advised to reduce excessive alcohol consumption" as the outcome variable. As determinants, we included: age > 65, sex, obesity (BMI > 30), smoking status, education level, history of a prior CVD event, diabetes, hypertension and hypercholesterolemia. We performed this analysis both in the total population and in that part of the population that was currently non-adherent to the guidelines (i.e. the currently excessive drinkers).

3. Results

3.1. Participant characteristics

Among 7350 EUROASPIRE participants mean age was 64 years (SD = 9.5), which did not materially differ between European regions. The overall proportion of female participants was 25%. Particularly in Western Europe, this proportion was smaller, with only 19% of the population being female (Supplementary Table 1).

Abstention was reported by 53% of the male participants and 77% of the female participants. As compared to lifetime abstainers and current drinkers, former drinkers more often had a positive history of cardiovascular events before the index event and more often suffered from diabetes or hypertension. Moreover, former drinkers most often reported to have reduced their alcohol consumption (Tables 1 and 2).

3.2. Alcohol consumption per region

Median alcohol consumption in current male drinkers was 53 g/week (25–75 percentile 19–108), which is approximately equal to five standard units per week. Alcohol consumption tended to be the highest in Western and Southern Europe (Fig. 1). Preference for beverage type differed among the European regions: male participants in Southern Europe showed a preference for wine, whereas in the other regions consumption of beer was most prevalent (Fig. 1). Current female drinkers consumed less alcohol than men, with a median consumption of

20 g/week (25–75 percentile 6–60), equal to 2 standard units per week. Wine was the most consumed type of alcoholic beverage in females across all European regions (Fig. 1).

Abstention rates differed per European region. In both men and women, abstention rates were highest in Southern and Eastern Europe. Western Europe showed the highest proportion of moderate to heavy drinkers, followed by Northern Europe (Fig. 2).

3.3. Adherence to guidelines

Overall, 92% of the participants currently adhered to the guidelines. This percentage was lower in Western (83%) and Northern (91%) Europe and higher in Southern (92%) and Eastern (96%) Europe ($p < 0.001$). Men were more often non-adherent (9%) as opposed to women (5%).

Supplementary Fig. 2 shows the proportions of participants advised to reduce alcohol consumption per region, both for currently adherent and currently non-adherent drinkers. The total proportion advised was the lowest in Western Europe (32%), followed by Southern Europe (54%), Northern Europe (57%) and Eastern Europe (70%). In the total population, the proportion that was currently non-adherent and had not been advised, hence the proportion that was incorrectly not advised, was 3%. This percentage was highest in Western Europe (9%) and lowest in Eastern Europe (1%). Percentages in Southern and Northern Europe were equal (both 3%) (Fig. 3).

When studying determinants associated with being advised more often in the total population, we found a number of independent predictors: younger people (< 65 years) were more often advised than older people. Males more often than females, and higher educated participants more often received advice than low educated participants. Moreover, participants with comorbidities or obesity were more often advised to reduce their alcohol consumption (Supplementary Table 2). Similar patterns were found in the non-adherent participants only, however, confidence intervals tended to be wider due to the limited number of participants in this subgroup (Supplementary Table 2).

4. Discussion

In this European cohort of coronary patients with a recent CHD event or procedure, 47% of the male and 23% of the female participants reported current alcohol consumption. Overall adherence to drinking guidelines (i.e. not more than 2 standard units (20 g)/day for men, and not more than 1 standard unit (10 g)/day for women) was 92%. However, this proportion tended to differ between male and female participants (9% of the men were excessive drinkers as opposed to 5% of the women) and European regions, with the highest proportion of both male and female excessive drinkers in Western Europe (17%), followed by Northern (9%), Southern (8%) and Eastern Europe (4%). In the total population, 57% of the participants were advised to reduce alcohol consumption and only 3% were incorrectly not advised. Proportions differed per region, with lowest advice rates in Western Europe: 9% were incorrectly not advised. Younger, male CHD patients and participants with comorbidities or obesity were more often advised to reduce alcohol consumption.

4.1. Strengths and limitations

General population data are available on the epidemiology of alcohol consumption in Europe, for example in the World Health Organization (WHO) reports on alcohol burden worldwide [2] and in Europe specifically [23]. However, to our knowledge, this is the first report that describes and compares alcohol consumption in a subpopulation of CHD patients across European regions. Additionally, we assessed and quantified adherence to current guidelines both by health professionals and patients.

An important limitation is that we did not have information on alcohol consumption patterns prior to the index event. Additionally, presumably a proportion of the participants has misinterpreted the adherence questions, answering affirmatively if *any* advice on alcohol consumption was given and not only advice on *excessive* consumption. Therefore, we cannot be certain which participants were former excessive drinkers and we can only compare *currently* adherent and *currently* non-adherent participants. It is likely that the proportion that was correctly advised is actually higher in the adherent group, because this group also contains the participants who did not need to be advised as they were already adherent before the index event. Likewise, the proportion advised in the non-adherent drinkers is likely to be higher, as the majority of correctly advised excessive drinkers probably became part of the currently adherent group. Generally, these misclassifications will have led to an underestimation of adherence to the guidelines. However, we were still able to make between-region comparisons.

Furthermore, the limited number of current alcohol consumers in the

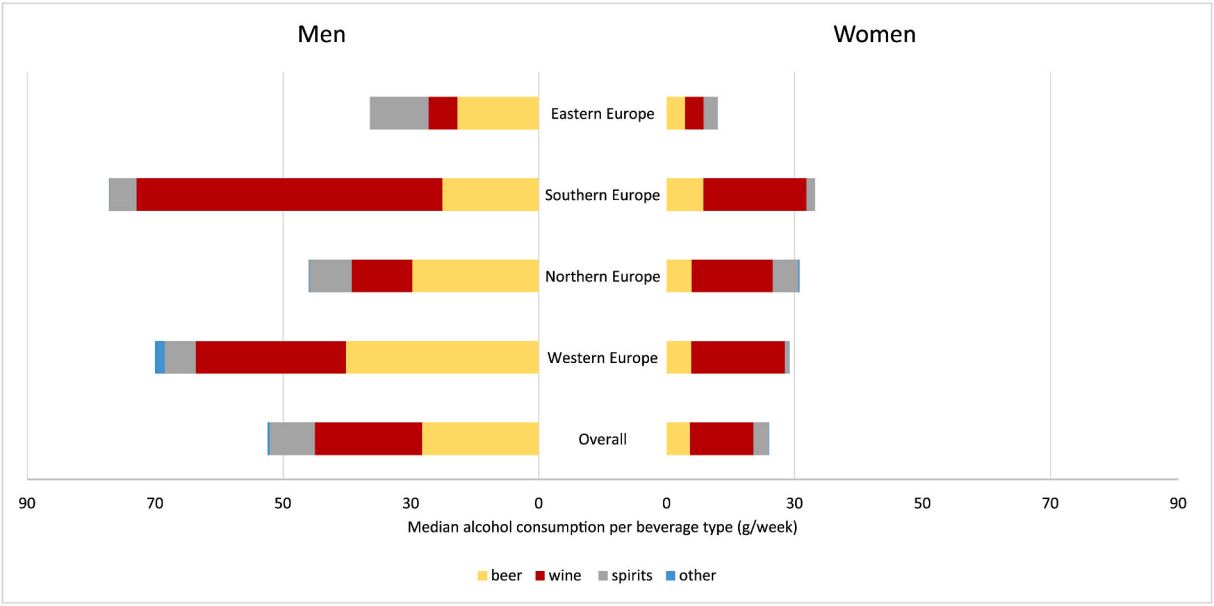

Fig. 1. Median alcohol consumption per beverage type in 2468 male and 398 female current drinkers with a recent coronary event, by European region.

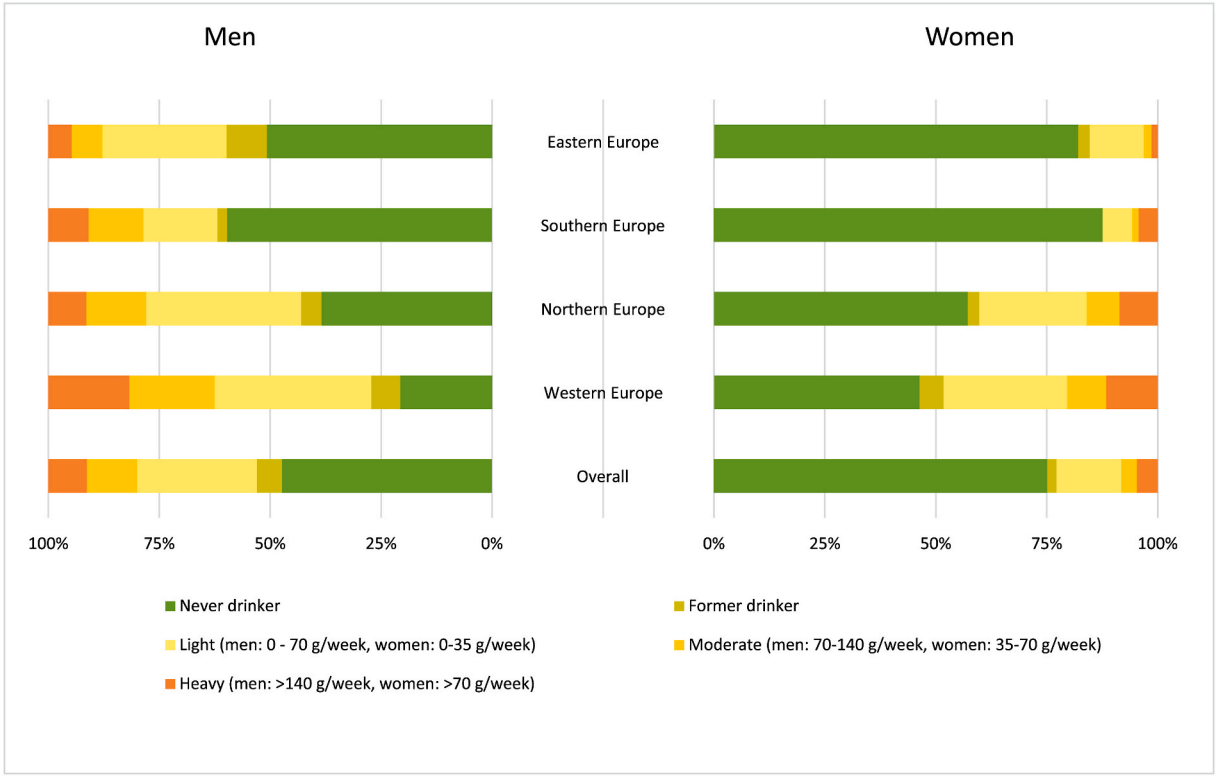

Fig. 2. Distribution of 5502 male and 1848 female participants in alcohol consumption categories, by European region.

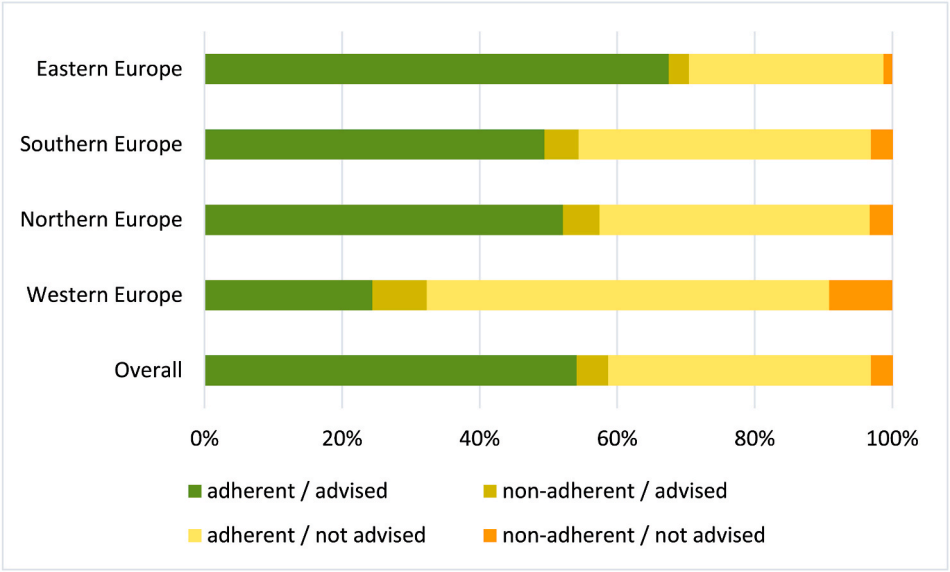

Fig. 3. Distribution of advice given in currently adherent and currently non-adherent participants.
The proportion non-adherent/not advised is the proportion of the total population that is incorrectly not advised.

survey forced us to describe the alcohol consumption per region, instead of per country. There is substantial heterogeneity between European countries regarding drinking patterns and definition of a standard unit. Since the questionnaire only provided one definition of a standard drink, the total amount of alcohol consumed might be underestimated or overestimated in some countries. Moreover, a quantity-frequency questionnaire like the one we used is a valid instrument to measure regular alcohol consumption, but tends to underestimate heavy episodic drinking [24]. In regions where this consumption pattern is more prevalent, for example in Eastern Europe [23], alcohol consumption might have been underestimated. Lastly, the low interview response rate (56%) might have led to an underestimation of the true alcohol consumption, as it is likely that the non-responders more often have an unhealthier lifestyle, including heavy or dependent drinking [24,25].

4.2. Comparison with other surveys

Previous studies have described alcohol consumption patterns in

CVD patients specifically and found comparable current drinking rates [26,27]. Helfand et al. compared alcohol consumption patterns in women having had a myocardial infarction with healthy women in the United States and reported that only 24% of the post-MI women were current drinkers as compared to 46% of the healthy women [17]. This is in line with the proportion of current female drinkers that we found in our European cohort (22%). In another study in two cohorts of older Europeans, differences in current drinking rates between post-myocardial patients and healthy peers were found as well, being most pronounced in women (34% current drinkers in CVD patients *vs* 51% in healthy participants in females compared to 71% *vs* 79% in males) [18]. To our knowledge, no data are available on consumption patterns in CHD patients per European region. Therefore, we compared our data to the WHO European data on alcohol consumption in the general population. According to the WHO report, most alcohol is consumed in Eastern Europe, followed by Western Europe. This differs from our results in which alcohol consumption in Eastern Europe was actually lowest in CHD patients. The WHO uses aggregate data on recorded alcohol consumption (e.g. sales data) instead of self-reported consumption, in this way capturing also heavy episodic drinking. This might be one of the reasons for the differences we found.

In general, adherence to consumption guidelines was high and the proportion that was incorrectly not advised was rather small. Both health professionals advising on consumption limits and CHD patients following this advice seem to do well in adhering to the European recommendations. However, still 1 out of 11 male CHD patients drinks excessively, so there is definitely more to gain regarding risk factor control. Interestingly, the proportion of participants that was advised to reduce alcohol consumption was the lowest in the regions where the proportion of excessive drinkers was highest. This calls for further exploration of perceptions on alcohol consumption of health professionals and patients in these regions. As an example, previous research has shown that smoking status of the health professional influences his perspective on smoking cessation: physicians who smoked are less likely to advise their patients to quit smoking [28–30]. Moreover, prevalence of smoking among physicians varies widely per country [31]. It would be interesting to explore whether the same principle holds for alcohol consumption and if it could partly explain our findings.

4.3. Conclusion

In conclusion, in this European cohort of CHD patients, the majority of participants currently adhered to the alcohol consumption levels recommended by the European guidelines, and alcohol consumption was lower as compared to the general population. Only a minor fraction of the CHD patients was incorrectly not advised to reduce excessive consumption. However, there is substantial heterogeneity in Europe. Most remarkable is the finding that in regions where alcohol consumption is the highest, participants are less often advised to reduce their consumption than in neighboring regions in which excessive drinking is less prevalent.

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Author contributions

IvdL contributed to the analysis and interpretation of the work and drafted the manuscript. DDB, KK and DG contributed to conception and design, data acquisition, analysis and interpretation and critically revised the manuscript. EM, NP, KD and MD contributed to conception and design and data acquisition, and critically revised the manuscript. IS, SvO, AvB and JB contributed to analysis and interpretation and critically revised the manuscript. All gave final approval and agree to be accountable for all aspects of work ensuring integrity and accuracy.

Declaration of competing interest

The authors declared the following potential conflicts of interest with respect to the research, authorship and/or publication of this article: KK had research grant support from the European Society of Cardiology to Imperial College London for the EUROASPIRE V survey. IvdL, DDB, DG, KD, MD, EM, NP, SvO, JB, IS and AvB have no financial interests that are relevant to the submitted work.

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Appendix A. Supplementary data

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