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ORIGINAL RESEARCH

Alcohol and educational inequalities: Hazardous drinking prevalence and all-cause mortality by hazardous drinking group in people aged 50 and older in Europe

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ABSTRACT

Background: We examined educational inequalities in hazardous drinking prevalence among individuals aged 50 or more in 14 European countries, and explored educational inequalities in mortality in hazardous drinkers in European regions. *Methods:* We analyzed data from waves 4, 5 and 6 of the Survey of Health Ageing and Retirement in Europe (SHARE). We estimated age-standardized hazardous drinking prevalence, and prevalence ratios (PR) of hazardous drinking by country and educational level using Poisson regression models with robust variance. We estimated the relative index of inequality (RII) for all-cause mortality among hazardous drinkers and non-hazardous drinkers using Cox proportional hazards regression models and for each region (North, South, East and West). *Results:* In men, educational inequalities in hazardous drinking were not observed (PR_{medium} = 1.09 [95%CI: 0.98–1.21] and PR_{high} = 0.99 [95%CI: 0.88–1.10], ref. low), while in they were observed in women, having the highest hazardous drinking prevalence in the highest educational levels (PR_{medium} = 1.28 [95%CI: 1.15–1.42] and PR_{high} = 1.53 [95%CI: 1.36–1.72]). Overall, the Relative Index of Inequality (RII) in all-cause mortality among hazardous drinkers was 1.12 [95%CI: 1.03–1.22] among men and 1.10 [95%CI: 0.97–1.25] among women. Educational inequalities among hazardous drinkers were observed in Eastern Europe for both men ($RII_{hazardous}$ = 1.21 [95%CI: 1.01–1.45]) and women ($RII_{hazardous}$ = 1.46 [95%CI: 1.13–1.87]). Educational inequalities in mortality among non-hazardous drinkers were observed in Southern, Western and Eastern Europe among men, and in Eastern Europe among women. *Conclusions:* Higher educational attainment is positively associated with hazardous drinking prevalence among women, but not among men in most of the analyzed European countries. Clear educational inequalities in mortality among hazardous drinkers were only observed in Eastern Europe. Further research on the associations between alcohol use and inequalities in all-cause mortality in different regions is needed.

KEYWORDS
Alcohol; middle-aged; SEP differences; hazardous drinking; Europe

Introduction

Educational inequalities in health reflect differences in opportunities for maintaining good health between people with different educational attainment.[1,2] Most of the studies in Europe that have analyzed the relationship between socioeconomic position (SEP) and alcohol consumption focused on educational inequalities, and provided overall mixed results on the associations between educational attainment and alcohol consumption.[3,4] This relationship depends on several variables such as country, age, gender,[5–8] as well as on the different ways of measuring alcohol use in a population (e.g., binge drinking, hazardous drinking), given that their prevalence may vary among socioeconomic groups.[5,9]

The health complications related to alcohol consumption are associated with SEP, whereas most of the previous research found worse morbidity and mortality indicators among the groups with disadvantaged SEP.[10–13] Therefore, this suggests alcohol to be an important contributor to all-

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STL, MBP and AE conceptualized and designed the research study. STL analyzed the data and wrote the first draft. All authors discussed the results and contributed to the final manuscript.

cause mortality inequalities, as it has been recently shown in recent publications using data from Nordic countries and the United Kingdom.[14,15] Additionally, inequalities in alcohol-related harm could be age-specific as overall alcohol consumption and drinking patterns have been changing across generations in most European countries.[16]

Alcohol use and ageing is an issue of growing relevance for public health in European societies[17,18] as its population is ageing rapidly. In this context, middle and older generations play a central role in society. In Europe, both the hazardous drinking prevalence among population aged 50+ (one in five people) and total mortality attributable to alcohol are high and with important differences between countries.[5,19] Furthermore, middle and old age groups have the highest alcohol-related mortality rates and therefore the highest number of deaths due to alcohol.[20,21]

SEP inequalities in alcohol consumption can be studied using several indicators of SEP including highest completed education or current (household) income. As alcohol drinking patterns over the life course are typically shaped at adolescence and younger adulthood,[22,23] partly during schooling, education represents an insightful SEP variable when examining alcohol consumption in adult and older populations. Indeed, education has been most commonly used as SEP variable in most of the studies examining this relationship using health survey data.[3,4,8] Despite this clear growing evidence on the importance of alcohol use and their consequences at older ages, previous studies on the topic were mostly focused on the adult population and did not distinguish the older population.[8,11–13,24] The studies focusing on alcohol consumption among middle and older aged individuals neither focused on interpreting the results on differences in alcohol consumption by socioeconomic position nor analyzed mortality follow-up.[5,6,25–27] We hypothesize that educational inequalities in alcohol consumption among middle-age and old individuals in Europe may not necessarily be consistent between populations.

We examined educational inequalities in hazardous drinking among individuals aged 50 or more in 14 European countries and explored educational inequalities in all-cause mortality by hazardous drinking group in European regions.

Methods

We used cross-sectional and longitudinal data from individuals aged 50–85 from the Survey of Health, Ageing and Retirement in Europe (SHARE)[28,29] for 14 countries (Austria, Belgium, Czech Republic, Denmark, Estonia, France, Germany, Italy, Luxembourg, the Netherlands, Slovenia, Spain, Sweden, Switzerland). For the cross-sectional analysis on alcohol prevalence we used data from wave 5, except for the Netherlands that we used data from wave 4 as data from wave 5 were unavailable. For the longitudinal analysis on all-cause mortality we used data from waves 4 (2011) and 5 (2013), with around 2-year mortality follow-up (measured in months and reported by a relative in waves 5 (2013) and 6 (2015), respectively). All countries obtained a probabilistic sample, although the sample design differed slightly between countries. Country-specific data were clustered into European regions according to drinking cultures: North (Sweden and Denmark); West (Austria, Belgium, Germany, Luxembourg, the Netherlands, and Switzerland); South (France, Italy and Spain) and East (Czech Republic, Estonia, and Slovenia), following previous research.[30] The analyses included complete data on all variables. The cross-sectional complete case sample size was 57,650 after excluding 903 cases with missing variables (1.5%). The longitudinal sample was derived from over 100,000 observations (20.2% of attrition at follow-up) accounting for 159,132 person-years at risk (Figure 1).

The outcome variable was hazardous drinking, which is generally defined as "quantity or pattern of alcohol consumption that places people at risk for adverse health events."[31] Hazardous drinking was estim-

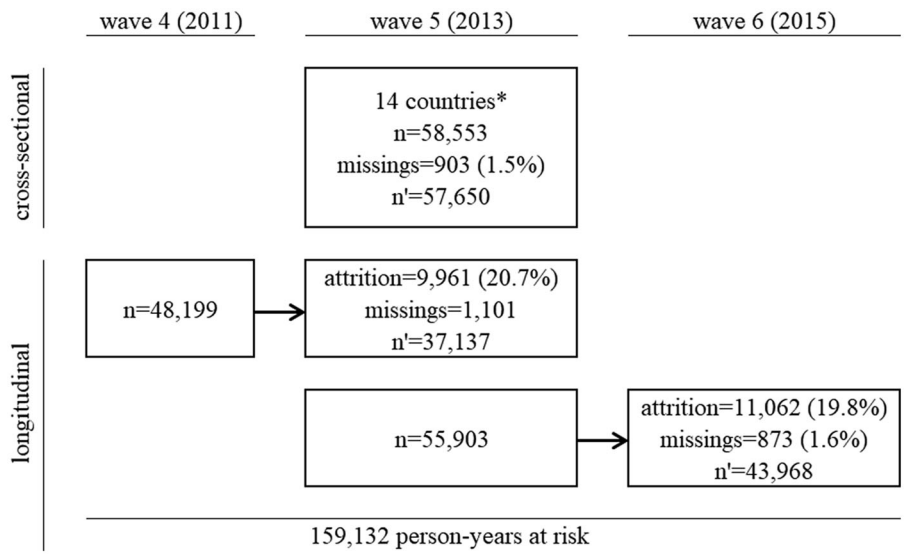

Figure 1. Flowchart of the SHARE data for the cross-sectional analysis on alcohol prevalence and for the longitudinal analysis on all-cause mortality used in the study. *Data from the Netherlands come from wave 4.

ated using three questions of the SHARE questionnaire adapted to the Alcohol Use Disorders Identification Test, Consumption (AUDIT-C). This indicator was based on three survey questions related to frequency of alcohol use (During the last three months how often did you drink any alcoholic beverage?), quantity of alcohol consumption (On the days you drank, about how many drinks do you have?), and binge drinking (In the last three months, how often did you have six or more drinks in one occasion?).[32] Each answer was ranked from 0 to 4 points, from low to high alcohol drinking frequency and quantity, and the final score was computed as the sum of the three scores. Men and women who scored ≥5 and ≥4 points, respectively, were classified as hazardous drinkers.[25,32]

Educational level, age, country of residence, self-reported health (excellent, very good or good, fair or poor), and smoking (yes, no) were the independent variables. Educational level was based on the highest educational degree obtained and reclassified into the International Standard Classification of Education (ISCED) of 1997, and it was categorized as follows: low (ISCED 1–2), medium (ISCED 3–4) or high (ISCED 5–6).

Analyses

All analyses were carried out separately for men and women. The sample distribution was calculated for each variable. We estimated age-standardized (direct method) hazardous drinking prevalence by country for each educational level and their corresponding 95% confidence interval (95%CI) using as standard the European population from the 2011 census from Eurostat. Subsequently, we fit several sex- and country-specific Poisson regression models with robust variance to obtain prevalence ratios (PR) of hazardous drinking[33,34] by educational level, adjusting for age and self-reported health and using the cross-sectional standard weights provided by SHARE.

For the mortality analyses, we used the European region-specific longitudinal sample. To examine educational inequalities in all-cause mortality among hazardous drinkers or non-hazardous drinkers, we used the relative index of inequality (RII), which considers all educational groups—from 0 to 6 in the ISCED-1997—and assumes a linear relationship between educational level and mortality. In other words, the RII represents the relative risk between two hypothetical extremes of the socioeconomic hierarchy, and it captures "the linear associations across the entire socioeconomic scale."[33] The RII was estimated applying Cox regression models[35] adjusting by age, country of residence, self-reported health and smoking. All data preparation and statistical analyses were performed in R 3.5.1 in R Studio 1.1.463.

Ethics

The SHARE project is subject to continuous ethics review. Wave 4 and the continuation of the project were reviewed and approved by the Ethics Council of the Max Planck Society. In addition, the country implementations of SHARE were reviewed and approved by the respective ethics committees or institutional review boards whenever this was required. The numerous reviews covered all aspects of the SHARE study, including sub-projects and confirmed the project to be compliant with the relevant legal norms and that the project and its procedures agree with international ethical standards. Please see overview and summary of the ethics approvals for more information.[36]

Results

A description of the characteristics of the cross-sectional data by sex is presented in Table 1. Of the total number of participants, 45% were men, 70% were ≥60 years, 61% had completed at least a medium or high educational degree (ISCED-1997) and 22% were hazardous drinkers, and roughly three out of four reported good or excellent health. Table 2 presents a description of the longitudinal data. We observed 1,476 deaths in 69,926 person-years at risk among men, and 1,036 deaths in 89,106 person-years at risk among women. The crude mortality rates were 21.1 per 1,000-person years in men and 11.6 per 1,000-person years in women. Details on the distribution of the data by region and sex are presented in Table 2.

The hazardous drinking prevalence at ages 50–85 (average of the 14 European countries studied) was for men 22.3% (95%CI: 21.3–23.3) among the lowest educated group, 27.3% (26.3–28.4) among the middle-educated group and 24.8% (23.6–25.9) among the highest educated group (Table 3). This suggested an inverse U-shape relationship between hazardous drinking and education. After adjusting for self-reported health and smoking, PRs showed no significant educational inequalities in hazardous drinking among men (PR_{medium} = 1.10 [95%CI: 1.00–1.22] and PR_{high} = 1.02 [95%CI: 0.91–1.15], ref. low). For women, hazardous drinking prevalence were 15.8% (15.1–16.6), 19.3% (18.5–20.1) and 25.1% (23.9–25.9) for the lowest, middle and highest educated group, respectively. Overall, inequalities in hazardous drinking were found among women with middle and higher educated groups showing higher hazardous drinking prevalence as compared to those with low education (PR_{medium} = 1.27 [95%CI: 1.15–1.41] and PR_{high} = 1.53 [95%CI: 1.39–1.75]).

The hazardous drinking prevalence was heterogeneous across the countries and educational levels. Among men, it ranged from 11.5% (95%CI: 8.5–14.5) among higher educated Swedish to 48.3% (43.3–53.3) among higher educated Danish. Among women, it ranged from 5.3% (4.2–6.3) among middle educated Estonians to 46.5% (42.1–50.9) among higher educated Danish. Among men, the results from the PRs suggested higher hazardous drinking prevalence among middle and higher educated groups in Denmark, Luxembourg (only higher educated group), and France (only middle educated group). Among women, country-specific results followed the overall result of higher hazardous drinking prevalence among middle and higher educated groups—and higher PRs—except in Eastern

Table 1. Characteristics of the cross-sectional data from the Survey of Health Ageing and Retirement in Europe, wave 5,* ages 50–85.

	Men ($n = 26,314$)				Women ($n = 32,239$)			
	Low (ISCED 0–2)	Medium (3–4)	High (5–6)	Missings	Low (ISCED 0–2)	Medium (3–4)	High (5–6)	Missings
Age								
50–59	1,957	3,326	1,958	66	2,838	4,136	2,724	146
60–69	3,164	3,970	2,539	205	4,298	4,451	2,402	174
70–85	3,998	3,055	1,923	153	6,103	3,247	1,561	159
Country								
North	994	1,517	1,267	69	1,178	1,408	1,702	73
Denmark	254	834	722	21	452	668	939	16
Sweden	740	683	545	48	726	740	763	57
West	10,023	11,840	12,367	11,879	11,901	7,949	2,900	192
Austria	230	977	550	23	720	1,063	527	42
Belgium	880	614	863	37	1,150	783	900	43
Luxembourg	277	286	168	3	436	251	121	1
Germany	164	1,451	962	30	515	1,660	642	19
Netherlands	433	324	373	53	751	343	314	59
Switzerland	151	870	280	24	380	949	204	28
South	4,183	1,503	915	148	5,317	1,565	946	168
France	616	741	406	47	1,041	763	466	58
Italy	1,437	422	184	22	1,722	504	182	25
Spain	2,130	340	325	79	2,554	298	298	85
East	5,695	6,680	7,683	7,972	7,981	5,189	1,377	46
Czech Republic	810	1,060	353	30	1,277	1,463	340	42
Estonia	704	1,048	457	1	870	1,671	736	0
Slovenia	293	701	232	6	645	678	255	4
Alcohol								
Hazardous	1,954	2,830	1,794	108	1,974	2,233	1,779	96
Non-hazardous	7,082	7,445	4,576	294	11,191	9,538	4,864	366
Missings	83	76	50	22	74	63	44	17
Self-reported health								
Good, very good or excellent	7,396	7,617	3,833	308	11,151	8,688	3,906	353
Fair or poor	1,707	2,714	2,575	98	2,063	3,132	2,768	111
Missings	16	20	12	18	25	14	13	15
Smoking								
Yes	2,013	2,438	1,034	88	1,904	2,205	958	69
No	7,080	7,899	5,378	317	11,308	9,618	5,716	393
Missings	26	14	8	19	27	11	13	17

*Data from the Netherlands come from wave 4.

Table 2. Person-years at risk and total deaths in the longitudinal Survey of Health, Ageing and Retirement in Europe (SHARE) sample, waves 4–6, ages 50–85.

	Person years at risk	Total deaths	Death rates (per 1,000)
Men			
West	24,185	327	13.5
North	8,525	138	16.2
South	18,339	414	22.6
East	18,877	597	31.6
Total	69,926	1,476	21.1
Women			
West	29,354	243	8.3
North	9,917	106	10.7
South	22,324	282	12.6
East	27,510	405	14.7
Total	89,106	1,036	11.6

Europe, Italy, and Switzerland where educational inequalities in hazardous drinking prevalence were not observed.

In terms of mortality, educational inequalities in total mortality were observed in the pooled European sample, irrespective of the hazardous drinking condition (see Figure 2). Overall, for men, the relative index of inequality (RII) was 1.12 (95%CI: 1.03–1.22) among hazardous drinkers and 1.16 (1.11–1.20) among non-hazardous drinkers, while for women these results were RII = 1.10 (0.97–1.25) and RII = 1.09 (95%CI: 1.04–1.14), respectively. Educational inequalities in mortality were observed in Eastern Europe irrespective of gender and hazardous drinking (men: $RII_{hazardous} = 1.21$ [95%CI: 1.01–1.44], $RII_{non\text{-}hazardous} = 1.17$ [95%CI: 1.08–1.26]; women: $RII_{hazardous} = 1.46$ [95%CI: 1.13–1.87], $RII_{non\text{-}hazardous} = 1.19$ [95%CI: 1.09–1.30]). Educational inequalities in mortality were also observed among non-hazardous drinking men in Southern, Western, and Eastern Europe, and among women in Eastern Europe. Finally, no evidence was found on educational inequalities in mortality in the remaining hazardous drinking-, gender-, region-specific groups.

Discussion

In this study we examined educational inequalities in hazardous drinking and in mortality among hazardous drinkers among Europeans aged 50 years old or over. The two main findings of this study are (1) Educational inequalities in the hazardous drinking prevalence—higher hazardous drinking among those with high levels of education—were found in women but not in men, with some country-specific exceptions; and (2) educational inequalities in all-cause mortality among hazardous drinkers (for both men and women) were found in Eastern Europe, but not in Southern, Northern and Western Europe, whereas educational inequalities in mortality among non-hazardous drinkers were observed in Southern, Western and Eastern Europe among men, and in Eastern Europe among women.

Table 3. Age-Adjusted Prevalence and Prevalence Ratio of Hazardous drinking by educational level, Survey of Health, Ageing and Retirement in Europe (SHARE), wave 5*, ages 50–85.

	Hazardous drinking prevalence (%)			Prevalence ratio (PR, ref. Low)**	
	Low (ISCED 0–2)	Medium (3–4)	High (5–6)	Medium (3–4)	High (5–6)
Men					
North	17.8 (14.9–20.7)	25.2 (22.9–27.6)	28.9 (26.1–31.7)	**1.75 (1.43–2.13)**	**2.05 (1.68–2.50)**
Denmark	33.7 (26.6–40.8)	42.4 (38.0–46.8)	48.3 (43.3–53.3)	**1.31 (1.07–1.59)**	**1.49 (1.22–1.81)**
Sweden	12.7 (9.5–15.9)	12.9 (10.1–15.7)	11.5 (8.5–14.5)	1.11 (0.76–1.64)	1.23 (0.82–1.85)
West	28.5 (26.1–30.8)	27.9 (26.4–29.4)	26.2 (24.5–27.9)	0.98 (0.86–1.11)	0.97 (0.84–1.11)
Austria	20.6 (15.1–26.2)	31.8 (27.9–35.6)	25.8 (21.5–30.1)	1.13 (0.84–1.51)	1.02 (0.74–1.41)
Belgium	33.0 (29.0–37.1)	34.7 (30.0–39.3)	36.5 (32.6–40.5)	1.04 (0.86–1.27)	1.13 (0.95–1.35)
Luxembourg	20.2 (14.8–25.5)	28.3 (21.9–34.7)	31.8 (23.3–40.4)	1.31 (0.95–1.79)	**1.54 (1.09–2.18)**
Germany	20.2 (13.7–26.8)	25.7 (23.1–28.4)	23.7 (20.7–26.6)	1.19 (0.86–1.64)	1.18 (0.84–1.64)
Netherlands	32.9 (27.2–38.6)	42.3 (34.8–49.8)	35.2 (29.0–41.5)	1.22 (0.98–1.53)	1.06 (0.84–1.33)
Switzerland	21.1 (14.7–27.5)	26.4 (23.2–29.7)	21.3 (16.0–26.6)	1.15 (0.85–1.55)	0.85 (0.59–1.24)
South	20.1 (18.7–21.5)	26.9 (24.1–29.6)	21.7 (18.8–24.7)	**1.34 (1.15–1.57)**	1.10 (0.90–1.35)
France	24.6 (20.7–28.6)	31.3 (27.2–35.4)	24.3 (19.7–29.0)	**1.27 (1.03–1.57)**	0.99 (0.76–1.29)
Italy	19.8 (17.5–22.2)	17.6 (13.6–21.6)	13.2 (8.5–18.0)	0.91 (0.68–1.23)	0.81 (0.53–1.24)
Spain	17.4 (15.5–19.3)	28.5 (22.1–34.9)	18.3 (14.0–22.6)	1.22 (0.73–2.04)	1.06 (0.57–1.95)
East	34.7 (31.6–37.8)	30.6 (28.4–32.9)	26.4 (23.0–29.8)	0.85 (0.71–1.03)	0.81 (0.65–1.01)
Czech Republic	38.6 (34.1–43.1)	35.0 (31.3–38.6)	33.1 (26.9–39.4)	0.88 (0.72–1.07)	0.89 (0.70–1.15)
Estonia	25.9 (21.7–30.0)	26.4 (23.2–29.7)	19.9 (15.8–24.0)	0.95 (0.79–1.15)	0.84 (0.65–1.09)
Slovenia	13.2 (9.5–17.0)	14.6 (11.8–17.4)	13.3 (8.6–18.0)	0.90 (0.60–1.35)	0.93 (0.54–1.59)
Total	22.3 (21.3–23.3)	27.3 (26.3–28.4)	24.8 (23.6–25.9)	1.10 (1.00–1.22)	1.02 (0.91–1.15)
Women					
North	15.1 (12.9–17.3)	19.6 (17.5–21.7)	27.3 (25.0–29.6)	**1.49 (1.23–1.80)**	**2.03 (1.69–2.44)**
Denmark	30.1 (24.9–35.3)	34.0 (29.7–38.4)	46.5 (42.1–50.9)	**1.25 (1.04–1.51)**	**1.66 (1.38–1.98)**
Sweden	7.4 (5.4– 9.3)	11.1 (8.9–13.4)	13.7 (11.1–16.3)	**1.62 (1.10–2.37)**	**1.98 (1.35–2.92)**
West	16.4 (15.3–17.6)	19.1 (18.0–20.2)	24.2 (22.6–25.8)	**1.19 (1.03–1.37)**	**1.50 (1.29–1.76)**
Austria	9.3 (7.1–11.4)	16.5 (14.0–19.0)	23.9 (19.8–28.1)	**1.64 (1.21–2.21)**	**2.55 (1.86–3.49)**
Belgium	21.0 (18.4–23.6)	30.1 (26.3–33.9)	36.8 (32.9–40.7)	**1.51 (1.26–1.82)**	**1.77 (1.49–2.10)**
Luxembourg	14.6 (11.3–18.0)	22.9 (16.9–29.0)	30.6 (21.1–40.0)	**1.48 (1.05–2.07)**	**2.01 (1.37–2.97)**
Germany	10.2 (7.6–12.9)	16.5 (14.6–18.4)	19.0 (15.7–22.3)	**1.50 (1.11–2.03)**	**1.65 (1.18–2.31)**
Netherlands	25.1 (21.6–28.7)	34.1 (28.0–40.2)	41.3 (34.7–47.9)	**1.38 (1.11–1.71)**	**1.90 (1.55–2.32)**
Switzerland	26.7 (21.7–31.6)	28.8 (25.5–32.1)	28.7 (21.8–35.6)	1.12 (0.92–1.37)	1.13 (0.85–1.51)
South	15.9 (14.8–17.1)	21.5 (19.2–23.8)	27.4 (23.8–31.0)	**1.31 (1.12–1.53)**	**1.63 (1.35–1.96)**
France	19.4 (16.8–22.0)	21.8 (18.5–25.1)	30.1 (25.0–35.3)	1.11 (0.90–1.38)	**1.53 (1.23–1.91)**
Italy	17.6 (15.7–19.5)	19.2 (15.6–22.8)	18.0 (12.0–24.1)	1.06 (0.83–1.36)	0.85 (0.56–1.29)
Spain	10.1 (8.9–11.3)	21.8 (16.7–27.0)	22.0 (16.4–27.6)	**2.10 (1.23–3.58)**	**2.34 (1.37–4.01)**
East	14.1 (12.3–15.8)	13.2 (11.9–14.5)	16.0 (13.5–18.5)	1.07 (0.75–1.51)	1.04 (0.66–1.64)
Czech Republic	15.6 (13.0–18.1)	15.2 (13.2–17.2)	22.6 (17.8–27.5)	1.15 (0.77–1.70)	1.17 (0.67–2.05)
Estonia	8.2 (5.6–10.7)	5.3 (4.2– 6.3)	6.8 (4.9– 8.7)	0.85 (0.58–1.26)	1.07 (0.70–1.64)
Slovenia	8.4 (6.3–10.5)	8.0 (6.0–10.1)	8.9 (5.5–12.3)	0.91 (0.60–1.36)	0.95 (0.55–1.61)
Total	15.8 (15.1–16.6)	19.3 (18.5–20.1)	25.1 (23.9–25.9)	**1.27 (1.15–1.41)**	**1.56 (1.39–1.75)**

*Data from the Netherlands come from wave 4.
**PR adjusted by age and self-reported health.
PR statistically significant at the 95% confidence levels are indicated in bold.

Before discussing our results further, we would like to highlight some of the strengths and limitations of our study. The first phase of this study was carried out using a large representative sample of the European population aged 50–85 years old, and in the second phase we used a longitudinal study. As typically done, the hazardous drinking prevalence was estimated based on self-reported data. We adapted the SHARE questions to the AUDIT-C test, which has been validated and is widely used to detect hazardous drinkers,[37,38] as previously used in several scientific publications.[5,6,9,25,33,39] This hazardous drinking definition based on AUDIT-C has the advantage to simultaneously capture the two main dimensions of the harmful effects of alcohol on health: levels and patterns of drinking.[40] Alternatively, we could have used other definitions, for example, binge drinking (reported to have had at least six drinks in a single occasion over the last three months). However, using binge drinking in a sample of old individuals may not accurately reflect alcohol drinking patterns in Southern European countries.[41] Nonetheless, in a sensitivity analysis we show comparable associations between education and binge drinking among men (see Table S1). Among women, binge drinking prevalence was lower as compared to hazardous drinking prevalence, and educational inequalities were less clearly observed for binge drinking. Again, this seems related to the fact that women with a hazardous drinking alcohol consumption do not necessarily binge drink. Another limitation refers to the grouping of countries, as we observed important differences in hazardous drinking prevalence between countries from the same region (e.g., North and East). For mortality, however, country-specific results seemed more in line with region-specific results (except for Northern European countries for women) (Table S2).

A shared limitation in longitudinal studies is the loss at follow-up (or attrition). In our case, because of the relatively short follow-up time/period (around 2 years) we could follow >75% of the cases, either survey follow-up or mortality follow-up (end-of life interview with a proxy-resident). In addition, as most health surveys, the SHARE sample is selected as eligible population excluded institutionalized groups. Nonetheless, a comparison of SHARE mortality data

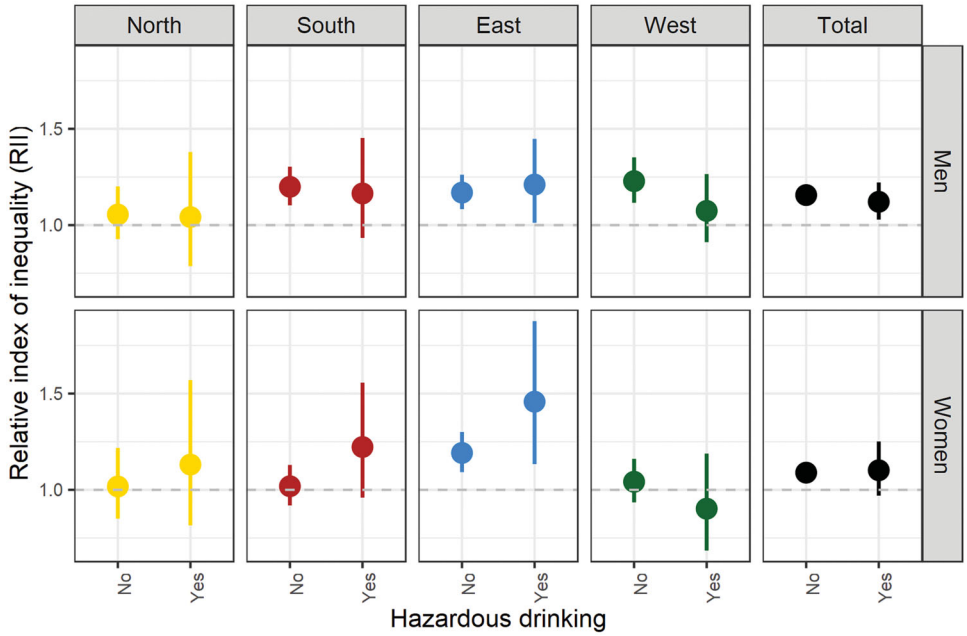

Figure 2. Association between educational attainment and age-adjusted mortality by hazardous drinking group and European region*. *North: Denmark and Sweden; West: Austria, Belgium, Luxembourg, Germany, the Netherlands and Switzerland; South: France, Italy and Spain; and East: Czech Republic, Estonia and Slovenia. Country-specific results are presented in Table S2. The bars indicate the 95% CI.

with mortality register data suggests SHARE mortality to be slightly lower than population level mortality.[42] Finally, we have only used education as an indicator of SEP, which has some limitations. For example, education is a more static measure compared to income, and is, therefore, less able to capture changes in SEP over the life course at adult ages. Furthermore, education may be a less sensitive measure for evaluating the magnitude of social inequalities in health as compared to income.[1] Nonetheless, most individuals adopt their drinking behaviors and finish their studies at adolescence or young adulthood, and those drinking behaviors at younger adulthood tend to predict alcohol use over the life course.[22,23] All in all, as for the mortality analyses these results are, to our knowledge, the first attempt to study the associations between educational attainment and all-cause mortality grouped by hazardous drinking group (yes, no) among the population aged 50 years old and over in a cross-region comparison in Europe. Therefore, we acknowledge that our mortality results are not necessarily reflecting population level mortality dynamics and should be taken cautiously because of the attrition and relatively small sample size.

This study used a sample of middle aged and older European, whereas previous pan-European studies focusing on socioeconomic differences in alcohol consumption frequently used samples of adults (aged 25 years and over, with different cut off ages), different alcohol consumption measures and presented mixed results.[3,4] Our results showing higher educational attainment to be positively associated with higher hazardous drinking prevalence among women and not among men are consistent with previous research using a sample from adult ages.[3] Our results for men on the lack of educational inequalities in hazardous drinking contrast with earlier findings based on data from the early 2000s, which found that higher individual socioeconomic position was positively associated with alcohol drinking status.[4] These differences seem explained by both differences between the studies in the age groups included and the use of one or another alcohol use definition.

Our findings on a clear distribution of hazardous drinking by educational level among women but not among men may be explained, as happened with tobacco, by the theory of diffusion of innovations.[43] According to this perspective, alcohol use in the population may have started in men with higher educational level, expanding later to men with lower educational level, afterwards to women with higher educational level and, finally, to those women with lower educational level.[44] This explanation is in line with a comparison between our results and previous research among working age adults from the late 1990s which found higher binge drinking prevalence among men from high SEP as compared to their lower SEP counterparts.[45] Indeed, supplementary analyses stratifying by age suggested that higher hazardous drinking prevalence among higher educated groups was observed in older men (ages 65–85) in the whole sample and in seven out of the 14 countries included in this study (see Supplementary material, Tables S3 and S4). Thus, this seems to indicate that hazardous drinking has spread out across all SEP groups among men, particularly for those aged 50–64, which suggest cohort effects in alcohol use. This theory seems to be also applicable to women as the increase in alcohol consumption among women seems to have occurred first in countries with high levels of women's labor force participation and high gender equality.[4,6] In line with that, the spread of alcohol use among women spread out later in time, and we would be in a stage that women from low SEP could be expected to increase their hazardous drinking prevalence as a consequence of women's empowerment.[6] Evidence from younger cohorts suggest that the relationship between socioeconomic position and alcohol

consumption has changed, as for example family SEP has not been associated with adolescents alcohol consumption.[7]

Country-specific results are interesting but also more difficult to be compared with previous research as SEP differences in hazardous drinking have rarely been analyzed among older European populations. For men, the country-specific exceptions were found in Denmark and in Luxembourg, where those with higher education had higher hazardous drinking prevalence. In Denmark, our results contrast with a finding of no association between SEP and risky single occasion drinking in a sample of adults aged 15–79,[46] and therefore this suggests that the inequalities we observed may be driven by quantity of alcohol consumption and not by patterns of drinking.

For women, inequalities in hazardous drinking were not observed in Eastern Europe, where hazardous drinking prevalence was typically low across all educational levels, especially among the generations analyzed in this study. Therefore, it seems plausible to think that women born in the 1930–50s in Eastern Europe had not widely adopted men's unhealthy lifestyles such as alcohol consumption. The other observed exceptions among women on no inequalities in hazardous drinking were found in the Netherlands and Italy. It seems plausible that these results for the Netherlands are related to a diffusion of hazardous drinking also among women with low educational level as they presented a considerably high prevalence as compared with low educated women in other countries. If this is true, Dutch women would be in and advanced staged in the theory of diffusion of innovations as regards to alcohol use.

Regarding educational inequalities in all-cause mortality among hazardous drinkers we found clear educational inequalities in Eastern Europe. This is in line with previous research highlighting the fact that (1) Eastern European countries have higher educational inequalities in all-cause mortality;[47] and that (2) the riskier drinking patterns are typically observed in Eastern Europe,[48] which are particularly influenced by SEP. However, we should note that educational inequalities in mortality among non-hazardous drinkers were also observed in the Eastern European region, and therefore seems clear that other determinants are playing an important role, as acknowledged in previous research.[49] Although our results are not directly comparable across regions, they seem to indicate that inequalities in mortality among hazardous drinkers are larger in Eastern Europe as compared to other European regions. A similar conclusion was reached for previous research that specifically analyzed socio-economic differences in alcohol-attributable mortality in Europe.[11]

For the rest of the regions the results are somewhat less clear as we did not find educational inequalities in all-cause mortality in the hazardous drinking group. Although this is somewhat difficult to be compared with previous research, it seems to contrast with a previous finding on important socioeconomic inequalities in alcohol-attributable causes of death.[11] Therefore, the fact that we did not find inequalities in all-cause mortality among hazardous drinkers does not necessarily imply that they do not exist. This is to our knowledge the first time that socioeconomic inequalities in all-cause mortality are being analyzed in individuals with hazardous alcohol use. The SHARE data that we used allowed us to provide some regional insights, but at the same time, we should recognize the rather low sample size as compared with mortality register datasets available mostly for Nordic countries. It could also be that inequalities in alcohol-attributable mortality are related to specific dimensions of alcohol use, such as the pattern of consumption.

Our results have strong implications for public health policy makers as the hazardous drinking prevalence at ages 50 years old and over in Europe is notably high and SEP inequalities in alcohol consumption exist among women. Reducing the high alcohol consumption levels among men, and both overall alcohol consumption levels and SEP inequalities in alcohol consumption among women, should be prioritized for preventive public health policymakers in most European countries. Future research should assess whether our results persist over time and explore the mechanisms that underlie potentially decreasing trends in both alcohol consumption levels and SEP inequalities. Additional research on the impact of alcohol consumption on inequalities in all-cause mortality should be also further explored with larger cohort studies, as most of the previous research on the topic mostly focus exclusively on causes wholly-attributable to alcohol[14] and not in other causes alcohol is indirectly associated with.

Conclusions

In sum, the hazardous drinking prevalence among individuals aged 50 years and over is high in most countries in Europe. Our results suggest important educational differences in hazardous drinking among Europeans aged 50–85 for women—those with higher educational level tend to engage more in hazardous drinking—but not for men, with few country-specific exceptions discussed above. These results call for a need of public health policies in order to reduce the elevated hazardous drinking prevalence and reduce their SEP inequalities. Further investigations should contrast these results as well as study the extent to which different dimensions of alcohol use have an impact on educational inequalities in all-cause mortality in European regions.

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Author contributions

STL, MBP and AE conceptualized and designed the research study. STL analyzed the data and wrote the first draft. All authors discussed the results and contributed to the final manuscript.

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