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High alcohol consumption in middle aged adults is associated with poorer cognitive performance only in the low socioeconomic group. Results from the GAZEL cohort study

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Abstract

Aims—To examine the association of alcohol consumption over 10 years with cognitive performance in different socioeconomic groups.

Design—Prospective cohort study, the French GAZEL study.

Setting—France.

Participants—Employees of France's national electricity and gas company.

Measurements—Alcohol intake was assessed annually, beginning in 1992, using questions on frequency and quantity of alcoholic beverages consumed in a week; used to define mean consumption and trajectory of alcohol intake over 10 years. Cognitive performance among participants aged ≥55 years (N=4073) was assessed in 2002–2004 using the *Digit Symbol Substitution Test (DSST)*, a measure of psychomotor speed, attention and reasoning. Occupational position at age 35 and education were used as the markers of socioeconomic position.

Findings—All analyses were stratified by socioeconomic position. In the low occupational group, participants consuming a mean of more than 21 drinks per week had 2.1 points lower (95% CI: −3.9, −0.3) DSST score compared to those consuming 4–14 drinks per week. In participants with primary school education, the corresponding difference was 3.6 points (95% CI: −7.1,−0.0). No association between alcohol consumption and cognitive performance was observed in the intermediate and high socioeconomic groups, defined using either occupation or education. Analysis of trajectories of alcohol consumption showed that in the low socioeconomic groups

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large increase or decrease in alcohol consumption was associated with lower cognitive scores compared to stable consumption.

Conclusions—Our results suggest that high alcohol consumption is associated with poorer cognitive performance only in the low socioeconomic group, possibly due to greater cognitive reserve in the higher socioeconomic groups.

There is increasing evidence showing health behaviors to be related to cognition, both in elderly [1–3] and middle-aged populations [4]. While it is well established that smoking [1;5] and physical inactivity [2] are harmful for cognitive outcomes, the association with alcohol remains unclear [6;7]. It has been suggested that light to moderate alcohol consumption is associated with lower risk of cognitive impairment and dementia compared to non-drinkers [6;7], but the impact of high alcohol consumption continues to be debated. Some studies have shown an inverse J- or U-shaped association between alcohol consumption and cognitive function, with high intake associated with lower cognitive performances [8–11], while in other studies this effect was not robust [12–14] or restricted to men [13;14]. On the other hand, high alcohol consumption has also been shown to be associated with better cognitive function, [15–18] although the protective effect might be restricted to women [13;14;19]. However, in most study populations, there were either few participants in the heavy alcohol consumption category [13–15;19] or no such category at all [16;18].

Socioeconomic position, assessed using measures of education, occupation or income, is known to be associated with both cognitive function [20] and alcohol consumption [21]. Thus, it is possible that inadequate attention to socioeconomic factors explains the inconsistency in the results on the association between alcohol and cognition. Socioeconomic position is known to modify the association between risk factors and health outcomes, for example that between alcohol consumption and alcohol-related mortality [22] and between intima-media thickness and cognitive function [23].

The objective of the present study is to examine the association between alcohol consumption and cognitive function in different socioeconomic groups, measured using education and adult occupational position. The specific focus of our analysis is the association with alcohol consumption over 10 years prior to the assessment of cognition, measured using the Digit Symbol Substitution Test (DSST), a neuropsychological test that assesses psychomotor speed, attention and reasoning [24], a cognitive domain particularly affected in vascular cognitive impairment [25].

METHODS

Study population

The GAZEL cohort was established in 1989 on 20,625 (73% men) employees, aged 40–50 for men and 35–50 for women, of France's national electricity and gas company: Electricité de France-Gaz de France (EDF-GDF) [26]. The study was approved by France's national ethics committee and is independent of the employer, EDF-GDF, and continues past retirement age. The study design consists of an annual postal questionnaire with occupational data updated through human resources department files. In 2002–2004, all participants were invited to one of the 54 Health Screening Centres ("Centres d'examens de santé") of the French social security located all over France. Only a sub-sample of the cohort was eligible for cognitive testing as it was introduced midway through the medical examination and restricted to those aged 55 years or more (N=10,537, composed of 9399 (89.2%) men). Due to small number of women in this cohort, the present study is based on men who participated in these cognitive tests (N=4525, 48.2% of the target population). An additional 452 participants without full data on alcohol consumption and covariates were excluded leading to analyses based on 4073 participants.

Measures

Alcohol consumption was assessed annually, beginning in 1992, using a validated questionnaire [27] composed of questions on the frequency and the daily consumption of different alcoholic beverages (wine, beer, aperitif or spirits) in the week preceding the questionnaire using drawings of standard alcoholic units. These quantities were converted to units of alcoholic drinks consumed (1 unit is equivalent to 10–12 g of alcohol) in a week. Participants were included in the analysis only if they responded to the question on alcohol consumption at least once in the 6–10 years period and the 1–5 years period preceding cognitive testing.

Mean alcohol consumption, total units consumed over the 10 years preceding cognitive testing divided by the number of years for which the response was available for each participant, was used to assess overall pattern of alcohol consumption and reduce measurement error. As in previous studies [28;29] this measure was categorized as follows: no alcohol consumption, 1–3 drinks/week (occasional drinkers), 4–14 drinks/week (light drinkers), 15–21 drinks/week (moderate drinkers), and more than 21 drinks/week (heavy drinkers).

Trajectories of alcohol consumption were examined as change in alcohol consumption over the 10-year period, achieved by fitting a linear regression of alcohol consumption on time (year 1 to year 10) for each participant, using the following formula drinks/week = $\alpha_i + \beta_i \times$ year + ε_i. The β_i represented the mean change in alcohol consumption per year [30], multiplied by 10 to estimate the mean change over 10 years. Rather than model this measure as a linear variable we categorized it into 5 groups to represent overall patterns of change as follows: large decrease (decrease≥11 drinks/week (10^{th} percentile)), small decrease (change between −10 and −4 (25^{th} percentile) drinks/week), stable (change between −3 and +4 (75^{th} percentile) drinks/week), small increase (change between +5 and +11 (90^{th} percentile) drinks/week), and large increase (increase≥12 drinks/week).

Cognitive Performance was assessed using the *Digit Symbol Substitution Test (DSST)*, a test that is unlikely to show ceiling effects in this age-group. The DSST is a subtest of the Weschler Adult Intelligence Scale-Revised, a timed paper- and pencil- task requiring translation of numbers to symbols using a key provided at the top of the test form. This test measures psychomotor speed, sustained attention and logical reasoning [24;31] and is suitable for non elderly populations. The subjects had 90 seconds to translate 93 numbers to symbols using the key. The score was the number of correct number of responses.

Socioeconomic position—Two measures were used in the analysis, occupational position and education. The measure of *occupational position* was taken from the employer's records of grade of employment at age 35 for all participants as it was prior to the measure of alcohol consumption and represented mid-career status. This measure has three levels, composed of managers (high), skilled workers (intermediate) and unskilled workers (low occupational position). *Education* was also measured using a 3-level variable: low (primary school or less, school leaving age approximately 11 years), intermediate (for professional qualifications), and higher education level (secondary school degree, the *baccalauréat* taken at around 18 years of age, or higher).

Data on covariates were drawn from the questionnaires and consisted of *marital status* and *smoking history* (current smokers when assessed for cognition, smokers who had stopped smoking in the 10 years prior to assessment for cognition, those who stopped even before, and never smokers). During the medical screening, concurrently to the measure of cognition, s*erum cholesterol and blood pressure, systolic and diastolic*, were measured. *Body Mass Index* (BMI) was calculated from the measure of height and weight (weight/height^2, kg/m^2) and categorized as normal weight (BMI<25), overweight (25≤BMI<30), and obese (BMI≥30).

Statistical methods

As the medical examination occurred over three years, data on alcohol consumption over the preceding 10 years implied extracting alcohol data from 1992 to 2001 for those screened in 2002, from 1993 to 2002 for those screened in 2003, and from 1994 to 2003 for those screened in 2004. In order to examine whether the association between alcohol consumption and performance on the DSST depended on socioeconomic position, an interaction term between alcohol categories and the measure of occupation (and education) was included in the model. Then, the association between categories of alcohol consumption and DSST scores in different socioeconomic groups was examined using analysis of covariance (ANCOVA). Mean cognitive score adjusted for covariates was calculated for each alcohol consumption category as well as the difference and 95% confidence intervals (CI) across these categories, with the "4–14 drinks/week" category as a reference. Models were first adjusted for age, screening centre, marital status, and smoking history, and then additionally for vascular risk factors described above. These analyses were repeated using trajectories of alcohol consumption instead of mean alcohol consumption. In the final analysis, the analysis for trajectories was adjusted for mean alcohol consumption in order to examine whether these results were independent of the effects of mean alcohol consumption.

To take into account the possible bias due to missing data, we undertook analysis using weights to account for missing data. Using logistic regression analysis, weights were generated by calculating the probability for each subject of participating in cognitive tests as a function of age, screening centre, retirement status at the time of the cognitive tests, and SEP, marital status, alcohol consumption, smoking status, and self-rated health at baseline. The inverse of the fitted probabilities of participating in cognitive tests were then used as weights.

RESULTS

Data on alcohol consumption and the DSST were available for 4073 men. Compared to the 5326 men not included in this study (4874 who did not come to the medical screening and 452 without full data on alcohol consumption and covariates), this study included fewer participants from the lower socioeconomic group (17% vs 27%, $p<0.0001$) but there were no age differences (59.4 years in both groups, range 55–65 years). Compared to moderate drinkers, abstainers and heavy drinkers at baseline were also less likely to be included in the analysis reported here (respectively 37.8% and 41.3% for abstainers and heavy drinkers, compared to 46.1% of moderate drinkers, p<0.001). 89.4 % of the participants included in the analysis had at least 8 annual measures of alcohol consumption and 4.4% had less than 6 measures.

Characteristics of the study participants as a function of the mean alcohol consumption categories are presented in Table 1. Alcohol consumption was found to be associated with age ($p=0.001$), marital status ($p=0.04$), and vascular risk factors ($p\leq0.001$). On average, participants had 13.3 (standard deviation (SD)=10.3) drinks of alcohol per week, composed of 10.9 (SD=9.3) drinks of wine, 1.3 (SD=2.5) drinks of beer, and 1.9 (SD=2.0) drinks of aperitif or spirit. The type of alcohol consumed was not socially patterned (all $p>0.20$). Participants with large increase (≥90th percentile) and decrease (≤10th percentile) in alcohol consumption had a mean alcohol consumption over the 10 years of 19.8 and 19.2 drinks per week, higher than those with a small increase (75^{th}-90^{th} percentile; 14.5 drinks/week) and decrease (10^{th}–25^{th} percentile; 14.8 drinks/week), also higher than those with stable (25^{th}-75^{th} percentile) alcohol consumption (9.6 drinks/week); all $p<0.0001$.

In order to examine whether the association between mean alcohol consumption and DSST score was different in the three occupational groups, we fitted an interaction term between alcohol consumption and occupation in a model adjusted for age, screening centre, marital status, and smoking history. This interaction term (p=0.07) led us to examine the association between alcohol consumption and DSST separately in the three occupational groups. Results (Table 2) show that in the low occupational group, participants consuming more than 21 drinks per week had a mean score on the DSST that was 2.1 points lower (95% CI: −3.9, −0.3) than those consuming 4–14 drinks per week. This difference corresponds to an age effect of approximately 4 years (in these data, one year of age was associated with 0.51 (standard error=0.05) point reduction in the DSST). Further adjustment for vascular risk factors did not much change these associations (results not shown). In the intermediate and high occupational groups, alcohol consumption was not associated with the DSST. Then, we examined the association between alcohol consumption and DSST in different educational groups (*p* for interaction=0.11). Similarly, we found that there was an association with alcohol consumption only in the lower educational group (Table 2, columns on the right hand side). To check whether these differences were due to different patterns of drinking in the socioeconomic groups, we compared the amount and the type of alcohol consumed by the heavy drinkers in the different socioeconomic groups. No difference was found for the amount of alcohol consumed (28.8 (SD=6.8) vs 28.7 (SD=6.9) drinks per week respectively in the low and the others occupational groups, $p=0.86$) or for type of alcohol consumed as the average consumption was 24 drinks of wine, 2 drinks of beer and 3 drinks of aperitif or spirit in all socioeconomic groups (all $p>0.14$). Similarly, the pattern of alcohol consumption among the heavy drinkers was not different in the three educational groups (all $p>0.37$).

Table 3 presents the association between trajectories of alcohol consumption over 10 years and the DSST score in the different socioeconomic groups. Compared to stable alcohol consumption, great increase and decrease in alcohol consumption were both associated with lower DSST score only in the low occupational group (−3.9 points (95% CI: −6.1, −1.7) and −3.5 points (95% CI: −6.2, −0.7) respectively for high increase and decrease compared to stable alcohol consumption); *p* for interaction=0.003. The association was robust to further adjustment for cardiovascular risk factors (results not shown). A similar pattern of association was evident in the different educational groups although the term for interaction did not reach statistical significance (*p* for interaction=0.29).

As both great increase and decrease in consumption was associated with higher alcohol consumption ($p<0.0001$) we examined whether the effect of change in consumption on the DSST score was influenced by mean alcohol consumption. The results showed that the effect of the 10-year change in alcohol consumption was not confounded by mean alcohol consumption over this period (results not shown). Furthermore, as depressive symptoms have been shown to be associated with lower cognitive performances [32], we undertook analyses stratified by occupational groups restricted to those without depressive symptoms, i.e. with a *Centre for Epidemiologic Studies Depression Scale* score < 16 [33] (N=2992 on the 3722 participants with data on depression). These results remained unchanged (see Figure S1 in supplementary graphs); a similar analysis could not be carried using education due to low numbers in the “primary school” category. Finally, weighted regression aimed at taking into account bias due to non-response also showed similar results (Figures S2 & S3).

DISCUSSION

The key finding of our study is that the association between alcohol consumption and cognitive performance, assessed using the DSST, differs as a function of socioeconomic position. Men in the heavy alcohol consumption category had lower DSST scores only if they belonged to the low socioeconomic group. These results were similar when socioeconomic position was assessed using occupation or education, even though the results appeared more robust with the former measure. Furthermore, compared to stable alcohol consumption, both great increases and decreases in alcohol consumption were association with poorer cognitive performance, but only in the low socioeconomic group; these results were robust to adjustment for mean alcohol consumption. Given that the association between alcohol consumption and cognitive function continues to be discussed, our results are important as they suggest that socioeconomic position could act as an effect modifier and explain the discrepancies reported in the literature.

Indeed, some studies reported an inverse J- or U-shaped association between alcohol consumption and cognition [8–11] while others do not show high consumption to be associated with lower cognitive performance [15–18]. It has been suggested that these differences could be due to the few numbers of heavy drinkers, particularly in elderly populations [6]. The smaller numbers may be the result of a selection bias, both due to higher risk of mortality and lower participation rates in heavy drinkers. However, even in middle-aged cohorts such as the Framingham Heart Study, men drinking 28–32 drinks per week (N=57, 8% of the men population) had better cognitive function than those drinking up to 7 drinks per week [19]. The Whitehall II study reported similar results, with better cognitive function in men consuming more than 30 drinks per week compared to those consuming 1 to 10 drinks per week [15]. Blue-collar workers make up less than a quarter of the Framingham study population [34] and the Whitehall II study consists exclusively of white-collar workers [15]. However, data from the Honolulu-Asia Aging Study [10], show that those drinking more than 28 drinks per week had lower cognitive scores than those drinking moderately, but half the participants were blue collar workers [35]. In view of the results of our study, the discrepancy in the literature could be due to effect modification by socioeconomic position.

To our knowledge, this is the first study to investigate explicitly the association between alcohol consumption and cognitive function separately in different socioeconomic groups. Socioeconomic factors have previously been shown to moderate the effect of risk factors on different health outcomes [22;36], including cognitive function [23]. Cognitive reserve has been used to explain the differential effect of risk factors on cognitive function in different social groups. It refers to the processes that mediate the association between brain pathology and its clinical expression [20]. Measures of social position or education are often used as proxies for cognitive reserve and have been shown to be associated with lower risk of impaired cognition [37]. High cognitive reserve allows the appearance of clinical symptoms of cognitive impairment to be delayed rather than provide protection against the onset of cognitive decline. In the present study, the harmful effect of high alcohol consumption was only evident in those with lower cognitive reserve, approximated by lower SEP.

The main mechanism thought to underlie the association between alcohol consumption and cognitive outcomes is the cerebro- and cardiovascular pathway. Low-to-moderate alcohol consumption has been found to be associated with better vascular health whereas abstinence and heavy alcohol consumption have both been shown to be risk factors for vascular diseases [38], which, in turn, are related to higher risk of cognitive impairment [39] and dementia [40]. As depression is seen to be associated with both alcohol consumption [41] and lower cognitive function [32], it could also be involved in the relationship between alcohol consumption and cognition. However, in the present study, results remained unchanged after excluding those with depressive symptoms.

We couldn’t find previous analysis of the impact of trajectories of alcohol consumption on cognition, our results show both a great increase and decrease to be associated with lower cognitive function in the low SEP groups and these results were independent of the mean level of alcohol consumption. These might implicate different underlying mechanisms with decrease in alcohol consumption being linked to presence of overt cardiovascular disease leading to behavior modification. As the association was evident only in the low SEP groups, we did not have sufficient power to examine finer categories of change in alcohol consumption. Our calculation of change in alcohol consumption assumes it to be linear, this method does not allow large drops in alcohol consumption over a shorter time-frame to be distinguished from overall decline over 10 years. Future research is thus needed to confirm the present findings and to investigate the mechanisms underlying these associations.

The specific strengths of this study include a prospective design with repeated measurement of alcohol consumption over a 10-year period, a population with a large socioeconomic range that included blue-collar workers, and enough heavy alcohol drinkers to allow sufficient power to examine the association between alcohol consumption and cognitive performance separately in different occupational groups. We were able to show poor cognitive performance related to alcohol consumption in a study population that is relatively young; it is possible that these effects will be larger in older populations. This study has also several limitations. One, we were unable to distinguish between regular consumption over the week and binge drinking. Moreover, abstinence was very rare and although it was associated with poorer cognitive performance as in other studies, this difference was not statistically significant in our analysis. Indeed, the non drinkers were more likely not to participate in the clinical examination, perhaps due to poor health. Although the analysis using weights to take into account missing data provide similar results to those in the main analysis, we cannot completely rule out bias due to missing data. Two, there were few participants in the low educational group which could explain the lack of a significant association with trajectories of alcohol consumption. Three, we used only one cognitive test; further studies ought to examine whether effect modification by socioeconomic position is also evident for other cognitive domains. Four, this study is based only on men as there were few women in the cohort and needs to be replicated in order to assess whether the findings also apply to women. Finally, a further caveat relates to the fact that although GAZEL is not a high risk population, it is also not representative of the general population as it does not include unemployed individuals.

In conclusion, this study shows that, in a middle-aged male population, heavy alcohol consumption is associated with poorer cognitive performance, but only in the low socioeconomic group, assessed either using occupation or education. Similarly, great increase or decrease in alcohol consumption was also associated with poor cognitive performance, here again the effect was restricted to the low socioeconomic group. We hypothesize that effect modification by socioeconomic factors is such that greater cognitive reserve in the higher socioeconomic groups leads heavy alcohol consumption not to have a harmful impact on cognition.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Characteristics of the study population as a function of mean alcohol consumption over 10 years

		Alcohol consumption over 10 years					
		No	Occasional	Light	Moderate	High	
	Drinks/week	**0**	**1–3**	**4–14**	**15–21**	**>21**	***p****
N (%)		59 (1.5)	524 (12.9)	1854 (45.5)	703 (17.3)	933 (22.9)	
Age at cognitive exam	(M, SD)	59.8 (2.8)	59.4 (2.9)	59.4 (2.7)	59.6 (2.8)	59.9 (2.8)	0.001
Lower occupational position	(N, %)	12 (20.3)	92 (17.6)	285 (15.4)	128 (18.2)	167 (17.9)	0.26
Primary school education or less	(N, %)	5 (8.5)	24 (4.6)	71 (3.8)	28 (4.0)	43 (4.6)	0.41
Married or cohabiting	(N, %)	49 (83.1)	488 (93.1)	1728 (93.2)	648 (92.2)	873 (93.6)	0.04
Current smokers	(N, %)	6 (10.2)	40 (7.6)	145 (7.8)	90 (12.8)	177 (19.0)	<0.0001
Overweight or obese	(N, %)	35 (59.3)	296 (56.5)	1169 (63.1)	454 (64.6)	629 (67.4)	0.001
Blood pressure (mmHg)							
Systolic	(M, SD)	135.9 (17.7)	134.4 (14.4)	134.6 (14.3)	136.0 (14.0)	137.0 (15.8)	0.001
Diastolic	(M, SD)	80.5 (9.0)	79.9 (9.0)	80.8 (8.9)	80.8 (8.9)	81.0 (9.6)	<0.0001
Total cholesterol (mmol/liter)	(M, SD)	5.5 (1.0)	5.5 (0.9)	5.7 (0.9)	5.7 (0.9)	5.8 (0.9)	<0.0001

M: Mean, SD: Standard deviation

* *p* for heterogeneity

Table 2

Digit-Symbol Substitution Scores (DSST) as a function of average alcohol consumption over 10 years (N=4073)

Analyses stratified by occupational position group				Analyses stratified by educational group			
	N (%)	**Mean**	**Δ‡ (95% CI)**		**N (%)**	**Mean**	**Δ‡ (95% CI)**
Low occupational position (N=684)				**Primary school (N=171)**			
Alcohol consumption				Alcohol consumption			
0 drink/week	12 (1.8)	40.0	−3.8 (−9.3, 1.6)	0 drink/week	5 (2.9)	33.7	−10.4 (−18.4, −2.4)*
1–3 drinks/week	92 (13.5)	44.6	0.8 (−1.4, 3.0)	1–3 drinks/week	24 (14.0)	39.4	−4.7 (−8.8, −0.5)*
4–14 drinks/week	285 (41.7)	43.8	ref	4–14 drinks/week	71 (41.5)	44.1	ref
15–21 drinks/week	128 (18.7)	42.9	−0.9 (−2.9, 1.1)	15–21 drinks/week	28 (16.4)	42.0	−2.1 (−6.0, 1.9)
>21 drinks/week	167 (24.4)	41.7	−2.1 (−3.9, −0.3)*	>21 drinks/week	43 (25.2)	40.5	−3.6 (−7.1, −0.0)*
Intermediate occupational position (N=2607)				**Professional qualification (N=2723)**			
Alcohol consumption				Alcohol consumption			
0 drink/week	40 (1.5)	47.1	−0.4 (−3.2, 2.4)	0 drink/week	42 (1.5)	46.5	−0.3 (−3.2, 2.4)
1–3 drinks/week	334 (12.8)	46.5	−1.0 (−2.1, 0.0)	1–3 drinks/week	337 (12.4)	46.3	−0.5 (−1.6, 0.6)
4–14 drinks/week	1201 (46.1)	47.5	ref	4–14 drinks/week	1226 (45.0)	46.8	ref
15–21 drinks/week	445 (17.1)	46.8	−0.7 (−1.7, 0.3)	15–21 drinks/week	490 (18.0)	46.0	−0.8 (−1.8, 0.1)
>21 drinks/week	587 (22.5)	47.1	−0.4 (−1.3, 0.4)	>21 drinks/week	628 (23.1)	46.0	−0.5 (−1.4, 0.4)
High occupational position (N=782)				**Secondary school and more (N=1179**			
Alcohol consumption				Alcohol consumption			
0 drink/week	7 (0.9)	46.5	−5.5 (−12.8, 1.8)	0 drink/week	12 (1.0)	46.3	−4.3 (−9.8, 1.1)
1–3 drinks/week	98 (12.5)	52.1	0.1 (−2.1, 2.2)	1–3 drinks/week	163 (13.8)	50.1	−0.6 (−2.2, 1.1)
4–14 drinks/week	368 (47.1)	52.0	ref	4–14 drinks/week	557 (47.2)	50.7	ref
15–21 drinks/week	130 (16.6)	51.9	−0.1 (−2.0, 1.8)	15–21 drinks/week	185 (15.7)	50.5	−0.2 (−1.8, 1.4)
>21 drinks/week	179 (22.9)	52.6	0.5 (−1.2, 2.3)	>21 drinks/week	262 (22.2)	50.5	−0.2 (−1.6, 1.2)

** $p<0.05$

† Adjusted for age, screening centre, marital status, and smoking history.

‡ Difference in DSST score compared to the "4–14 drinks/week" category.

Table 3

Digit-Symbol Substitution Scores (DSST) as a function of trajectories of alcohol consumption over 10 years† (N=4073)

Analyses stratified by occupational position group				Analyses stratified by educational group			
	N (%)	**Mean**	**Δ‡ DSST (95% CI)**		**N (%)**	**Mean**	**Δ‡ DSST (95% CI)**
Low occupational position (N=684)				**Primary school (N=171)**			
10 year change in alcohol consumption (drinks/week)				10 year change in alcohol consumption (drinks/week)			
≤−11 (≤10th percentile)	90 (13.2)	40.0	−3.9 (−6.1, −1.7)*	≤−11 (≤10th percentile)	24 (14.0)	39.7	−2.2 (−7.0, 2.6)
−10 to −4 (10th to 25th) percentile)	103 (15.1)	42.9	−1.0 (−3.1, 1.1)	−10 to −4 (10th to 25th) percentile)	34 (19.9)	41.0	−0.9 (−4.8, 3.0)
−3 to +4 (25th to 75th) percentile)	307 (44.9)	43.9	ref	−3 to +4 (25th to 75th) percentile)	64 (37.4)	41.9	ref
+5 to +11 (75th to 90th) percentile)	106 (15.5)	44.9	1.0 (−1.1, 3.1)	+5 to +11 (75th to 90th) percentile)	31 (18.1)	45.2	3.2 (−1.0, 7.5)
≥+12 (≥90th percentile)	78 (11.4)	41.4	−2.5 (−4.8, −0.1)*	≥+12 (≥90th percentile)	18 (10.5)	40.2	−1.7 (−6.7, 3.4)
Intermediate occupational position(N=2607)				**Professional level (N=2723)**			
10 year change in alcohol consumption (drinks/week)				10 year change in alcohol consumption (drinks/week)			
≤−11 (≤10th percentile)	266 (10.2)	47.7	−0.4 (−1.6, 0.7)	≤−11 (≤10th percentile)	301 (11.1)	45.3	−1.1 (−2.2, 0.0)
−10 to −4 (10th to 25th) percentile)	409 (15.7)	48.6	0.4 (−0.6, 1.4)	−10 to −4 (10th to 25th) percentile)	421 (15.5)	47.4	1.0 (−0.1, 2.1)
−3 to +4 (25th to 75th) percentile)	1243 (47.7)	48.2	ref	−3 to +4 (25th to 75th) percentile)	1272 (46.7)	46.4	ref
+5 to +11 (75th to 90th) percentile)	411 (15.8)	47.8	−0.3 (−1.3, 0.7)	+5 to +11 (75th to 90th) percentile)	429 (15.8)	46.7	0.3 (−0.7, 1.3)
≥+12 (≥90th percentile)	278 (10.7)	48.6	0.5 (−0.7, −1.6)	≥+12 (≥90th percentile)	300 (11.0)	46.3	−0.1 (−1.3, 1.0)
High occupational position (N=782)				**Secondary school and more (N=1179)**			
10 year change in alcohol consumption (drinks/week)				10 year change in alcohol consumption (drinks/week)			
≤−11 (≤10th percentile)	75 (9.6)	51.5	0.3 (−2.1, 2.7)	≤−11 (≤10th percentile)	106 (9.0)	50.4	−0.1 (−2.0, 1.9)
−10 to −4 (10th to 25th) percentile)	142 (18.2)	51.8	0.6 (−1.2, 2.5)	−10 to −4 (10th to 25th) percentile)	199 (16.9)	50.3	−0.2 (−1.7, 1.3)
−3 to +4 (25th to 75th) percentile)	352 (45.0)	51.2	ref	−3 to +4 (25th to 75th) percentile)	566 (48.0)	50.5	ref
+5 to +11 (75th to 90th) percentile)	125 (16.0)	51.5	0.4 (−1.6, 2.3)	+5 to +11 (75th to 90th) percentile)	182 (15.4)	50.0	−0.4 (−2.0, 1.2)
≥+12 (≥90th percentile)	88 (11.3)	50.7	−0.5 (−2.8, 1.7)	≥+12 (≥90th percentile)	126 (10.7)	50.5	0.0 (−1.8, 1.8)

* p<0.05

† Estimated from a linear regression of time on drinks/week for each participants.

‡ Adjusted for age, screening centre, marital status, and smoking history.