

## The regional geography of alcohol consumption in England: comparing drinking frequency and binge drinking

## **Abstract**

Alcohol consumption frequency and volume are known to be related to health problems among drinkers. Most of the existing literature that analyses regional variation in drinking behaviour uses measures of consumption that relate only to volume, such as 'binge drinking'. This study compares the regional association of alcohol consumption using measures of drinking frequency (daily drinking) and volume (binge drinking) using a nationally representative sample of residents using the Health Survey for England, 2011-2013. Results suggest the presence of two differentiated drinking patterns with relevant policy implications. We find that people in northern regions are more likely to binge drink, whereas people in southern regions are more likely to drink on most days. Regression analysis shows that regional variation in binge drinking remains strong when taking into account individual and neighbourhood level controls. The findings provide support for regional targeting of interventions that aim to reduce the frequency as well as volume of drinking.

**Key words:** alcohol, binge drinking, drinking frequency, Health Survey for England, regions

## **Introduction**

Drinking alcohol is an integral part of the culture, social, family and occupational life in the UK (Fuller, 2008; Smith & Foxcroft, 2009). Although heavy alcohol consumption exists across a wide range of countries globally, comparison of per capita alcohol consumption among people aged 15 years and over shows the UK to be among the countries with heaviest alcohol intake in Europe (Smith & Foxcroft, 2009). Harmful use of alcohol consumption is associated with over 40 medical conditions in the UK population including: cancer, stroke, obesity, hypertension or diabetes (NHS, 2010) and was associated with more than 1 million hospital admissions in 2012-13 (Health and Social Care Information Centre, 2014). The financial burden is estimated to be over £25.1 billion and therefore alcohol misuse emerges as one of the main public health challenges currently faced by both the NHS and other public service providers (NHS, 2010). Trends suggest the problem has worsened in the last 25 years. In England and Wales, alcohol-related deaths doubled between 1991 and 2008, although, since 2008, there has been a small decrease in alcohol related deaths (ONS 2013).

The harm associated with alcohol consumption is not uniformly distributed across the UK, with considerable variation between its constituent countries and between all regions in England (Breakwell et al. 2007). Geographical variations in alcohol-related deaths have become more pronounced as patterns of alcohol consumption increase more rapidly in some areas than others. Robinson et al. (2015) found that alcohol-related mortality was higher in regions with greater per capita alcohol consumption (North East, North West and Yorkshire and The Humber). In order to direct policy makers towards appropriate local interventions to reduce alcohol related harm, it is important to determine whether these geographical variations can be explained by known determinants of alcohol consumption, or whether region is an independent predictor accounting for other explanatory factors. What follows is a

description of the empirical evidence on regional variation in alcohol consumption in the UK.

One of the first explorations of regional differences in drinking habits in the UK was conducted by Balarajan & Yuen (1986) using the General Household Survey. They found higher levels of 'heavy drinking', which they define as women who drink more than 28 units per week and men who drink more than 35 units, in northern regions of England as compared to England's southern regions. Duncan, Jones & Moon (1993) confirmed these findings by showing a north versus south gradient, with northern English regions reporting higher levels of alcohol consumption than southern regions and London emerging as the region with lowest rates of alcohol intake. However, regional differences in this study were largely explained by individual factors.

An issue with comparing studies internationally and even within the UK is the variation in drinking volume definitions such as heavy drinking or binge drinking. Different studies establish different definitions and recommended guidelines depending on the amount of alcohol, the period of consumption, the variation of consumption between sexes and the definition of the consumption measurement 'unit' (Twigg & Moon, 2013). In 1995, the UK government introduced their 'sensible drinking guidelines', which included daily maximum units alcohol recommended both for men (3-4) and for women (2-3) (DoH, 1995). Thus, the broadly accepted definition for binge drinking in England draws from the level of daily consumption that is twice the recommended 'sensible guidelines' (Shelton & Savell, 2011). The literature conducted in the field uses this concept as an agreed definition of binge drinking.

A recent cross-sectional study from the Health Survey for England found lowest levels of binge drinking in London, East of England and West Midlands as

compared with the greatest prevalence of binge drinking in the North East and Yorkshire and the Humber (Shelton & Savell, 2011). Furthermore, Twig & Moon (2013) included the concept of 'episodic binge drinking' in their analyses. This concept captured individuals who binge drink in one day while maintaining every other day in the week alcohol free. In fact, the results for episodic binge drinking showed higher levels in northern regions as compared to southern regions as well as males being more likely to engage in this drinking pattern than women.

Most previous literature in the field is based on self-reported alcohol consumption in social surveys, which only constitutes 60% of all alcohol sales in England (Boniface and Shelton, 2013). The question raised is who is drinking the other 40% of alcohol purchased. A study conducted by Boniface & Shelton (2013) addressed the discrepancy between self-reported consumption and alcohol sales as well as how this affects regional variations in England. Their findings suggested an inverse pattern in binge drinking such that the South West had the highest levels of binge drinking when taking into account age, gender, income and neighbourhood deprivation. Moreover, when analyses accounted for under-reporting the results were consistent with previous literature, with the North East showing significantly higher levels of binge drinking than any other region, except the North West, which showed similar levels of binge drinking compared with the North East.

The research conducted to date on regional variations has focused on measures of heavy drinking, binge drinking or episodic binge drinking, often with reference to the UK government established guidelines published in 1995. A criticism of these definitions is that they may not capture the frequency of regular drinking within or marginally above recommended guidelines. The study of a concept that accounts for the variability of alcohol free days is noteworthy because this pattern of drinking has been reported to be related with heart disease, cancer and liver disease (NHS, 2010). For example, Hatton et al. (2009) conducted a study of drinking patterns

in 234 participants with liver disease. Their findings concluded that liver deaths were a result of daily or near daily frequent drinking, instead of episodic or binge drinking. There is also emerging literature using Mendelian randomisation, that suggests small reductions in alcohol consumption among light to moderate drinkers (>0 to < 21 units per week) can have a positive effect on cardiovascular health (Chen et al. 2008; Holmes et al. 2014). These results are consistent with previous literature which shows that moderate persistent drinking was associated with increased risk of hemorrhagic stroke, cancer and a wide range of accident and injuries (Ashley, et al., 1994; Doll et al., 1994). Furthermore, these results are also consistent with recent recommendations from the Royal College of Physicians (OECD, 2015) that warn about the risk of liver disease, alcohol dependence and serious illness increases if people drink every day.

The publication of the 2016 UK Chief Medical Officers' Alcohol Guidelines have brought to the public's attention the risks of binge drinking as well as drinking frequency, which has previously received much less attention as a public health issue. The guidelines on frequency now state:

“there are adverse effects from drinking alcohol on a range of cancers – this was not fully understood in 1995 [previous release of government guidelines] – and these risks start from any level of regular drinking and then rise with the amounts of alcohol being drunk.” (DoH 2016:3).

The NHS now recommends that people should have several drink-free days per week.

Although recent literature has consistently demonstrated the existence of regional variation in binge drinking in England, less is known about how other drinking patterns; especially how frequency of consumption varies across regions. The current paper adds to the literature by exploring whether regional inequalities in drinking

behaviour in England are influenced by different ways of measuring alcohol intake. To this end, we extend existing knowledge of binge drinking diversities in England by moving beyond a single alcohol consumption factor and adding a measure of drinking frequency. Drawing on data of alcohol intake from the Health Survey for England, 2011 to 2013, we also consider whether the north versus south gradient that emerges in binge drinking is different when assessing frequency of drinking and whether individual factors may explain regional diversities in alcohol consumption.

## **Method**

### **Sample**

This paper used pooled data from the nationally representative 2011, 2012 and 2013 cross-sectional Health Survey for England (HSE) samples. These were the latest collections available at the time of writing. The rationale for combination of collections was to increase the sample size enabling us to look at regional variations and control for many different confounders. More detailed information about the study sampling and instrument techniques are explained elsewhere (Craig & Shelton 2008). In HSE 2011, 2012 and 2013 a total of 31,930 respondents were included with 10,617, 10,333 and 10,980 respectively for each year. Our sample was restricted to 15,305 respondents aged 16 or above who had a drink in the last seven days and who provided detailed information on the amount that they drank. The decision to restrict the sample to current drinkers was taken on the basis of HSE questioning format, which only asked drinkers about the heaviest drinking day. The Oxford A Research Ethics Committee provided ethical approval for the HSE.

### **Measures**

Binge drinking was analysed by looking at the number of units consumed on the heaviest drinking day of those that drank in the last seven days in relation to the UK government sensible drinking guidelines. Binge drinkers were defined as those that drank twice the amount recommended on their heaviest drinking day, which amounts to greater than 8 units in men and greater than 6 units in women (Health and Social Care Information Centre, 2015; NHS, 2016).

Daily drinking was explored in relation to the number of alcohol free days in the last seven days. Participants were dichotomised into non-daily drinking (having two or more alcohol free days per week) or daily drinking (having one or less alcohol free days per week). This definition is based on several European governments' guidelines that recommend having at least two alcohol free days per week (AIM, 2012; NHS, 2010) and on recent research which has suggested that daily drinking is associated with increased risk of chronic diseases (House of Commons Science and Technology Committee, 2012; OECD, 2015).

The current study employed a geographical division consistent with previous literature, nine regions were included: North East, North West, Yorkshire and the Humber, East Midlands, West Midlands, East of England, London, South East and South West (Boniface & Shelton, 2013; Shelton & Savell, 2011; Twigg & Moon, 2013)

Information on the individuals' age, ethnicity, marital status, whether there were children under the age of 16 in the household, social class, education, smoking status, neighbourhood deprivation and urbanisation were used as control variables based on their known association with alcohol consumption shown in earlier studies. Ethnicity was split into two categories of White British or 'ethnic minorities'. The rationale behind this dichotomisation was that the number of other than White British participants was very low and dividing them into more detailed ethnic breakdown



would have yielded very small groups. Previous research suggests that ethnic minorities are less likely to drink alcohol (Bécares, Nazroo, and Stafford 2009). Marital status was categorised into single; married; cohabiting; separated or divorced; and widowed. It has been shown that excessive alcohol intake levels are higher among those who are not married or cohabiting (Twigg & Moon, 2013; Duncan, 2006).

Social class was based on the National Statistics Socio-economic classification (NS-SEC) of the household reference person (i.e. the head of the household) and split into three categories: higher managerial and professional, intermediate occupations; and routine and manual occupations or not classified. Cummins et al (1981) find that those in lower social class occupations are more likely to consume three or more drinks regularly, a behaviour they describe as ranging from moderate to heavy drinking. Education included three hierarchical categories: degree or equivalent, below degree qualification and no qualifications. The less well educated have been shown to drink more during a drinking occasion (Casswell, Pledger, and Pratap 2002). We added a fourth education category for those in full-time education because students are known to be heavier drinkers and because classifying them at their current educational attainment level might be misrepresentative (Webb et al. 1996). Smoking was divided into three categories of current smokers, ex regular smokers, and never-smoked. Smoking and binge drinking are health behaviours that are often found to coexist (Poortinga 2007).

We included a measure of neighbourhood deprivation of where the respondent lived, using quintiles of the index of neighbourhood deprivation (IMD). The degree of neighbourhood urbanisation was divided into three categories: urban, suburban (town and fringe) or rural (village, hamlets and isolated dwellings). Neighbourhood deprivation and rurality have both shown to be associated with alcohol-related

mortality, with higher risk for those living in the most deprived neighbourhoods or in urban areas (Erskine et al. 2010).

### **Statistical Analyses**

The data were analysed using STATA 14. Stepwise logistic regressions were conducted to estimate the differences of binge drinking and daily drinking between regions in England. All models were stratified by gender. The first model simply presents unadjusted regional odd ratios for the two alcohol measurements. The North East was chosen as a reference category for the logistic regression models of binge drinking because it had the highest prevalence of binge drinking of any region. Similarly, the South East was chosen as a reference category for the logistic regression models of daily drinking because it had the highest prevalence of daily drinking.

The second model examined regional odds of binge and daily drinking controlling for demographic variables: age and ethnic group, marital status and whether there were children in the household. In the third model social class, income education and smoking status were incorporated. The fourth model added neighbourhood characteristics: deprivation and urbanisation. Multinomial logistic regression was conducted for binge drinking as a sensitivity analysis to explore possible differences within the amount of alcohol intake in relation to the guidelines: within the limits; exceeding limits but not binge drinking; or binge drinking. Models were stratified by gender, given the well-known variation in drinking by men and women.

The findings were not substantively different to the binary logistic model and therefore are not presented here. All analyses included non-response and complex sample design weights, to take into account the two-stage stratified sampling design of primary sampling units within clusters, of the Health Survey for England. Less than 1%

of values were missing on each of the explanatory variables.

## Results

Table 1. Sample characteristics by sex and binge drinking and daily drinking

	Male			Females		
	%		Unweighted N	%		Unweighted N
	Binge	Daily		Binge	Daily	
Age 16+ in ten year bands						
16-24	46.6	6.3	610	40.6	2.8	629
25-34	38.4	9.8	1,062	34.6	5.2	1,083
35-44	33.7	13.2	1,281	27.2	9.6	1,406
45-54	34.7	20.5	1,409	25.0	13.6	1,568
55-64	27.0	26.7	1,376	15.0	17.7	1,318
65-74	14.6	31.3	1,216	10.0	25.2	999
75+	5.4	38.8	737	2.8.0	29.9	611
Ethnicity						
White British	31.9	19.6	7,277	24.3	13.7	7,281
Minority	18.0	11.5	404	16.3	6.6	322
Children in HH						
No	31.0	21.5	5,741	22.5	15.4	5,293
Yes	31.2	12.3	1,950	27.2	8.6	2,321
Marital status						
Single	43.2	12.4	1,365	38.5	5.9	1,273
Married	24.0	21.5	4,506	18.6	15.0	4,013
Separated	34.9	26.5	516	23.8	15.8	795
Widowed	11.1	34.2	286	5.7	24.8	578
Cohabitees	39.7	15.1	1,018	32.5	10.5	954
NS-SEC						
Managerial and professional occupations	28.0	20.0	3,326	23.3	14.4	2,787
Intermediate occupations	31.8	21.2	1,570	22.3	15.5	2,207
Routine and manual occupations	34.1	17.0	2,744	25.5	10.7	2,541
Qualification						
Degree	27.8	18.0	2,130	23.7	12.3	2,085
Below degree qualification	33.8	19.2	3,876	24.5	13.7	3,910
No qualification	23.8	27.0	1,363	14.6	18.5	1,269
FT student	41.2	4.7	313	41.8	3.5	345
Cigarette Smoking Status						
Current cigarette smoker	45.7	22.3	1,564	41.3	15.7	1,443
Ex-regular cigarette smoker	27.1	26.7	2,585	23.6	19.3	1,970

Never regular cigarette smoker	26.5	12.9	3,536	18.0	10.0	4,197
Quintile of IMD SCORE						
0.53->8.49 [least deprived]	26.7	21.3	1,863	20.5	15.4	1,878
8.49->13.79	29.5	19.5	1,796	22.9	15.8	1,772
13.79->21.35	32.0	18.5	1,630	24.5	12.7	1,645
21.35->34.17	32.7	18.7	1,361	24.1	12.3	1,314
34.17->87.80 [most deprived]	37.2	16.5	1,041	30.6	7.9	1,005
Degree of urbanisation						
Urban	32.0	18.0	5,859	24.9	12.2	5,787
Town & fringe	29.2	20.4	818	21.5	14.3	814
Village, hamlet and isolated dwellings	26.4	25.2	1,014	19.7	19.7	1,013
<b>Total</b>	<b>31.0</b>	<b>19.1</b>	<b>7,691</b>	<b>23.9</b>	<b>13.4</b>	<b>7,614</b>

Table 1 presents the socio-demographic characteristics of the sample by gender and binge and daily drinking. Male drinkers were more likely than female drinkers to binge drink (31% vs 24%) and to drink daily (19% vs 13%). The prevalence of male binge drinking among drinkers was higher in younger, White British, single, lower NSSEC and current smoker groups and those living in more deprived neighbourhoods and urban areas. Female drinkers were more likely to binge drink if they were younger, White British, living with children, single, a current smoker, living in most deprived neighbourhoods and living in an urban area.

The characteristics by gender for daily drinking were somewhat different. Male drinkers were more likely to drink on at least six days out of the last seven days if they were older, White British, not living with children, widowed, an ex-smoker, living in a less deprived neighbourhood and living in a rural area. Female drinkers were more likely to drink daily if they were older, White British, not living with children, widowed, not in the routine NSSEC category, an ex-smoker, living in a less deprived neighbourhoods and in a rural area.

Figure 1. Proportion binge drinking by region and gender, England, 2011-2013

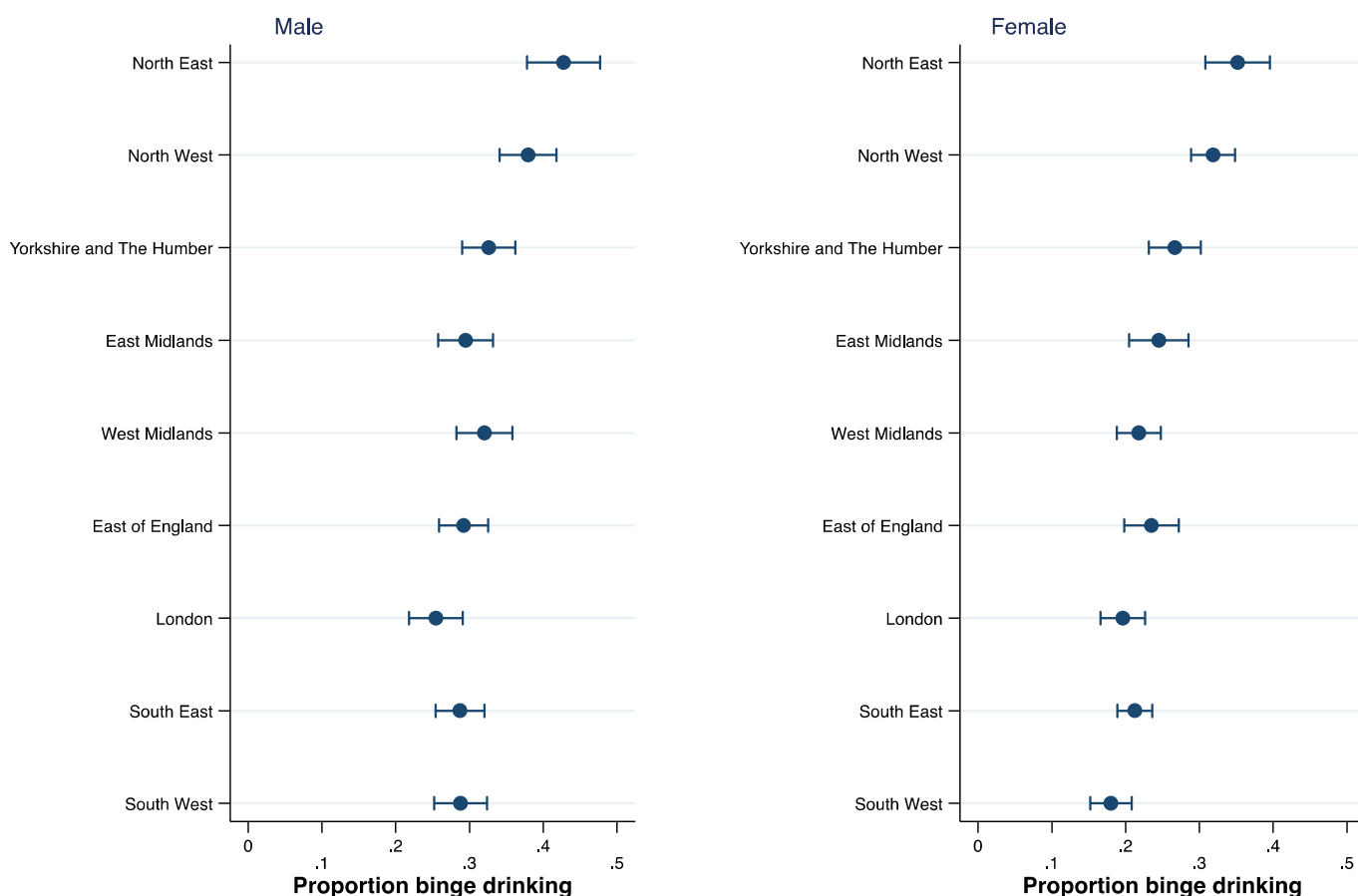


Figure 1 shows descriptive estimates of binge drinking across the nine regions in England by gender and 95% confidence intervals around each estimate. There is a clear north-south gradient in that drinkers living in northern regions are more likely to binge drink compared with those living in southern regions. In men, the North East (42.8%) and the North West (37.9%) had the highest percentages whereas London (25.4%), the South East (28.7%) and the South West (28.8%) had the lowest percentages of binge drinking. In women, binge drinking was highest in the North East (35.2%) and the North West (31.9%) and lowest in the South West (18.0%), London (19.6%) and the South East (21.2%).

Figure 2. Proportion daily drinking by region and gender, England, 2011-2013

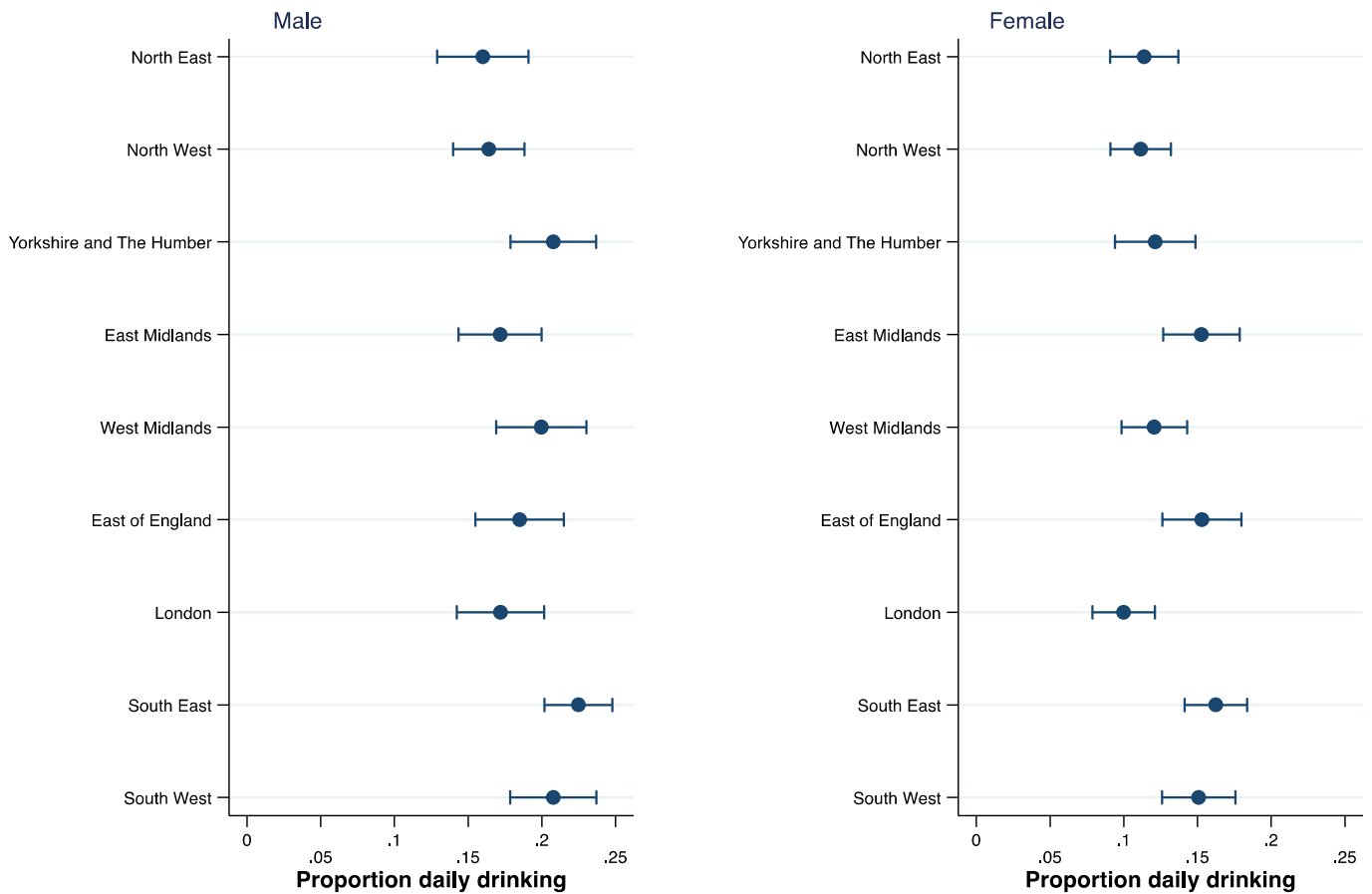


Figure 2 shows the descriptive estimates of daily drinking across English regions by gender and 95% confidence intervals around each estimate. There is a reverse, albeit less distinct, north-south divide in relation to daily drinking. Those living in the most northerly regions (i.e. North East and North West) are least likely to drink on more than five out of the last seven days, whereas those living in the most southerly regions (particularly, South East) are most likely to be daily drinkers. In men, daily drinking was highest among drinkers in the South East (22.5%) and lowest among drinkers in the North East (15.9%) and the North West (16.4%). In women, daily drinking was highest among drinkers in the South East (16.2%) and lowest among drinkers in London (9.9%), the North West (11.1%) and the North East (11.4%).

Table 2. Logistic regression models of binge drinking stratified by gender

	Model 1 - unadjusted		Model 2 + demographic controls		Model 3 + socioeconomic & smoking controls		Model 4 + neighbourhood controls	
	Odds ratio	95% CI	Odds ratio	95% CI	Odds ratio	95% CI	Odds ratio	95% CI
<b>Male</b>								
North East	1.000	[1.000,1.000]	1.000	[1.000,1.000]	1.000	[1.000,1.000]	1.000	[1.000,1.000]
North West	0.819	[0.631,1.062]	0.789	[0.612,1.017]	0.776	[0.593,1.014]	0.773	[0.591,1.012]
Yorkshire and The Humber	0.648**	[0.500,0.841]	0.630***	[0.492,0.809]	0.606***	[0.468,0.785]	0.607***	[0.469,0.786]
East Midlands	0.560***	[0.427,0.734]	0.547***	[0.418,0.715]	0.527***	[0.399,0.696]	0.532***	[0.402,0.704]
West Midlands	0.631***	[0.483,0.824]	0.641***	[0.496,0.830]	0.633**	[0.481,0.834]	0.633**	[0.480,0.834]
East of England	0.552***	[0.426,0.715]	0.542***	[0.419,0.700]	0.513***	[0.393,0.671]	0.519***	[0.396,0.681]
London	0.457***	[0.346,0.604]	0.444***	[0.336,0.586]	0.422***	[0.317,0.562]	0.418***	[0.313,0.557]
South East	0.540***	[0.417,0.699]	0.561***	[0.436,0.722]	0.537***	[0.414,0.698]	0.546***	[0.419,0.710]
South West	0.542***	[0.415,0.707]	0.533***	[0.411,0.692]	0.515***	[0.391,0.678]	0.515***	[0.390,0.681]
<b>Female</b>								
North East	1.000	[1.000,1.000]	1.000	[1.000,1.000]	1.000	[1.000,1.000]	1.000	[1.000,1.000]
North West	0.861	[0.680,1.090]	0.853	[0.677,1.075]	0.888	[0.695,1.113]	0.868	[0.685,1.099]
Yorkshire and The Humber	0.670**	[0.515,0.871]	0.661**	[0.512,0.852]	0.685**	[0.530,0.885]	0.678**	[0.524,0.877]
East Midlands	0.598***	[0.447,0.798]	0.571***	[0.434,0.752]	0.597***	[0.450,0.791]	0.587***	[0.440,0.783]
West Midlands	0.513***	[0.395,0.665]	0.499***	[0.389,0.640]	0.518***	[0.404,0.664]	0.510***	[0.397,0.654]
East of England	0.566***	[0.427,0.750]	0.559***	[0.427,0.732]	0.559***	[0.426,0.734]	0.544***	[0.413,0.716]
London	0.450***	[0.343,0.590]	0.412***	[0.317,0.534]	0.410***	[0.312,0.540]	0.407***	[0.309,0.537]
South East	0.497***	[0.391,0.631]	0.513***	[0.406,0.648]	0.527***	[0.417,0.665]	0.513***	[0.404,0.650]
South West	0.405***	[0.309,0.530]	0.422***	[0.324,0.551]	0.432***	[0.330,0.566]	0.420***	[0.320,0.553]

Table 2 shows the regional odds of binge drinking in adult drinkers in England (in reference to the North East region), adjusting for individual and neighbourhood controls in four steps. Model 1 shows that all regions have a significantly ( $p < 0.05$ ) lower odds of binge drinking compared with the North East, except for the North West. This remains the case when taking into account individual demographic controls in model 2. For example, a male drinker living in London was more than half as likely to binge drink compared with a male drinker in the North East with an odds ratio of 0.444. Introducing socioeconomic and smoking status variables in model 3 slightly attenuated the regional odds ratios in women but not in men, and including neighbourhood characteristics in model 4 had almost no effect on the regional association with binge drinking in men.

The regional association of binge drinking among female drinkers was similar to men when taking into account individual demographic controls. The inclusion of socioeconomic and smoking status controls slightly attenuated the relationship and the addition of neighbourhood characteristics slightly accentuated the relationship.

Table 3. Logistic regression models of daily drinking stratified by gender

	Model 1 - unadjusted		Model 2 + demographic controls		Model 3 + socioeconomic & smoking controls		Model 4 + neighbourhood controls	
	Odds ratio	95% CI	Odds ratio	95% CI	Odds ratio	95% CI	Odds ratio	95% CI
<b>Male</b>								
North East	0.656**	[0.503,0.857]	0.676**	[0.515,0.886]	0.700*	[0.533,0.919]	0.730*	[0.554,0.961]
North West	0.676***	[0.542,0.844]	0.698**	[0.555,0.879]	0.712**	[0.565,0.897]	0.744*	[0.587,0.944]
Yorkshire and The Humber	0.904	[0.725,1.127]	0.910	[0.720,1.150]	0.929	[0.732,1.180]	0.955	[0.751,1.215]
East Midlands	0.715**	[0.563,0.907]	0.735*	[0.576,0.937]	0.755*	[0.591,0.966]	0.745*	[0.584,0.951]
West Midlands	0.860	[0.681,1.085]	0.883	[0.694,1.122]	0.878	[0.689,1.118]	0.900	[0.705,1.149]
East of England	0.782*	[0.615,0.994]	0.7900	[0.618,1.009]	0.784*	[0.615,1.000]	0.786	[0.616,1.004]
London	0.716**	[0.559,0.916]	0.85	[0.655,1.103]	0.822	[0.633,1.067]	0.878	[0.673,1.147]
South East	1.000	[1.000,1.000]	1.000	[1.000,1.000]	1.000	[1.000,1.000]	1.000	[1.000,1.000]
South West	0.904	[0.724,1.129]	0.878	[0.695,1.108]	0.888	[0.703,1.120]	0.890	[0.706,1.122]
<b>Female</b>								
North East	0.663**	[0.502,0.875]	0.701*	[0.528,0.931]	0.731*	[0.548,0.976]	0.820	[0.611,1.101]
North West	0.647**	[0.499,0.838]	0.702**	[0.537,0.918]	0.715*	[0.545,0.937]	0.789	[0.600,1.037]
Yorkshire and The Humber	0.712*	[0.527,0.961]	0.719*	[0.527,0.982]	0.763	[0.554,1.053]	0.824	[0.597,1.139]
East Midlands	0.929	[0.721,1.198]	1.002	[0.776,1.293]	1.099	[0.848,1.423]	1.099	[0.850,1.422]
West Midlands	0.708**	[0.545,0.919]	0.741*	[0.570,0.963]	0.782	[0.597,1.025]	0.828	[0.633,1.082]
East of England	0.932	[0.719,1.208]	0.961	[0.730,1.266]	0.992	[0.743,1.324]	1.008	[0.756,1.343]
London	0.572***	[0.431,0.759]	0.676**	[0.502,0.909]	0.652**	[0.483,0.882]	0.726*	[0.534,0.989]
South East	1.000	[1.000,1.000]	1.000	[1.000,1.000]	1.000	[1.000,1.000]	1.000	[1.000,1.000]
South West	0.916	[0.714,1.176]	0.855	[0.661,1.106]	0.891	[0.687,1.157]	0.890	[0.687,1.153]

Table 3 shows the regional odds of daily drinking among drinkers in England in reference to the South East, adjusting for individual and neighbourhood characteristics using the same four steps as for binge drinking. In the unadjusted model all regions had a lower odds of daily drinking compared with the South East. However, the differences were only significant ( $p < 0.05$ ) for the North East, North West, East



Midlands, East of England and London. When taking into account individual demographic controls in model 2, the odds ratio for male drinkers in the East of England and London were no longer significant compared to the South East and the significant odds ratio for the North East, North West and East Midlands were marginally attenuated. The estimates for model 2 show that in the North East and the North West, drinkers were at least 30% less likely to drink in six of the last seven days compared to those in the South East. The inclusion of socioeconomic and smoking status controls (model 3) further attenuated the significant odds ratios from model 2 and the inclusion of neighbourhood characteristics in model 4 led to the further attenuation in odds ratio for the North East and North West. Male drinkers in the North East, North West and East Midlands were 25% less likely to drink most days compared to male drinkers in the South East when taking into account all the control variables in the final model.

Female drinkers in the North East, North West, Yorkshire and the Humber, West Midlands and London were significantly less likely to be daily drinkers than those in the South East (model 1). When taking into account demographic controls in model 2 the odds ratio were attenuated, but remained significant. A female drinker living in these regions was at least than 25% less likely to drink almost everyday in the last seven days. The North East, North West and London remained the only regions to be significantly different from the South East when adding socioeconomic and smoking status controls in model 3. The inclusion of neighbourhood characteristics and smoking status explained some of the regional variation in daily drinking among women (model 4), except for London that sustained a significant difference compared with the South East with an odds ratio of 0.726.

## **Discussion**

The main objective of the present research was to increase the understanding

of the drinking behaviour patterns across different regions in England using two different measures of alcohol consumption. It aimed to explore whether regional differences in binge and daily drinking could be explained by individual and neighbourhood characteristics. The results of the study confirmed the north versus south gradient in binge drinking reported in previous literature (Balarajan & Yuen, 1986; Boniface & Shelton, 2013; Shelton & Savell, 2011; Twigg & Moon, 2013, Robinson et al., 2015) with northern regions showing greater levels of binge drinking than southern regions, especially in the North East, which had the highest levels of binge drinking in men and women. In fact, living in the North East was associated with a significantly higher likelihood of binge drinking compared with any other English region, except the North West, even when individual and neighbourhood characteristics known to be associated with alcohol consumption and alcohol-related harm were held constant. The same pattern emerged for men and women.

It is not clear why this is the case or what it is about regions such as the North East that encourages people to binge drink regardless of their age, ethnicity, marital status, social class, smoking status and neighborhood deprivation. Perhaps the culture of recreational activity is different in northern regions as compared with southern regions where central cities are more compact and encourage drinkers to move more quickly between establishments, when drinking outside the household (Roberts 2013). There might also be other residual confounding that we have not taken into account in our modeling. For example, people living in northern regions tend to have poorer health and may binge drink to cope with physical and mental illnesses.

A different pattern captured the tendency towards daily drinking across English regions with a general trend of southern regions consuming alcohol more frequently than northern regions. The South East showed the greatest levels of daily drinking in men and women. However, after controlling for demographic, socioeconomic,

smoking status and neighbourhood controls, the regional variation in male and female daily drinking was much less pronounced. London was the only region that had a significantly lower likelihood of female daily drinking compared to the South East. In the case of men, the regional differences remained fairly consistent when adding demographic, socioeconomic, smoking status and neighbourhood variables. The North East, North West and East Midlands all had a lower likelihood of male daily drinking compared to the South East in the fully adjusted model, although it was attenuated when compared with the unadjusted model. The reasons why there are fewer alcohol free days among respondents living in the South East may be because people do not tend to binge drink and can therefore afford themselves to drink more frequently, but in smaller quantities. Nonetheless, the people that are more likely to drink daily are also the people drinking higher quantities over the course of a week (analysis not shown here). This suggests a worrying picture that there may be groups of people who are not binge drinking but who are close to the threshold on an almost daily basis.

The greatest attenuation in the daily drinking models was produced after demographic controls were added, especially the odds for London relative to the South East. The demographic controls were age, ethnic group, number of children in the household and marital status. Previous research has suggested that older age and non-white ethnicity are important determinants of alcohol consumption (Boniface & Shelton, 2013). Thus, London, which has a young ethnically diverse population, contains groups that have much lower alcohol consumption and this could be portraying why the South East has more daily alcohol consumption compared with London.

In addition, introducing socioeconomic characteristics and smoking status in the model also decreased the magnitude in effects of both binge and daily drinking in

women. Therefore, as previous literature has suggested, this could imply that characteristics such as social class, education and social status could act differentially on the risk of either binge or daily drinking between men and women (Fone, et al., 2013). In order to explain these effects, different mechanisms should be taken into account. First, alcohol misuse may be more acceptable in lower social class and less educated groups and among those that smoke. It could mean that drinking might be constructed as a problem in some groups, but not in other groups, which would lead to the spread of these unhealthy drinking patterns by social exchange and in those groups who do not consider drinking and drunkenness a social stigma (Fone et al., 2013). Second, the stress of being in a low socioeconomic position may make certain individuals more vulnerable to psychological distress, which may lead them to use alcohol as a coping strategy.

The addition of neighbourhood characteristics: deprivation and urbanisation had the greatest attenuating effect on daily drinking in men and women when comparing other regions to the South East. This may reflect the fact that the South East has relatively fewer deprived neighbourhoods and more rural neighbourhoods than other regions, such as the North East, North West and London. Those living in deprived neighbourhoods relative to less deprived neighbourhoods and urban neighbourhoods relative to rural neighbourhoods are less likely to drink daily.

Furthermore, in the cases where regional differences can be better explained by something we have or have not adjusted for there should not be an overwhelming interpretation of regional geography as a passive backdrop to binge or daily drinking. In fact, geography and the relationships with the people that live in certain places should be explored to understand why living in the North of England seems to generate greater odds of engaging in binge drinking or why, to a lesser extent, the same applies to people living in the South East with daily drinking (Jayne, Vallentine &

Holloway, 2006). Drinking, far from being an activity that is experienced in the same way for all people, is a behavior constructed under a mixture of practices (Jayne, Vallentine & Holloway, 2006), which increases the difficulty of understanding the rationale behind this health behaviour. We suggest, that greater availability of cheap alcohol, measured by higher alcohol outlet densities (Robinson et al., 2015) might influence geographical inequalities in harmful drinking. However, this would not explain the differentiation between binge and daily drinking. It is important to recognise that the differences between daily drinking could be explained by avoiding days of drinking after unpleasant negative psychological and physiological consequences commonly experienced when engaging in binge drinking. This would explain why northern regions showed more alcohol free days, as their higher levels of binge drinking pattern could be motivating a greater need for having alcohol free days. Another potential explanation, could be that there are specific cultural differences in drinking habits that seem to be best explained by the places in which drinking takes place. In fact, the results show an interesting gender-region association with men showing greater regional variation once individual and neighbourhood characteristics factors were controlled.

The findings have important policy implications as most regional policies and guidelines have intended to stem binge drinking in Northern regions. Moreover, as daily drinking has been suggested to play an important role in mortality and illness (NHS, 2010, OECD, 2015), it could be argued that different patterns of high levels of daily drinking compared with binge drinking warrants regional specific policies to tackle these issues. Subsequent research should aim to further analyse the differentiated drinking patterns that are characteristic of each English region as well as their impact on public health. Moreover, campaigns focused on following 'safe' levels of consumption taking binge drinking as a reference needs to recognise that averaging the number of drinks on the heaviest drinking day may obscure daily

drinking practices.

Despite its novelty and strengths, the current study design presents some limitations. First, we have focused on two definitions of alcohol consumption that do not take into account the number of hours over which alcohol is consumed or whether food accompanies its intake, which have been showed to influence the harm that alcohol exerts (OECD, 2015). Moreover, the definition for daily drinking has been adapted from other country's guidelines as there is not currently an official strict definition available in England. In fact, both definitions rely centrally on self-reporting and previous research has demonstrated pronounced discrepancies between self-reported consumption and alcohol sales across all English regions (Boniface & Shelton, 2013). The current research could not explore whether those who engaged in binge drinking took 48 hours off drinking, as recommended by the Department of Health (2007). Future literature could attempt to explore this pattern by employing the drinking diaries included in Health Survey for England, 2011.

Additionally, the conceptualisation of regions attending to Government Office Regions portray large geographical areas and although a more in depth appreciation of locations has been considered via deprivation and urbanisation measures, future literature should consider the variation in patterns of drinking across smaller areas. Furthermore, the current research does not address the unpacking of changes over time, which is a challenge identified by previous literature (Kneale & French, 2008; Twigg & Moon, 2013). As this limitation has been present in most of the literature of the field, future research should to overcome this restriction. The clearest starting point for further research that this study provides is an exploration of the explanation for regional differences in binge drinking, over and above those accounted for in the analysis. This could involve testing further individual characteristics associated with both binge drinking and regions, for example, health status as well as more directly related mechanisms that enable this type of behaviour, such as availability of licensed

premises.

Yet, our study offers a detailed picture of alcohol consumption in England from the most important nationally representative survey of health behaviour. In fact, our research suggests the presence of two differentiated patterns that have challenging policy implications. Furthermore, as daily drinking is increasingly being included in several guidelines and acknowledged as a health problem by different organisations (NHS, 2010; OECD, 2015), this study provides a novel approach that identifies the regions where this pattern is more salient and points toward South East as a risk area for this type of behaviour. Although this is not supported in the data derived from research studying alcohol-related mortality (Robinson et al., 2015) further research should aim to explore the temporal relationship between alcohol consumption patterns and harm including time series analyses of aggregate data. This would enable to provide more definitive conclusions about the relationship between alcohol consumption and related harm in specific subpopulations such as the South East.

The identification of the regions in which binge and daily drinking are more prevalent could be used as a reference in the design of differentiated policies that target alcohol misuse attending to area characteristics, especially those that aim to discourage binge drinking. In fact, including recommendations of having alcohol free days every week as well as informing about the harm derived from daily drinking could be a starting point to extend the alcohol sensible recommended guidelines, which might be excessively focused on heavy drinking. However, given our findings, interventions that target those individual characteristics known to be associated with drinking daily would serve better than a regionally targeted policy.

Overall, the research warns policy makers of the existence of an overlooked drinking pattern as well as paves the way for future studies to develop a more in depth exploration of this drinking behaviour and the consequences derived from it at smaller

geographical scales.



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