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The relationship between drinking pattern, social capital, and area-deprivation: findings from the Health Survey for England

[AU: OK?]

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ABSTRACT. Objective: The purpose of this study was to establish the relationships between heavy episodic and drinking frequency with area-deprivation and social capital in England. [AU: Correct that study looked at relationships between drinking and both area deprivation and social capital, as title states? If not, please clarify.]**Method:** Using the Health Survey for England 2002–2006, a nationally representative cross-sectional survey (*N* = 54,422), multilevel logistic regression models with individuals nested within primary sampling units were carried out, stratified by sex, on (a) drinkers versus nondrinkers, (b) heavy episodic drinking versus drinking less (on the heaviest drinking day), and (c) fewer than 2 drink-free days versus at least 2 drink-free days. Key exposures were individual social capital variables (social trust, active civic participation, social support, neighborhood perception). Models adjusted for age, area-deprivation, economic activity, education, ethnicity, longstanding illness, marital status, and children in the household. **Results:** Lack of social support (men: OR = 0.69, 95% CI [0.60, 0.79]; women: OR = 0.77, 95% CI [0.69, 0.86]) and no civic participation (men: OR = 0.75, 95% CI [0.67, 0.83]; women: OR = 0.73, 95% CI [0.68, 0.78]) decreased the odds of being a drinker versus a nondrinker.[AU: We added OR and CI to all of these stats.] Among men, low social trust increased (OR = 1.16, 95% CI [1.04, 1.30]) and no civic participation decreased (OR = 0.81, 95% CI [0.74, 0.89]) the odds of heavy episodic drinking; among women, good overall neighborhood perception decreased the odds (OR = 0.91, 95% CI [0.86, 0.97]). Lack of social support (men: OR = 1.25, 95% CI [1.14, 1.36]; women: OR = 1.20, 95% CI [1.02, 1.40]) and no civic participation (men: OR = 1.25, 95% CI [1.14, 1.36]; women: OR = 1.37, 95% CI [1.25, 1.51]) increased the odds of having fewer than 2 drink-free days. Men and women living in the most deprived areas were less likely to drink, more likely to engage in heavy episodic drinking, and more likely to have at least 2 alcohol-free days, after social capital variables were adjusted

for. **Conclusions:** Social capital is associated with drinking alcohol, and low forms is associated with heavy episodic and frequent drinking. [AU: Correct?] Interventions to reduce heavy episodic consumption should be targeted at those with low social capital and those living in deprived areas where heavy drinking is normalized. Drink-free days recommended in guidelines could be further targeted at those lacking social support. (*J. Stud. Alcohol Drugs, 78,* 000–000, 2017)

LIVING IN A DEPRIVED AREA increases the risk of poor health behaviors, including heavy alcohol consumption (Fone et al., 2013; Hill & Angel, 2005; Lin et al., 2012; Matheson et al., 2012; Stimpson et al., 2007) and heavy episodic consumption (Fone et al., 2013). It is not understood, however, whether neighborhood deprivation is also associated with nondrinking independent of individual social capital. The alcohol-harm paradox suggests that alcohol-related deaths are higher in more deprived neighborhoods despite average levels of consumption being similar to those in less deprived neighborhoods (Bellis et al., 2016). Drinking behavior may be polarized within deprived neighborhoods, whereby many more people abstain from drinking or drink harmfully compared with less deprived neighborhoods. Ecological analysis of mean consumption may mask this extreme variation.

Although studies have found individual-level high socioeconomic position (SEP) to be associated with more frequent alcohol consumption at lower quantities and low SEP to be associated with less frequent consumption but at higher quantities (Casswell et al., 2003; Huckle et al., 2010), the neighborhood context was found to influence drinking patterns independent of individual-level SEP (Fone et al., 2013; Lin et al., 2012; Matheson et al., 2012). Possible theories include the disadvantage hypothesis, whereby stress arising from living in a deprived area drives residents to use substances as a coping mechanism. Alternatively, the social contagion hypothesis posits that behaviors are influenced through social relationships within neighborhoods (Fone et al., 2013). Social relationships may differ between the most and least deprived areas, having a differing effect on consumption patterns.

The latter is plausible; drinking is often undertaken in social settings, and studies have linked social activity with drinking behavior (Borsari & Carey, 2001; Sieving et al., 2000; Thrul & Kuntsche, 2015; Tucker et al., 2015). Studies have also found a relationship between social

capital and substance use (Chuang & Chuang, 2008; Lindström, 2005; Murphy et al., 2014; Poortinga, 2006; Weitzman & Chen, 2005; Weitzman & Kawachi, 2000) and between social capital and health more generally (Lochner et al., 2003; Samuel et al., 2015; Verhaeghe & Tampubolon, 2012).[AU: Following changes OK?] There are many definitions of social capital, including quality and quantity of social networks and the "shared norms, values and understandings that facilitate co-operation within or among groups" (Organisation for Economic Co-operation and Development, 2001, page 41 [AU: Pls provide page number for this direct quote from ref.]). Social capital was identified by Bourdieu (1986) and has been formulated according to differing conceptual frameworks by the likes of Coleman (1990) and Putnam (1995) and, later on, in relation to health (Kawachi et al., 2008). Today, concepts such as social trust, civic participation, and social support are well established at measuring aspects of social capital in surveys (Harpham et al., 2002). High social capital may protect against harms of alcohol consumption by promoting norms whereby drinking patterns such as heavy episodic drinking are sanctioned as deviant behavior or by providing a network where health information is better disseminated.[AU: Word change ok?]

For example, studies have found high forms of social capital such as volunteering to be protective against binge drinking among college students (Weitzman & Chen, 2005; Weitzman & Kawachi, 2000). Similarly, interpersonal trust at the community level reduced risk of heavy episodic drinking among men in countries within the former Soviet Union (Murphy et al., 2014).

Aspects of social capital may be associated with consuming alcohol (Chuang & Chuang, 2008; Poortinga, 2006). For example, positive perceptions of neighborhood cohesiveness were associated with greater drinking frequency but in smaller quantities in New Zealand (Lin et al., 2012) and with drinking less than 2 units of alcohol per day in England (Poortinga, 2006).

However, the latter study did not take into account riskier levels of drinking such as heavy episodic or assess differences between men and women or in conjunction with neighborhood deprivation.[AU: Correct?]

Given that studies have found it is the more affluent who drink (Iparraguirre, 2015), whereas those living in more disadvantaged areas suffer the harms (Erskine et al., 2010), it is possible that social capital has differential effects on different patterns of drinking behavior depending on area deprivation. Our hypothesis being that, within less deprived areas, there is higher social capital, which may normalize drinking at safe levels. The aim of this study was to establish how individual social capital affects drinking pattern among men and women in England and whether social capital alters the relationship between area-deprivation and drinking pattern.

Participants and setting

This study used pooled data from the Health Survey for England (HSE) 2002–2006, the survey years when information on social capital was collected, which was limited to participants with responses to drinking status (N = 54,442). The HSE is a nationally representative cross-sectional survey of the population living in private households in England. Participants were selected through a multistage stratified probability sampling design, using the Postcode Address File as the sampling frame. Postcode sectors were used as the primary sampling units (PSUs) (N = 2,467).

Information in this study was collected via trained face-to-face interviewers, with the exception of social capital variables, which were collected via a self-completion booklet at the time of interview (Mindell et al., 2012). The London Multicentre Research Ethics Committee. granted ethical approval for the surveys before data collection.[AU: OK/correct?]

Drinking status, quantity, and frequency

Drinking status was dichotomized into drinkers and nondrinkers, determined by yes and no answers to the question, "Do you ever drink alcohol nowadays?" (N_{men} = 24,156; N_{women} = 30,266). Drinkers were asked what they drank on the heaviest drinking day in the past week. Heavy episodic drinking was defined as drinking more than 8 units for men and 6 units for women on the heaviest drinking day in the past week. This amounts to twice the recommended daily limits of alcohol consumption (no more than 3–4 units for men, 2–3 units for women) that were recommended in the United Kingdom during the period of the survey (House of Commons, 2012) which is often used as a proxy for what is referred to as binge drinking in the United Kingdom (Fone et al., 2013; Office for National Statistics [ONS], 2013). We compared heavy episodic drinkers to drinkers who drank less than this in the past week (N_{men} = 17,977; N_{women} = 18,098).

In addition, participants were asked on how many days they drank in the past week. This was dichotomized into having fewer than 2 drink-free days and having at least 2 drink-free days (N_{men} = 18,040; N_{women} = 18,165). In addition to limiting one's alcohol consumption volume, it has been suggested by the Royal College of Physicians (2011) to have at least 2 drink-free days per week, as has been recommended for some time in other countries such as New Zealand and Poland (Alcohol in Moderation [AIM], 2015), recognizing that harmful consumption has two components—quantity and frequency.

Individual social capital

At the individual level, social trust (high/fair/low) was derived from scores on binary responses to three questions on whether people in general can be trusted, helpful, or fair. Civic participation (none/any) was based on whether participants regularly attended a list of different

organizations. Social support (no lack/some lack/severe lack) was derived from aggregating scores from seven questions on a three-point scale concerning family and friend relationships, such as whether they can be relied on and whether they provide support and encouragement.

Neighborhood perception variables were derived using principal component analysis of four statements relating to perceptions of living in the neighborhood. These consisted of statements such as "this area is a place where neighbors look after each other." Others statements sought to determine whether the participant enjoyed living in the area and whether vandalism, graffiti, or teenagers hanging around were a problem. Ratings were strongly agree/agree/disagree/strongly disagree.

A two-factor solution was found, accounting for 78% of the variation. These factors were labeled "neighborhood satisfaction" and "neighborhood cohesion." Neighborhood satisfaction had positive loadings on each statement, with the highest for vandalism not being a problem (.80). Neighborhood cohesion had highest loadings on neighbors looking after each other (.65) and negative loadings for vandalism, graffiti, and teenagers hanging around being a problem.

Area deprivation and covariates

Area deprivation was measured using the 2000 and 2004 Index of Multiple Deprivation with lower super output areas split across quintiles of the distribution, ranging from the least to the most deprived. The index combines scores across seven different domains across lower super output areas in England: income, employment, health and disability, education and skills, barriers to housing and services, living environment, and crime. It is compiled by the U.K. Department for Communities and Local Government (2011).

Other covariates included economic activity (employed/not in employment), highest educational qualification (degree or above/other/no qualifications), ethnicity (White/non-White),

longstanding illness (no LI/nonlimiting LI/limiting LI), marital status (married or cohabitees/single/separated, widowed or divorced) and presence of children under 15 in the household (yes/no).

Statistical analysis

Missing data on social capital variables accounted for 10% at most (more detail on missing data is provided in Supplemental Table A). A higher proportion of participants with missing information on social capital questions had no qualifications, were not in employment, and were in low social class groups, suggesting that missing data was missing at random but not missing completely at random. In light of this, we imputed missing data via multiple imputation chained equations.

All variables described here were used to impute missing data in 20 imputed data sets, and estimates were taken from an average across all 20 imputed data sets. We imputed 20 data sets, due to 20 being the lower recommendation (StataCorp, 2013 [AU: Pls include this ref. in the reference list.]) to reduce sampling error as compared with imputing fewer number of data sets. In addition, we included variables to be predictive of missing cases such as self-rated health. We followed recommendations by Von Hippel (2007) by deleting the imputations in the outcomes of drinking status, volume, and frequency in the respective models.[AU: Edited correctly? If not, pls clarify.] Stata Version 14 mi command (StataCorp, 2013) was used to carry out multiple imputations of missing data and subsequent analyses on all imputed data sets.

Using the multiple imputed data sets, chi-square tests for bivariate associations were conducted between variables and drinking status, volume and frequency, and characteristics of the sample reported. Second, multilevel logistic regression modeling was used on the three outcomes. Multilevel models were used to account for the intracluster correlation, reflecting the

selection of individuals within a subset of PSUs. The intercept was assumed to be random at the level-2 PSU level (Rabe-Hesketh & Skrondal, 2012). First we regressed area-deprivation without social capital on the outcomes. We then ran the same model including all social capital variables. Both steps included adjustments for all individual covariates. This was done to observe whether social capital altered the relationship between area-deprivation and drinking pattern, suggesting it could mediate the relationship, with persons living in the most deprived areas having lower social capital. If area-deprivation remained statistically significant and there was a percentage reduction [$(OR_{\text{Model 1}} - OR_{\text{Model 1 + social capital}} / (OR_{\text{Model 1}} - 1)$], this may suggest mediation via social capital (Baron & Kenny, 1986). We calculated the interclass correlation coefficient, the percentage of variance accounted for by level 2 PSU variables, using the formula: $\sigma^2 / (\sigma^2 + \pi^2 / 3)$, where σ^2 is the PSU variance.

Given gender differences in drinking pattern and in relation to social capital (Chuang & Chuang, 2008; Wilsnack et al., 2000), analytical models were stratified by sex. As a sensitivity analysis, we carried out each analysis on the whole sample adjusting for sex (supplemental table C) and limited the model based on having fewer than 2 drink-free days to the two least deprived quintiles only to observe whether associations remained among the least deprived quintiles (supplemental table D)[AU: Which tables?]. Nonresponse weighting was applied to all analyses.

Results

Supplemental Table A shows that measures of low social capital were more prevalent in more deprived quintiles of areas (e.g., 26% of those with severe lack of social support lived in the most deprived quintile, compared with 15% in the least deprived quintile of areas; $p < .001$). Supplemental Table B presents proportions on variables with imputed data versus raw data. Missing data were highest on social capital variables (7%–10%). There was little change in the

distribution between the imputed data sets and the raw sample. Furthermore, models using raw data did not differ substantively from models using imputed data (results not shown)

Table 1 presents demographic and social capital characteristics by drinking status, volume, and frequency for men and women and chi-square test statistics. The highest proportion that lived in the most deprived areas were found among nondrinkers (men: 31%, women: 27%). Using row percentages, those in deprived quintiles had the lowest number of drinkers (men: 78%, women: 69%) compared with the least deprived quintile (men: 92%, women: 85%) (row percentages not shown in Table 1). Low social trust was greatest among nondrinkers and binge drinkers (men: 48% and 46%; women: 41% and 46%, respectively). Lack of social support (some and severe) was greatest in nondrinkers (men: 56%, women: 41%). No civic participation was highest among nondrinkers (men and women: 49%). All variables had a statistical significant association with drinking status, volume, and frequency ($p < .001$).

[COMP: Table 1 about here]

Multilevel logistic regression results for the odds of being a drinker versus nondrinker are presented for men and women in Table 2. Living in the most deprived quintile compared with the least deprived quintile decreased the odds of being a drinker (men: odds ratio [OR] = 0.67, 95% CI [0.56, 0.80]; women: OR = 0.64, 95% CI [0.57, 0.73]) compared with a nondrinker. For women, a clear area-level social gradient was found. Women living in the most deprived quintiles were less likely to be drinkers. The odds of being a drinker did not reduce after accounting for all social capital variables for men (OR = 0.69, 95% CI [0.58, 0.83]) and women (OR = 0.66, 95% CI [0.58, 0.75]). No civic participation (men: OR = 0.75, 95% CI [0.67, 0.83]; women: OR = 0.73, 95% CI [0.68, 0.78]) and severe lack of social support reduced the odds of being a drinker (men: OR = 0.69, 95% CI [0.60, 0.79]; women: OR = 0.77, 95% CI [0.69,

0.86]).[AU: OK per Table 2? Or should this retain the original and the table be changed?] Among women, low social trust (OR = 0.90, 95% CI [0.82, 0.99]) decreased the odds of being a drinker; no significant association for social trust was found among men. Living in an area that was perceived to be "cohesive" increased the odds of being a drinker among men (OR = 1.06, 95% CI [1.01, 1.11]). No association was found for the components neighborhood satisfaction and neighborhood perception for men and women.

[COMP: Table 2 about here]

Table 3 presents multilevel logistic regression results for heavy episodic drinking versus less than heavy episodic drinking for men and women. Living in more deprived quintiles increased the odds of heavy episodic drinking for men and women (e.g., most deprived quintile, men: OR = 1.53, 95% CI [1.31, 1.77]; women: OR = 2.18, 95% CI [1.82, 2.61]) compared with the least deprived quintile. After including social capital variables, the effect of deprivation was reduced by 5%, 8%, 9% in the third to fifth quintiles among men and by 5%, 12%, 15%, and 18% in the second to fifth quintile, respectively, among women. Among men, fair (OR = 1.15, 95% CI [1.02, 1.29]), and low (OR = 1.16, 95% CI [1.04, 1.30]) social trust increased the odds of heavy episodic drinking, and no civic participation decreased the odds (OR = 0.81, 95% CI [0.74, 0.89]). No association with these variables was found among women. Among women neighborhood satisfaction was associated with lower odds of heavy episodic drinking (OR = 0.91, 95% CI [0.86, 0.97]).

[COMP: Table 3 about here]

Multilevel logistic regression results for having fewer than 2 drink-free days a week versus at least 2 drink-free days is presented in Table 4. Among men, those living in the third to the most deprived quintile had lower odds of having fewer than 2 drink-free days (e.g., most

deprived quintile, OR = 0.84, 95% CI [0.73, 0.97]). A similar relationship was found among women, which was significant for the third and fourth quintiles only. After including social capital variables, the relationship remained statistically significant, reducing the odds by 5%–13% for men and 5%–8% for women.[AU: OK?] No civic participation (men: OR = 1.25, 95% CI [1.14, 1.36]; women: OR = 1.37, 95% CI [1.25, 1.51]) and severe lack of social support (men: OR = 1.21, 95% CI [1.08, 1.36]; women: OR = 1.20, 95% CI [1.02, 1.40]) were associated with having fewer than 2 drink-free days a week.[AU: OK per Table 4?] Women with fair social trust were less likely to have fewer than 2 drink-free days a week (OR = 0.86, 95% CI [0.77, 0.96]). Neighborhood perceptions were not significant for men, the component neighborhood cohesion was significant for women only (OR=1.05, 95%CI[1.00,1.10])..

[COMP: Table 4 about here]

Using the whole sample adjusting for sex in Supplemental Table C, there was little difference in associations for drinking status, volume, and frequency; however, gender differences in social capital variables that predict heavy episodic drinking could be observed by stratifying the sample. In Supplemental Table D, which was limited to the two least deprived quintiles only and assessed risk of frequent drinking, no civic participation (OR = 1.27, 95% CI [1.15, 1.41]) and severe lack of social support (OR = 1.19, 95% CI [1.03, 1.38]) remained statistically significant in increasing the odds of having fewer than 2 drink-free days a week. In every model the PSU level accounted for little variation in drinking pattern (3%–13%), and there was little change after accounting for social capital variables.

Discussion

Individual social capital and drinking

Social capital (high social support and any civic participation) was associated with drinking alcohol rather than not drinking. Low forms (lack of social support and no civic participation) were associated with having fewer than 2 drink-free days a week among drinkers. Low social trust also increased the odds of heavy episodic drinking among men; however, no civic participation decreased the odds. To some extent, high social capital appears to be associated with drinking alcohol, while also protecting against riskier forms such as heavy episodic and frequent drinking.

Among men, lower social trust increased the odds of heavy episodic drinking, as expected; however, no civic participation decreased the risk of heavy episodic consumption. The combination of low trust and active civic participation was also found to be a risk factor for heavy drinking among men in Sweden (Lindstrom, 2005) and countries within the former Soviet Union (Murphy et al., 2014), suggesting that this result is not an anomaly in our models. This association might be explained by certain social organizations fostering heavy drinking norms, where peer encouragement has been found to influence substance use (Tucker et al., 2015). For example, in organizations such as social groups (e.g., working men's clubs), sports groups, and trade unions, among men the prevalence of heavy episodic drinking was high (results from our analyses not shown here). As others have suggested, targeted interventions among male-dominated social groups at high risk for drinking are required (Kingsland et al., 2015). Furthermore, drinking heavily on a single occasion, a phenomenon deemed "binge drinking" in England, was high at the time of the survey (23% of men in 2005; ONS, 2013). Therefore, it is possible that such behavior was more normalized among men.

Conversely, low forms of social capital were also associated with having fewer than 2 drink-free days a week, including no civic participation and severe lack of social support.

Although high social capital was associated with drinking alcohol, it also suggests that it is those who lack social support that are at risk for drinking frequently, perhaps to cope with the lack of support. This, in turn, may make them more vulnerable to the harms of alcohol. Our findings are consistent with those in the former Soviet Union, in which individual-level social isolation was associated with CAGE problem drinking (Murphy et al., 2014).

Area deprivation and drinking pattern

Social gradients consistently have been found in nondrinking (Caldwell et al., 2008; Ng Fat & Shelton, 2012; van Oers et al., 1999) and heavy episodic drinking (Fone et al., 2013; Twigg & Moon, 2013).[AU: OK?] Socioeconomic disadvantage through life has been linked to both abstention and binge drinking (Caldwell et al., 2008). To our knowledge, this is the first study to show that this pattern exists within deprived areas after adjusting for a range of possible confounders including individual SEP and social capital. This extreme variation in drinking behavior in deprived areas could lead to potential conflict among people living in these spaces that may further lower social capital and result in greater alcohol-related harm in such areas (Bellis et al., 2016; Erskine et al., 2010).

Factors suggestive of social exclusion, such as lack of social support and no civic participation associated with nondrinking, provide further explanation for the social gradient, alongside poor physical and mental health (Ng Fat et al., 2014; Saarni et al., 2008). Alcohol is often consumed within social contexts, therefore fewer opportunities to drink may be presented to those whom are socially excluded. Deprivation may be an antecedent to this, depleting material and social resources, “isolating both residents and communities from mainstream society” (Carpiano, 2006, Page 169) [AU: pls provide page number from reference for the quotation.]).

Living in areas with high levels of deprivation may encourage higher levels of consumption among those who drink, to escape from stress, where there is lower social capital to normalize this at safe levels. Positive neighborhood perceptions were protective for heavy episodic drinking among women, whereas low social trust increased risk. Psychosocial factors, such as poor perception of the neighborhood and low social trust, appear to be a risk factor for heavy drinking and may be reinforced in areas of high deprivation.[AU: OK?]

Social capital mildly reduced the association of area-deprivation with drinking volume and frequency, with the strongest association found in the most deprived quintile (no association was found for drinking status). Area-deprivation remained a robust predictor after accounting for social capital, suggesting that there may be other mechanisms, such as alcohol availability or structural features of the environment, that are also important. Alcohol availability has been found to be related to alcohol harm and use (Gmel et al., 2016; Pollack et al., 2005; Richardson et al., 2015), although findings are mixed and the causal direction is not clearly established. Unfortunately, we were unable to account for structural features, such as the local alcohol environment (Theall et al., 2009), which is an area of possible future investigation.

Living in areas with lower levels of deprivation was associated with having fewer than 2 drink-free days a week. Positive neighborhood perceptions were found to be associated with greater frequency of drinking, but in smaller quantities (Lin et al., 2012) in New Zealand.We also found increased odds of greater drinking frequency with the neighborhood perception component ‘cohesion’ among women, but this was not significant among men. . Other studies have found it is the affluent, particularly the older affluent, who are at greater risk of drinking at harmful levels in England (Iparraguirre, 2015). In a sensitivity analysis limited to the two least deprived quintiles only (Supplemental Table D), lack of social support and no civic participation

remained significant in increasing the odds of having fewer than 2 drink-free days a week, suggesting that low social capital may be a risk factor for frequent drinking regardless of area-deprivation.

Strengths and limitations

Strengths of this study include a large, nationally representative sample and adjustment for a range of confounders. There was a relatively large proportion of missing data within social capital variables, which we accounted for by using multiple imputations on the assumption that data were missing at random..[AU: Is there a clear distinction between "missing at random" and "missing completely at random? Will this be clear to the readers?]

We attempted to assess mediation using Baron and Kenny's method (1986); however, this has low statistical power (MacKinnon et al., 2002). In our models, social capital mildly reduced the effect of the association of area-deprivation with drinking volume and frequency (no association was found for drinking status), and there was a minute change in the variation explained at the PSU level after inclusion of social capital variables. Therefore, there are likely to be other features of area-deprivation or at the PSU level that may be more important in predicting drinking pattern, such as the structural environment.[AU: OK?] Future studies wishing to investigate this relationship further could use more sophisticated methods such as structural equation modeling (MacKinnon et al., 2002). Our focus on the relationship between social capital and drinking pattern made this beyond the scope of this study.

Unfortunately, we were constrained by questions asked at the time of the survey in HSE 2002–2006. Questions were not asked about average weekly consumption, nor were detailed questions asked about social capital, which could have assessed the quality of social ties or

different types of social capital such as bridging or bonding capital.[AU: OK?] We believe the use of a large, nationally representative survey offsets this limitation.

The HSE is cross-sectional; therefore, we cannot assume causality or rule out reverse causality. For example, problematic frequent drinking could lead to lower levels of social capital and isolation, or not drinking alcohol could lead to lower social capital. Nonetheless, we feel that this work provides an important interpretation of drinking culture in England, through the use of concepts within social capital theory. Future work could explore temporal relationships in more depth using longitudinal or qualitative data.

Conclusion

Social capital is related to drinking pattern, with high forms (social support, trust, civic participation) being associated with drinking alcohol as opposed to not drinking alcohol, thereby highlighting that drinking alcohol is the norm in England, which may make it difficult for people to resist social pressures to drink. Active civic participation increased odds of heavy episodic drinking among men, suggesting that not all forms of social capital are protective against harmful drinking patterns. Living in a deprived neighborhood increased the likelihood of heavy episodic drinking among men and women. In light of this, interventions should target deprived neighborhoods and social activities that reinforce heavy drinking among men. Frequent drinking was associated with lack of social support and no civic participation; the current UK government guidelines appear to be justified in suggesting drink-free days which could be further targeted at drinkers who are lack social support.

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TABLE 1. Characteristics of drinking status, volume, and frequency among men and women

	Men						Women					
	Non-drinker	Drinker	<HED	HED	≥2 drink-free days	<2 drink-free days	Non-drinker	Drinker	<HED	HED	≥2 drink-free days	<2 drink-free days
N	3,106	21,050	13,253	4,724	13,252	4,788	6,550	23,716	15,592	2,506	14.786	3,379
Age, in years, *M* (*SE*)	49 (0.08)	48 (0.02)	51 (0.03)	39 (0.05)	45 (0.03)	54 (0.05)	53 (0.06)	47 (0.03)	49 (0.30)	34 (0.06)	45 (0.03)	56 (0.06)
Area level neighborhood social capital mean score												
Satisfaction, *M* (*SE*)	-14 (0.42)	-2 (0.15)	6 (0.18)	-16 (0.31)	-3 (0.18)	9 (0.31)	-1 (0.29)	3 (0.14)	10 (0.17)	-25 (0.44)	2.3 (0.18)	19 (0.37)
Cohesion, *M* (*SE*)	-8.5 (0.41)	-1.2(0.15)	-0.1(0.18)	-0.2(0.31)	-1.1(0.18)	2.2(0.31)	-2.6(0.29)	2.5(0.14)	3.1(0.17)	1.7(0.45)	2.2(0.18)	5.9(0.38)
%%	%	%	%	%	%	%	%	%				
Index of Multiple Deprivation												
Least deprived quintile	13.6	22.2	24.9	18.1	21.8	26.6	14.3	22	24.6	14.4	22.2	27.7
2	15.6	21.4	22.8	19.4	21.4	23.4	17	21.3	22.7	17.1	21.2	24.6
3	17.8	20.4	20.1	21.2	20.6	20.0	18.1	20.1	20.4	17.8	20.4	19.7
4	21.7	19.9	18.5	21.8	20.1	17.3	23.2	19.9	18.7	23.4	20.2	16.1
Most deprived quintile	31.3	16.1	13.7	19.5	16.2	12.8	27.4	16.7	13.7	25.4	16.1	11.8
In Employment	44.4	60.7	59.0	71.0	64.1	56.6	35.1	54.1	55.0	63.8	57.9	48.7
Education												
Degree or higher	13.4	20.7	23.7	17.9	21.7	23.3	10.8	17.1	19.5	16.0	18.8	19.4
Other	46.7	56.7	53.9	65.8	58.4	53.2	40.6	57.9	57.1	68.5	59.8	54.1
No qualifications	39.9	22.5	22.5	16.3	19.9	23.5	48.5	25.0	23.5	15.5	21.4	26.5
Marital status												
Married or cohabiting	56.9	67.8	73.3	56.5	66.4	75.2	53.5	61.5	66.6	47.2	62.2	70.2
Single	29.7	22.0	16.4	34.5	24.3	13.1	16.6	19.3	14.9	40.8	21.0	8.7
Separated/widowed/divorced	13.4	10.2	10.3	9.0	9.3	11.7	29.9	19.2	18.6	12.0	16.8	21.1
White ethnicity	70.1	95.4	95.5	97.6	95.5	97.6	78.8	95.8	96.7	97.7	96.4	98.5
Limiting longstanding illness												
No longstanding illness	47.0	55.0	53.5	63.4	59.1	47.9	44.0	55.8	55.8	66.7	58.7	51.2
Longstanding illness	16.8	21.3	22.3	19.8	20.3	25.3	16.9	20.2	20.7	16.5	19.7	21.6
Limiting longstanding illness	36.2	23.2	24.2	16.7	20.6	26.8	39.2	24.0	23.6	16.8	21.6	27.2
Social trust												
High	25.0	30.7	33.8	25.4	30.2	35.1	26.8	32.5	35.1	25.0	32.1	40.1
Fair	26.6	28.0	27.9	28.6	28.5	26.8	32.4	31.9	32.0	29.3	31.8	30.5
Low	48.4	41.3	38.4	46.0	41.3	38.2	40.8	35.7	33.0	45.7	36.1	29.5
No civic participation	48.7	38.9	38.3	35.8	36.7	40.1	49.2	37.9	35.3	41.2	35.6	38.7
Social support												
No lack	43.8	56.6	57.4	57.4	57.9	55.8	59.3	67.7	69.3	65.7	68.8	68.7
Some lack	29.2	27.7	27.2	27.8	27.3	27.4	24.8	22.7	21.9	23.7	22.3	21.6
Severe lack	27.0	15.7	15.4	14.8	14.8	16.8	16.0	9.3	8.8	10.7	8.9	9.7

Notes: Proportions are the averages across all imputed data sets, Health Survey for England 2002–2006. HED = heavy episodic drinking. All categorical variables had a statistical significant bivariate association with drinking status, volume, and frequency (based on chi-square tests, $p < .001$).

TABLE 2. Multilevel logistic regression on the odds of drinking versus not drinking among men (*N* = 24,156) and women (*N* = 30,266)

	Men		Women	
Variable	Model 1 OR [95% CI]	Model 2 OR [95% CI]	Model 1 OR [95% CI]	Model 2 OR [95% CI]
Area-deprivation				
Least deprived quintile	1	1	1	1
2	0.99 [0.83, 1.19]	1.00 [0.84, 1.20]	0.91 [0.81, 1.02]	0.92 [0.82, 1.04]
3	0.89 [0.75, 1.06]	0.91 [0.76, 1.08]	**0.85 [0.75, 0.95]**	**0.86 [0.76, 0.97]**
4	0.91 [0.76, 1.08]	0.93 [0.78, 1.11]	**0.74 [0.65, 0.83]**	**0.76 [0.67, 0.85]**
Most deprived quintile	**0.67 [0.56, 0.80]**	**0.69 [0.58, 0.83]**	**0.64 [0.57, 0.73]**	**0.66 [0.58, 0.75]**
Social trust				
High	–	1	–	1
Fair	–	1.02 [0.89, 1.17]	–	0.91 [0.83, 1.00]
Low	–	1.02 [0.89, 1.17]	–	**0.90 [0.82, 0.99]**
Civic participation				
Any		1		1
None	–	**0.75 [0.67, 0.83]**	**–**	**0.73 [0.68, 0.78]**
Social support				
No lack		1		1
Some lack	–	**0.85 [0.76, 0.96]**	–	0.95 [0.88, 1.04]
Severe lack	–	**0.69 [0.60, 0.79]**	**–**	**0.77 [0.69, 0.86]**
Neighborhood perception				
Satisfaction	–	0.99 [0.93, 1.04]	–	0.97 [0.94, 1.01]
Cohesion	–	**1.06 [1.01, 1.11]**	–	1.01 [0.98, 1.05]
Level 2 PSU variation (*SE*)	**0.483 (0.050)**	**0.481 (0.049)**	**0.190 (0.024)**	**0.188 (0.024)**
Inter-class correlation	12.81	12.75	5.47	5.41

Notes: Models adjusted for economic activity, highest educational qualification, ethnicity, longstanding illness, marital status, children in the household, and variables presented in table. **Bold** indicates statistical significance. OR = odds ratio; CI = confidence interval; PSU = primary sampling units.[AU: OK?]

TABLE 3. Multilevel logistic regression on the odds of heavy episodic drinking versus less than heavy episodic drinking among men (*N* = 17,977) and women (*N* = 18,098) who drank in the previous week

	Men		Women	
Variable	Model 1 OR [95% CI]	Model 2 OR [95% CI]	Model 1 OR [95% CI]	Model 2 OR [95% CI]
Area-deprivation				
Least deprived quintile	1	1	1	
2	1.10 [0.96, 1.26]	1.10 [0.96, 1.26]	1.24 [1.03, 1.49]	1.23 [1.02, 1.47]
3	**1.25 [1.08, 1.45]**	**1.24 [1.07, 1.44]**	**1.37 [1.14, 1.64]**	**1.33 [1.11, 1.59]**
4	**1.36 [1.18, 1.56]**	**1.33 [1.15, 1.53]**	**1.62 [1.36, 1.95]**	**1.53 [1.27, 1.84]**
Most deprived quintile	**1.53 [1.31, 1.77]**	**1.48 [1.26, 1.72]**	**2.18 [1.82, 2.61]**	**1.96 [1.63, 2.37]**
Social trust				
High	–	1	–	1
Fair	–	**1.15 [1.02, 1.29]**	–	0.98 [0.85, 1.13]
Low	–	**1.16 [1.04, 1.30]**	–	1.08 [0.93, 1.25]
Civic participation				
Any		1		1
None	–	**0.81 [0.74, 0.89]**	–	1.09 [0.97, 1.23]
Social support				
No lack		1		1
Some lack	–	1.03 [0.93, 1.14]	–	1.08 [0.94, 1.24]
Severe lack	–	0.95 [0.83, 1.09]	–	1.17 [0.97, 1.41]
Neighborhood perception				
Satisfaction	–	0.96 [0.91, 1.01]	–	**0.91 [0.86, 0.97]**
Cohesion	–	1.03 [0.99, 1.09]	–	1.03 [0.98, 1.09]
Level 2 PSU variation (*SE*)	0.447 (0.041)	0.445 (0.041)	0.430 (0.055)	0.434 (0.055)
Inter-class correlation	12.0	11.9	11.6	11.7

Notes: Models adjusted for economic activity, highest educational qualification, ethnicity, longstanding illness, marital status, children in the household, and variables presented in table. **Bold** indicates statistical significance. OR = odds ratio; CI = confidence interval; PSU = primary sampling units.[AU: OK?]

TABLE 4. Multilevel logistic regression on the odds of at least 2 drink-free days versus less than 2 drink-free days among men (*N* = 18,040) and women (*N* = 18,165) who drank in the previous week

	Men		Women	
Variable	Model 1 OR [95% CI]	Model 2 OR [95% CI]	Model 1 OR [95% CI]	Model 2 OR [95% CI]
Area-deprivation				
Least deprived quintile	1	1	1	1
2	0.93 [0.83, 1.04]	0.93 [0.83, 1.04]	0.96 [0.84, 1.09]	0.95 [0.84, 1.08]
3	**0.86 [0.77, 0.98]**	**0.86 [0.76, 0.97]**	**0.87 [0.76, 1.00]**	**0.87 [0.76, 0.99]**
4	**0.84 [0.74, 0.96]**	**0.83 [0.73, 0.95]**	**0.81 [0.71, 0.93]**	**0.80 [0.69, 0.92]**
Most deprived quintile	**0.84 [0.73, 0.97]**	**0.82 [0.71, 0.95]**	0.88 [0.75, 1.03]	0.86 [0.73, 1.01]
Social trust				
High	–		–	
Fair	–	0.91 [0.82, 1.01]	–	**0.86 [0.77, 0.96]**
Low	–	1.01 [0.91, 1.12]	–	0.93 [0.83, 1.05]
Civic participation				
Any				
None	–	**1.25 [1.14, 1.36]**	–	**1.37 [1.25, 1.51]**
Social support				
No lack				
Some lack	–	1.03 [0.94, 1.14]	–	0.97 [0.87, 1.08]
Severe lack	–	**1.21 [1.08, 1.36]**	–	**1.20 [1.02, 1.40]**
Neighborhood perception				
Satisfaction	–	1.01 [0.96, 1.06]	–	1.00 [0.95, 1.06]
Cohesion	–	1.03 [0.98, 1.08]	–	**1.05 [1.00, 1.10]**
Level 2 PSU variation (*SE*)	0.256 (0.030)	0.254 (0.030)	0.118 (0.036)	0.118 (0.036)
Interclass correlation	7.2	7.2	3.4	3.5

Notes: Models adjusted for economic activity, highest educational qualification, ethnicity, longstanding illness, marital status, children in the household, and variables presented in table. **Bold** indicates statistical significance. OR = odds ratio; CI = confidence interval; PSU = primary sampling units.[AU: OK?]

Supplemental Table A. Percentage distribution of social capital measures across Index of Multiple Deprivation quintiles

	Social Trust			Civic Participation	Social Support		
	High	Fair	Low	No Civic Participation	No Lack	Some lack	Severe lack
Index of Multiple deprivation quintile							
Least Deprived	26.9	20.9	15.6	17.1	22.6	18.8	15.4
2	23.7	20.6	17.9	19.0	21.7	19.4	17.1
3	20.3	20.5	18.9	19.7	19.9	19.9	19.1
4	16.9	20.5	23.2	22.4	19.6	21.4	22.4
Most deprived	12.2	17.5	24.5	21.8	16.2	20.5	26.0
			p<0.001	p<0.001			p<0.001

Supplemental Table B. Comparison of characteristics of the raw sample versus imputed data sets, for the variables with imputed data, HSE 2002-2006

	Proportion missing and then imputed in each variable (N=54,422)[a]	Raw Sample		Imputed data set[b]
Variables with imputed data[c]	%	N	%	%
Economic Activity				
In Employment		28078	53.5	53.8
ILO unemployed	3.5	24432	46.5	46.2
Education				
Degree or higher		9528	17.5	17.5
Other	0.2	29737	54.8	54.8
No qualifications		15059	27.7	27.8
Marital Status				
Married/cohabitating		33225	62.8	62.7
Single	2.8	10735	20.3	20.6
Separate/Widowed/Divorced		8921	16.9	16.7
Ethnicity				
White		49927	92.2	92.1
Non-White	0.5	4250	7.8	7.9
Limiting longstanding illness				
No LI		29245	53.8	53.7
Non limiting LI		10900	20	20
Limiting longstanding illness	0.0	14269	26.2	26.2
Social Trust				
High		15550	30.9	30.6
Fair	7.6	15181	30.2	30.1
Low		19534	38.9	39.2
Civic participation				
Active		29524	60.4	59.7
No civic participation	10.1	19392	39.6	40.3
Social Support				
No Lack		31153	61.5	61
Some Lack		12679	25	25.2
Severe Lack	6.9	6816	13.5	13.7
Area level social capital mean score				
Safe(Mean(s.e))	7.2	50522	*-0.40 (0.43)*	*-0.44 (0.10)*
Cohesion (Mean (s.e))	7.2	50522	*-0.27 (0.43)*	*-0.20 (0.10)*

a Sample corresponds to 54,442 men and women with drinking status reported, after deleting the imputed missing in the outcomes

b Proportions are the average across 20 imputed data sets

c Sex, age, IMD and children in the household had no missing data

Supplemental Table C. Multilevel logistic regression on drinking status, volume and frequency, using total sample

	Drinker versus Non-drinker		**Heavy Episodic versus Less than Heavy Episodic**		**Fewer than 2 drink-free days a week versus at least 2 drink-free days**	
	Model 1	**Model 2**	**Model 1**	**Model 2**	**Model 1**	**Model 2**
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Area-deprivation						
Least deprived quintile	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)
2	0.94(0.85-1.05)	0.95(0.85-1.06)	**1.13(1.01-1.28)**	**1.13(1.00-1.27)**	0.94(0.85-1.04)	0.95(0.85-1.06)
3	**0.87(0.78-0.98)**	**0.89(0.80-0.99)**	**1.29(1.14-1.46)**	**1.26(1.12-1.43)**	**0.87(0.78-0.97)**	**0.89(0.80-0.99)**
4	**0.80(0.72-0.89)**	**0.82(0.73-0.91)**	**1.44(1.28-1.63)**	**1.39(1.23-1.57)**	**0.83(0.75-0.93)**	**0.82(0.73-0.91)**
Most deprived quintile	**0.66(0.59-0.74)**	**0.67(0.60-0.76)**	**1.73(1.53-1.96)**	**1.63(1.43-1.85)**	**0.86(0.76-0.97)**	**0.67(0.60-0.76)**
Social trust						
High social trust	-	1.00 (Ref)	-	1.00 (Ref)	-	1.00 (Ref)
Fair social trust	-	0.95(0.88-1.02)	-	1.09(0.99-1.19)	-	0.95(0.88-1.02)
Low social trust	-	0.95(0.88-1.03)	-	**1.14(1.04-1.25)**	-	0.95(0.88-1.03)
Civic Participation	-				-	
Active	-	1.00 (Ref)		1.00 (Ref)	-	1.00 (Ref)
No civic participation	-	**0.74(0.70-0.79)**	-	**0.91(0.84-0.98)**	-	**0.74(0.70-0.79)**
Social Support						
No Lack		1.00 (Ref)		1.00 (Ref)		1.00 (Ref)
Some Lack	-	**0.92(0.86-0.99)**	-	1.05(0.97-1.15)	-	**0.92(0.86-0.99)**
Severe Lack	-	**0.74(0.68-0.80)**	-	1.01(0.91-1.13)	-	**0.74(0.68-0.80)**
Neighbourhood perception						
Safe	-	0.97(0.94-1.01)	-	**0.94(0.90-0.98)**	-	0.97(0.94-1.01)
Cohesion	-	1.03(1.00-1.06)	-	1.03(1.00-1.07)	-	1.03(1.00-1.06)
Level 2 Between PSU Variation (s.e)	**0.2785(0.0217)**	**0.2748(0.0216)**	**0.3583(0.0274)**	**0.3581(0.0275)**	**0.2868(0.0243)**	**0.2748(0.0216)**
Inter-class correlation	7.80	7.71	9.82	9.82	8.02	7.71

Models adjusted for sex, age, education, economic status, ethnicity, limiting longstanding illness, marital status and children in the household

Supplemental Table D. Multilevel logistic regression on having fewer than 2 drink-free days a week versus atleast 2 drink-free days, limited to the two least deprived quintiles only

	OR (95% CI)
Social trust	
High social trust	1.00 (Ref)
Fair social trust	**0.89(0.80-0.99)**
Low social trust	1.03(0.92-1.15)
Civic Participation	
Active	1.00 (Ref)
No civic participation	**1.27(1.15-1.41)**
Social Support	
No Lack	1.00 (Ref)
Some Lack	1.05(0.95-1.17)
Severe Lack	**1.19(1.03-1.38)**
Neighbourhood perception	
Safe	1.02(0.96-1.09)
Cohesion	1.01(0.96-1.06)
Level 2 Between PSU Variation (s.e)	**0.3330(0.0404)**
Inter-class correlation	9.19

Models adjust for sex, age, education, economic status, ethnicity, limiting longstanding illness, marital status and children in the household