The social penalty paid by teetotallers

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Abstract

Background:

Recent trends suggest that the proportion of individuals in Britain who do not drink alcohol is increasing. Despite this, British culture is still fairly dominated by alcohol as a cultural norm, and as an instigator/focus of social activities. Little is known about the effects of stopping drinking alcohol on social outcomes, which are important factors that also help protect health.

Aims:

Examine if drinking alcohol has a causal effect on an individual's social life.

Methods:

We use data from 11,631 individuals in the UK Household Longitudinal Study (UKHLS) and adopt the outcome-wide longitudinal framework detailed by VanderWeele et al. (2020) to examine the causal relationship between alcohol consumption and social outcomes. Our two exposures are a binary variable for drinking and a categorical variable for frequency of drinking. We look at five binary social outcomes; being able to visit friends when feels like it, feeling isolated, lacking companionship, feeling left out, and feeling lonely. We control for past values of the outcome and exposure, and many covariates. We report E-values, the minimum strength of association that an unmeasured confounder would need to have with both the treatment and the outcome to fully explain away our treatment-outcome association.

Results:

We find that being a drinker has a most likely causal protective effect against not visiting friends when feels like it with an odds ratio (OR) of 0.71 (E -value: 2.18) and against feeling isolated often with an OR of 0.71 (E-value: 2.18). We also find evidence that it is not simply about drinking vs. non-drinking, and that the frequency of drinking matters. Drinking monthly or less had no statistically significant effect on social outcomes relative to not drinking, while drinking 2-3 times a week had the biggest protective effect against adverse social outcomes, including against not visiting friends when you feel like it with an OR of 0.59 (E-value: 2.81).

Conclusions:

Our results suggest a positive relationship between drinking and social interaction, and that this relationship may be causal. This could be due to alcohol being the norm for socialization in the UK disadvantaging teetotallers.

1. Background

There has been a widespread increase in policy makers' efforts to reduce alcohol consumption. The aim of these policies is to improve population health. A recent study conducted by Manthey et al. (2019) found that alcohol consumption decreased in most European countries between 1990–2017.

The final *Adult Drinking Habits in Great Britain* survey, conducted by the Office for National Statistics (ONS), found that from 2005 to 2017 the proportion of British adults belonging to the age groups 16 to 24, 25 to 44 and 45 to 64, who were teetotal (i.e. did not drink alcohol) had increased. For example, the proportion of teetotallers between the ages of 25 to 44 increased from 16–21% from 2005 to 2017 (ONS, 2018). A study of repeated cross-sectional surveys of young people found non-drinking amongst respondents increased from 18–29% from 2005 to 2015 (Ng Fat et al., 2018; Fig. 1).

There are a number of possible factors that could be driving these trends; including increased awareness of the adverse effects of alcohol, an increasing focus on health and wellness, and an improved knowledge base on the link between alcohol and adverse health outcomes such as cancer (Boffetta and Hashibe, 2006).

Despite this increased prevalence of teetotalism and reduced alcohol consumption, social culture in Britain is still dominated by socialisation over alcohol as a cultural norm, and alcohol is seen as an instigator/focus of social activities (Smith and Foxcroft, 2009). Public houses (or pubs) are a common place for individuals to meet friends and socialize. There is anecdotal evidence that being teetotal (not drinking alcohol) has an adverse effect on an individual's social life with individuals finding it harder to socialise

with friendship groups based around alcohol (Gillespie, 2018). Thurnell-Read (2021) conducted a qualitative study of staff and pub-goers (n = 86) and found that pubs are particular social settings that establish, maintain, and protect social connection and interaction (though they also found this was not always in connection with drinking).

Previous research has found moderate benefits of alcohol consumption on socialization (Peele and Brodsky, 2000) (Dare et al., 2014) (Wilkinson and Dare, 2014). Nezlek et al. (1994) used data from 90 college students in the U.S. and found that relative to those who reported 'some binge drinking episodes', those who had no binge drinking episodes reported less intimacy and less disclosure in their interactions.

Socialization is very important to us as human beings. For example, social isolation has been shown to have adverse effects on health and health behaviours (Algren et al., 2020). Friendship, as measured by the frequency with which individuals see friends and quality (satisfaction with friendships), has also been found to be positively associated with life satisfaction (Amati et al., 2018).

In his influential book "Bowling Alone: The Collapse and Revival of American Community" Putnam (2000) argues that social links and connectedness are key for healthy flourishing societies. Putnam famously used the example of the decline in Americans participating in social situations in bowling halls to highlight falling levels of social capital, a loosely defined term that Putnam broke into two distinct strands. Bonding – or exclusive – social capital refers to strong social ties between homogenous individuals (i.e. within families and/or existing networks of friends). Bridging – or inclusive – social capital refers to individuals and/or groups of individuals who attempt to expand social networks to include a more diverse social grouping. In this dichotomisation, attending pubs may be thought of as both.

Regardless of the exact type of social capital that going to a pub and partaking in alcohol consumption is, there is a plethora of recent research that shows that high levels of social capital are good for health. Ehsan et al. (2019) conducted a systematic review and concluded that there is good evidence that social capital strongly predicts better mental and physical health, and that social capital was protective against mortality.

Social capital can affect health through several channels. Firstly, groups with higher levels of cohesion are better equipped to participate in collaborative actions that benefit the wider community. Secondly, more cohesive groups are better placed to ensure positive social norms (of good health) are adhered to. Thirdly, reciprocity of exchanges between members of a social network helps promote beneficial health behaviours. Finally, social capital context can help the diffusion of information that is beneficial for health between the group members. More broadly, potential mechanisms between social capital and health include reduced loneliness and a greater sense of belonging. For example, social capital can empower people to take more of an interest in themselves and their friends/peers and their community which can lead to a 'warm glow' effect.

There is a large global burden of disease attributable to alcohol-use (Rehm et al., 2009). However, given the importance of socialization, it would be undesirable for individuals to have a reduced social life as the result of a lifestyle choice to reduce/stop alcohol consumption.

It would also be interesting to see if there are any potential social life benefits to alcohol which could be factored into any analysis of the social cost of alcohol. Previous analysis of this kind was conducted by Godfrey (1997).

In this study, we use Britain as a case study to examine the relationship between alcohol consumption and a variety of socialisation outcomes. We do this through an initial chi-square test, and then move to try to establish if there is a potential causal relationship using the outcome-wide longitudinal framework constructed by VanderWeele et al. (2020).

2. Data

2.1. Dataset

We use data from the UK Household Longitudinal Study (UKHLS) also known as 'Understanding Society'; a nationally representative household-level study of the UK population (University of Essex, ISER, 2020). Understanding Society collects data on a wide range of participant characteristics including economic, social and biological outcomes. Most importantly for our study, it asks participants a range of questions on alcohol consumption and social outcomes.

Understanding Society has a large cohort with approximately 54,000 adult participants in the wave with the most responses (Wave 2), taken from nearly 40,000 households (CLOSER, n.d.). It has ten waves of data; collected from 2009 to 2019. Our preliminary chi-squared test to look for differences in social outcomes by teetotal status uses data from wave 9. Our VanderWeele outcome-wide framework analysis uses data from waves 3 (2011–2013), 5 (2013–2015), 6 (2014–2016), 7 (2015–2017) and 9 (2017–2019) as these are the waves in which the relevant variables were included.

2.2. Exposures

We conduct analysis on both the extensive and intensive margin of alcohol consumption.

For our extensive margin analysis, we use a binary exposure that indicates if an individual has had an alcoholic drink in the last 12 months, our measure of drinker status.

For our main exposure (wave 7), the variable is derived from the question 'In the past 12 months have you taken an alcoholic drink?'. If they respond 'Yes' the drinker status variable takes a value of 1. For our prior exposure (wave 5) the variable is derived from the question 'How often have you had an alcoholic drink during the last 12 months?' if the respondent answers anything other than 'Not at all in the last 12 months', the variable takes a value of 1.

For the main exposure (wave 7) in the intensive margin analysis, we use the categories provided in the frequency of alcohol consumption question 'Thinking about the past 12 months, how often do you have a drink containing alcohol?', the categories for this question are 'Never' (our base category), other categories include 'Monthly or less', '2–4 times per month', 2–3 times per week', or '4 + times per week'.

For our prior exposure (wave 5) in the intensive margin analysis, we use slightly different categories due to differences in the way the question is asked. Individuals are asked 'how often have you had an alcoholic drink of any kind during the last 12 months?', from the participants' responses, we constructed 5 categories including 'No' (our base category), 'Every 2 months or less', '1–2 times a month', '1–2 times a week', or '3 + times a week'.

2.3. Outcomes

Our primary outcome of interest is a binary variable that indicates whether an individual does not go out and see friends socially when they feel like it. This is derived from the question 'Do you go out socially or visit friends when you feel like it?'. Our variable takes a value of 1 if they say no, and a value of 0 if they say yes. Data on this question is available in waves 3, 6 and 9 of the Understanding Society Dataset.

We have several other outcomes of interest. One of which is a binary social isolation variable, derived from the question 'How often feels isolated from others?' which has three answers. We code this variable to take a value of 1 if an individual responds 'Often', and a value of 0 if an individual responds with 'Hardly ever or never' or 'some of the time'. In addition, we have a binary variable for often feeling a lack of companionship derived from the question "How often do you feel you lack companionship?", feeling left out derived from the question "How often do you feel left out?", and feeling lonely derived from the question "How often do you feel lonely?".

2.4. Covariates

We control for a variety of characteristics that could feasibly be linked to both alcohol consumption and to an individual's ability to socialise. Having a child, and employment status, are likely to impose time constraints on individuals that may both reduce their ability to see friends and may reduce the amount of alcohol they consume.

Additionally we also include controls for social class; which may influence someone's ability to socialise, as deprivation has been linked to increased isolation (Barnes et al., 2006), higher social class may also mean someone has more resources to go out and see friends. Furthermore, those with lower socioeconomic status consume less alcohol then their peers (Beard et al., 2016). Our proxies for socioeconomic status include monthly household income, and educational attainment, both of which have been found to be positively associated with alcohol consumption (Ng Fat et al., 2017).

We also control for an individual's level of physical and mental health using self-assessed health, SF-12 physical component, and the General Health Questionnaire subjective well-being score (GHQ); bad health has been found to be associated with non-drinking,

and it is also likely to affect an individual's social life (Fat and Shelton, 2012). Related to health, we also include a proxy for diet, we also control for the number of days per week an individual eats fruit and vegetables.

We also control for the number of close friends an individual has; as having a low number of close friends would both restrict an individual's ability to socialize, and the amount of people they could drink with.

We further include a binary control for whether an individual takes part in activities for at least one of a series of listed groups. These groups include political parties, trade unions, environmental groups, Parents'/School associations, tenants/residents' groups, religious/church organisations, voluntary services, pensioners' organisations, scouts/guides, professional organisations, other community groups, social/working men clubs, sports clubs, WI/townswomen's guilds, women's group/female organisations, or 'other'.

We additionally control for 'Big Five' personality traits, as these have been found to be related to alcohol consumption, while personality traits such as extraversion may affect how much an individual socialises (Lui et al., 2022).

Additional, we include a number of controls that VanderWeele et al. (2020) suggest studies in the social sciences should generally control for; these include neighbourhood social cohesion, smoking, ethnicity, political affiliation, and depression.

Data for our covariates come from wave 6, except for the 'Big Five' personality traits, and how often an individual eats fruit and vegetables, which come from waves 3 and 5 respectively.

Figure 2 shows a flowchart of variables and the waves they are derived from.

3. Empirical Strategy

3.1. Chi-squared analysis

To establish that there is a relationship between teetotalism and social outcomes, we initially test the relationship using a chi-squared test looking to see if we see differences in whether sees friends socially by drinker status with data from wave 9 of Understanding Society.

3.2. Outcome-wide Longitudinal causal framework

The chi-squared test is useful for establishing if there is an association between teetotal status and social outcome. However, it may be that people who do not socialise have less opportunity to consume alcohol (reverse causality) or there may be other factors such as health status that affect both social relationships and alcohol consumption (omitted variable bias/confounding).

To address these issues of reverse-causality and confounding we make use of the outcome-wide longitudinal framework specified by VanderWeele et al. (2020). This framework advocates including a large number of covariates so that an estimate of the treatment effect is as unaffected by omitted variable bias as possible.

Additionally, this framework advocates use of temporal ordering of covariates, exposure and outcome that is possible in longitudinal data. Exposure data should come from a period that precedes the outcome variable. The temporal ordering of exposure preceding outcome is necessary for our suggested causal relationship to be plausible, if exposure and outcome are measured at the same time, it makes it impossible to untangle cause and effect.

Additionally, data on covariates should come from a period that precedes exposure. Controlling for covariates from a period that precedes exposure helps reduce the risk of accidentally controlling for a mediator of the relationship between exposure and outcome which would lead to a biased estimate of the treatment effect.

The framework further suggests that depending on data availability, pre-exposure levels of the outcome should be controlled for. Controlling for the exposure at baseline can help mitigate (but not fully rule out) reverse causation, as in this instance it would allow us to look at the effect of changes in drinking behaviour on subsequent socialising conditional on previous socialising. It helps us rule out the possibility that if those who drink are more social, that this is not because people who are more social are more likely to drink.

It also advocates for controlling for pre-baseline exposure to reduce the risk of reverse causality and to reduce the risk of confounding. Figure 3 provides a visual explanation of how controlling for previous exposure can help reduce the risk of uncontrolled for confounding being the sole driver of our relationship. Including a prior measure of the exposure means that for a set of unobserved confounders to explain away our entire relationship, it would have to be associated with the outcome and the baseline exposure, independent of its relationship with the prior exposure (VanDerWeele et al., 2020). As shown in Fig. 3. taken from VanDerWeele et al. (2020), the relationship between U (Unmeasured confounders) and prior exposure (A^{Prior}), as well as U and to our final outcome (Y_k) would have to be present and substantial.

Following the guidance of the VanderWeele framework, we construct a logit regression model that has multiple outcome variables using data from wave 9, exposure data from wave 7, covariate data from wave 6, prior outcome data from wave 6, and prior exposure data from wave 5. We were only able to include prior outcome data for our main outcome variable of interest, seeing friends socially, as this was the only outcome variable for which data was collected before wave 9.

3.2.1. E-values

As a form of sensitivity analysis, we calculate E-Values for our point-estimates and confidence intervals, which can be viewed as a measure of robustness for associations against uncontrolled for confounding (VanderWeele et al., 2020). VanderWeele and Ding (2017) define E-Values as the 'minimum strength of association, on the risk ratio scale, that an unmeasured confounder would need to have with both the treatment and the outcome to fully explain away a specific treatment-outcome association, conditional on the measured covariates.' An advantage of E-Values is that unlike other forms of sensitivity analysis it requires minimal assumptions (VanderWeele and Ding, 2017).

As an example, if the E-Value for an estimated relative risk between an exposure and outcome after controlling for observed confounders was 2, an unmeasured confounder would have to be associated with both the treatment and the outcome by a risk ratio of 2-fold each to explain away the estimated relationship between exposure and outcome (VanderWeele and Ding, 2017). The lowest possible E-Value is 1, which means that no un-measured confounding is required to explain away the exposure-treatment relationship.

E-values are reliant on the magnitude of the association between the exposure and outcome, so unlike p-values, E-values cannot be made arbitrarily small by increasing sample-size, though they do not make precision inconsequential. More precise estimate of the effect size will lead to smaller 95% confidence intervals, so should lead to smaller e-value estimates for the confidence interval (though this is still bounded by the effect size).

E-values do not specifically consider the number of covariates that have been used but E-value estimates can be interpreted as more robust when more potential confounders are controlled for as it means there are less un-measured confounders out there that could explain away the relationship (VanderWeele and Ding, 2017).

We use the formula for E-values specific to relative risks or odds ratios (OR) where the binary outcome is rare (< 15%) (VanderWeele and Ding, 2017).

E-Value equations if OR < 1:

Point-estimate:

E-Value = $OR^* + \sqrt{OR^* \times (OR^* - 1)}$ (1)

CI:

If UL > = 1, then E-value = 1 (2)

If UL < 1, then E-Value = $UL^* + \sqrt{UL^* \times (UL^* - 1)}$ (3)

Where OR*=1/OR and UL* = 1/UL

E-Value equations if OR > 1:

Point-estimate:

E-Value = $OR + \sqrt{OR \times (OR - 1)}$ (4)

CI:

If LL < = 1, then E-value = 1 (5)

If LL > 1, then E-Value = $LL + \sqrt{LL \times (LL - 1)}$ (6)

Where OR*=1/OR and UL* = 1/UL

We specify the formula we use for E-Values for both our point-estimates and confidence-intervals in Equations 1–6, where OR is the odds ratio, UL is the upper confidence interval, and LL is the lower confidence interval. Empirical proofs for E-values can be found in Ding and VanderWeele (2016). We use the E-Value calculator created by Mathur et al. (2018) (VanderWeele and Ding, 2017).

3.2.2. Regression analysis

$Y_{i9} = \tau A_{ij7} + \rho A_{ij5} + \delta Y_{i6} + B X_{i6} + u_i$ (7)

Equation 7 details our estimation strategy, Y_{i9} represents our final outcome variables (socialisation outcomes) for individual 'i' in wave 9. A represents our alcohol exposure, A_{ij7} represents the exposure in wave 7 (post-baseline), and A_{ij5} represents the exposure in wave 5, a prior (pre-baseline) value of the exposure. The superscript 'j', indicates which exposure we are using, j = 1 indicates we are looking at extensive margin (binary drinker/teetotal variable), and j = 2 indicates we are looking at intensive margin (categorised frequency of alcohol consumption). Y_{i6} represents a baseline value of the outcome (from wave 6). X_{i6} is our vector of covariates taken at baseline (wave 6). U_i represents our random error for individual 'i'. Our coefficient of interest is τ, which conditional on assumptions holding, represents the causal effect of teetotalism on later social outcomes.

We estimate our results using logit regression with robust standard errors. We report the change in odds ratio associated with each variable.

We report the point-estimate change in odds ratio for our exposure, the E-Value for the point-estimate, as well as the E-Value for the 95% confidence interval.

3.3. Software

Our analysis was conducted using Stata 14 (StataCorp, 2015).

4. Results

4.1. Sample construction

Details of how we arrived at our final sample size of 11,631 can be found in Figure S1 amongst our supplementary figures and tables. Table S1 provides details on the differences in demographics at baseline (wave 6) between those in our sample and those who are not. On average, our sample has higher educational attainment, is older and is more likely to be married than those who are not in the sample (Table S1).

4.2. Descriptive statistics

Table 2 presents descriptive statistics on the analysis sample. Approximately 13% of our sample were not visiting friends socially when they wanted to in our outcome wave (wave 9). 6% felt isolated often, 7% felt they lacked companionship often, 5% felt left out often, and 7% felt lonely often. 84% of our sample were drinkers at time of exposure (wave 7), and the most populated frequency of drinking category was '2-3 times a week' (24.6%).

The average age of our sample in wave 6 was 52.7. Our sample was mostly female (58%). Our sample was mostly white (89.9%), and Atheism (47%) was the biggest religious group, shortly followed by Christianity (46%).

70.5% of our sample were married, and 30% of our sample had a child aged 16 or under at baseline. The average monthly net-household income for our sample was £3463.51 per month. 43.4% of our sample were at least degree educated. Most of our sample was in work (59%) as opposed to being unemployed or out of the labour market.

4.3. Chi-squared results

Table 1 shows results from some basic chi-squared analysis from wave 9 of the Understanding society data. We get a Pearson chi-squared of 600.25, and therefore reject the null hypothesis that teetotalism and whether goes out socially are independent of each other. We see more teetotallers not socialising when they feel like it (1,742) than we would expect to if these variables were independent of each other (1,085.50).

4.4. Outcome-wide Longitudinal Framework results

Our extensive margin results can be found in table 3, and our intensive margin results can be found in table 4.

The results from the outcome-wide framework analysis found that being a drinker decreased the odds of an individual not seeing friends socially when they felt like it, with an OR of 0.71 (P.E. E-value: 2.18, 95% C.I. E-value: 1.57) (Table 3). To put these into context, according to a study conducted by (Blum et al., 2020), the median e-value for point estimates of 348 studies they identified as having results the authors described as 'unlikely to be affected by confounding' was 1.82 (IQR 1.4 to 2.71). The median e-value for 95% confidence intervals in the same 348 studies was 1.28 (IQR 1.02 to 1.74).

Being a drinker also decreased the odds of often feeling isolated with an OR of 0.71 (P.E. E-value: 2.18 , 95% C.I. E-value: 1.32) (Table 3).

We find little evidence of being teetotal having a causal effect on lacking companionship, feeling left out, or feeling lonely (Table 3).

Drinking 2-4 times per month was associated with a lower risk of not seeing friends socially when they felt like it, with an OR of 0.63 (P.E. E-value: 2.58, 95% C.I. E-value: 1.79) (Table 4). The corresponding OR for drinking 2-3 times per week was 0.59 (P.E. E-value: 2.81, 95% C.I. E-value: 1.90) and the corresponding OR for drinking 4+ times per week was 0.60 (P.E. E-value: 2.73, 95% C.I. E-value: 1.71) (Table 4).

Drinking 2-4 times per month was associated with a lower risk of feeling isolated, with an OR of 0.65 (P.E. E-value: 2.47, 95% C.I. E-value: 1.39) (Table 4). The corresponding OR for drinking 2-3 times per week was 0.50 (P.E. E-value: 3.38, 95% C.I. E-value: 1.96) (Table 4). The corresponding OR for drinking 4+ times per week was 0.702 though this was statistically insignificant (P.E. E-value: 2.2, 95% C.I. E-value: 1) (Table 4).

Drinking 2-3 times a week was associated with a lower risk of often feeling left out, with an OR of 0.63 (P.E. E-value: 2.56 , C.I. E-value: 1.23) (Table 4). There were no other statistically significant effects of level of alcohol consumption on lacking companionship often, feeling left out often, or feeling lonely often (Table 4).

5. Discussion

Our results indicate there is a potential negative causal relationship between teetotalism and social interaction. We also find evidence of a potential causal relationship between teetotalism and feelings of isolation. We do not find teetotalism to be related to feelings of lacking companionship, feeling left out, or feelings of loneliness.

We find a strong suggestion that the relationship between drinking and our outcome varies with the frequency of alcohol consumed. This is most apparent for the outcome of not socialising when feels like it, where those who drank 2–3 times per week appeared to be at the lowest risk. Across all outcomes, drinking 2–3 times per week had the biggest protective effect against the adverse

outcome relative to other drinking categories (both less and more frequent), though the relationship was not statistically significant for lacking companionship or feeling lonely often.

Our results somewhat agree with the findings presented in the existing literature of Murphy et al. (2005) and Wilkinson and Dare (2014), that alcohol consumption can be associated with increased social activity. The reason for our finding of a negative relationship between teetotalism and socialisation could be due to alcohol being the norm for socialization in the UK, and that being teetotal is therefore a disadvantage, limiting the number of opportunities for social interactions (e.g. pub trips). Alternatively, it could be because alcohol acts as a 'social lubricant' and makes it easier for individuals to socialise.

The differences in findings by social outcome are notable. Drinking appears to have a protective effect against not seeing friends when one feels like it, and being isolated often, with there also being some evidence of a relationship with being left out often, but has no discernible relationship with lacking companionship often, the reasons behind this are beyond the scope of this paper but should be looked at in future work.

However, there is always the possibility our findings are due to reverse causality, with individuals making decisions/life choices that lead to seeing friends less, and if drinking is a by-product of seeing friends, they will end up drinking less. This would be in line with the findings of Wilkinson et al. (2012) who found in a mixed-methods study that retired adults began to drink more as they had more leisure time to socialize. By implementing the outcome wide longitudinal design, and including a baseline value of the outcome we have somewhat mitigated the risk of our findings being caused by the presence of reverse-causality (VanderWeele et al., 2020).

5.1. Strengths and limitations

Our study has several strengths; we believe it is one of the first to examine the relationship between alcohol consumption and social interaction using such a large dataset. Because of the nature of the dataset we were also able to conduct a study using the outcome-wide causal framework constructed by VanderWeele et al. (2020).

However, our study also has weaknesses, due to the nature of the dataset; we were not able to construct a continuous variable that looked at the frequency of social interactions. We were also only able to control for baseline outcome in our models that had 'not socialising when feels like it' as an outcome. We were also unable to identify potential mediators and moderators of the relationship between alcohol consumption and socialising.

5.2. Future research

Future research should look to replicate our results in a non-UK context, the UK has a notable drinking culture, so it would be of interest to see if the same negative relationship between teetotalism and socialisation can be found in another context. If this relationship is not found in other contexts it could suggest that this relationship is due to the prominent role that alcohol plays in UK social life.

Future research should also focus on trying to use a quasi-experimental or experimental design to try and confirm that this relationship between reduced alcohol consumption and socialization is causal. It would also be valuable to assess this relationship using a continuous variable of number of social interactions as our binary variable may miss some of this relationship. Future research should also look to identify potential mediators and moderators of the relationship between alcohol consumption and socialisation.

Future research could also examine why the relationship between alcohol consumption and socialising varies by the measure of socialising used.

5.3. Policy implications

Our research suggests the need for an increased emphasis on non-alcohol related social activities in the UK to ensure that those who have choose not to drink do not have to face a limited social life. Due to the adverse effects alcohol has on health, we do not recommend individuals increase the amount they drink to improve social outcomes, and feel it is the duty of others to help infrequent and non-drinkers improve their social outcomes.

Our research also suggests though that socialising induced by alcohol is something that should be accounted for in any new efforts to estimate the societal cost of alcohol consumption, similar to the estimates produced by Godfrey (1997).

Abbreviations

OR: Odds ratio

Declarations

Ethics approval and consent to participate

This study uses data on humans from the main survey of 'Understanding Society', the collection of this data received ethics approval from the University of Essex Ethics Committee. Our use of the data for this study does not violate the terms of the End User License.

All methods/procedures were carried out in accordance with relevant guidelines and regulations.

Consent for publication

NA

Availability of data and materials

The dataset analysed during the current study are available in the UK Data Service repository, http://doi.org/10.5255/UKDA-SN-6614-16

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

BW came up with the concept of the work, contributed substantively to the design of the work, obtained the data, performed statistical analysis of the data, contributed to the interpretation of the data and results, and drafted the paper. LM contributed substantively to the design of the work, contributed to the interpretation of the data and results, and substantively revised the work.

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Tables

Table 1 : Chi-Squared test of whether sees friends when feels like it with Drinker status

	Goes out socially when feels like it	Does not go out socially when feels like it	Total
Drinker	22,792	2,980	25,772
	(22,135.50)	(3,636.50)	(25,772.00)
Teetotal	5,951	1,742	7,693
	(6,607.50)	(1,085.50)	(7,693.00)
Total	28,743	4,722	33,465
	(28,743.00)	(4,722.00)	(33,465.00)

Pearson chi2(1) = 600.2560 Pr = 0.000

Notes: Data for both exposure and outcome for chi-squared analysis comes from wave 7. Expected values are in brackets.

Table 2: Descriptive statistics

	Mean/Freq	S.D./%
Outcome (Wave 9)		
Does not go out socially or visit friends when feels like it	0.13	0.33
Isolated Often	0.06	0.23
Lack companionship Often	0.07	0.25
Left out Often	0.05	0.22
Lonely Often	0.07	0.25
Exposure (Wave 7)		
Drinker/teetotal (Drinker = 1)	0.84	0.37
Alcohol frequency (Wave 7)		
Never	1878	16.2%
Monthly or less	2434	20.9%
2-4 times a month	2663	22.9%
2-3 times a week	2858	24.6%
4+ times a week	1792	15.4%
Baseline Outcome (Wave 6)		
Does not go out socially or visit friends when feels like it	0.11	0.31
Prior exposure (Wave 5)		
Drinker status	0.84	0.37
How often have you had an alcoholic drink during the last 12		
No	1847	15.9%
Every 2 months or less	1841	15.8%
1-2 times a month	1648	14.2%
1-2 times a week	2911	25.0%
3+ times a week	3384	29.1%
Covariates (Wave 6)		
Highest educational qualification		
No Education	2104	18.1%
GCSE	3354	28.8%
A-Level	1126	9.7%
Degree	5047	43.4%
Total household net income - no deductions	3463.51	5843.49
Age	52.7	15.24
Sex (Female = 1)	0.58	0.49
Urban/rural (Rural = 1)	0.25	0.43
Self-assessed health		
Excellent	1966	16.9%

very good	4348	37.4%
Good	3332	28.6%
Fair	1505	12.9%
Poor	480	4.1%
Marital status		
Married/Cohabiting	8205	70.5%
Widowed	714	6.1%
Separated/Divorced	1184	10.2%
Never Married	1528	13.1%
Has child aged 16 or under	0.3	0.46
Cares for elderly or sick person	0.22	0.42
Subjective wellbeing (GHQ): Likert	10.59	5.11
Religion		
Atheist	5468	47.0%
Christian	5356	46.0%
Muslim	342	2.9%
Other	465	4.0%
Ethnicity		
White	10452	89.9%
Mixed race	169	1.5%
Asian	646	5.6%
Black	312	2.7%
Other	52	0.4%
In employment	0.59	0.49
SF-12 Physical Component Summary (PCS)	49.83	10.79
days each week eat fruit		
Never	654	5.6%
1 - 3 days	2803	24.1%
4 - 6 days	2166	18.6%
every day	6008	51.7%
days each week eat vegetables		
Never	120	1.0%
1 - 3 days	1794	15.4%
4 - 6 days	3056	26.3%
every day	6661	57.3%
Neighbourhood Social Cohesion,(Î± = .78)	14.96	2.51
Number of close friends	5.4	8.66

Big 5 personality trait: Agreeableness	5.65	1.01
Big 5 personality trait: Conscientiousness	5.56	1.06
Big 5 personality trait: Extraversion	4.59	1.31
Big 5 personality trait: Neuroticism	3.53	1.42
Big 5 personality trait: Openness	4.61	1.27
Government Office Region		
North East	572	4.9%
North West	1340	11.5%
Yorkshire and the Humber	991	8.5%
East Midlands	955	8.2%
West Midlands	1059	9.1%
East of England	1195	10.3%
London	1170	10.1%
South East	1709	14.7%
South West	1266	10.9%
Wales	447	3.8%
Scotland	856	7.4%
Northern Ireland	71	0.6%
Smoker	0.14	0.35
Political allegiance		
Unknown party/other party	4859	41.8%
Conservative/right-wing	3170	27.3%
Left/centre-left	3071	26.4%
Centrist	531	4.6%
Has been diagnosed with depression before	0.1	0.3
Active in organisation	0.54	0.50

Table 3: Van Der Weele framework extensive margin results

	Does not go out socially when feels like it		Isolated often		Lack companionship often		Left out often		Lonely often	
	Coefficient + 95% C.I.	E-Value	Coefficient + 95% C.I.	E-Value	Coefficient + 95% C.I.	E-Value	Coefficient + 95% C.I.	E-Value	Coefficient + 95% C.I.	E-Value
Drinker status	0.71***	2.18	0.71*	2.18	1.02	1.17	0.83	1.72	0.86	1.61
	[0.58,0.87]	1.57	[0.53,0.94]	1.32	[0.78,1.34]	1	[0.61,1.12]	1	[0.66,1.11]	1
Prior drinker status	0.87	1.56	0.92	1.4	0.79	1.84	0.97	1.23	0.88	1.54
	[0.71,1.08]	1	[0.68,1.23]	1	[0.60,1.04]	1	[0.71,1.32]	1	[0.67,1.14]	1
Baseline outcome	5.03***	9.54								
	[4.35,5.83]	8.17								
N	11631		11435		11436		11433		11437	

Note: Odd-ratio associated with each variable are displayed. 95% confidence intervals are in brackets. E-values for coefficient and 95% confidence interval can be found in the column to the right. Exposure, prior exposure, and baseline outcome (only model 1) are displayed. Covariates include; Highest educational qualification, total household net income, age, sex, urban/rural, self-assessed health, marital status, has child aged 16 or under, carer status, GHQ, religion, ethnicity, employed/non-employed, SF-12 Physical Component Summary (PCS), days each week eat fruit, days each week eat vegetables, Neighbourhood Social Cohesion, Number of close friends, Agreeableness (Big 5), Conscientiousness (Big 5), Extraversion (Big 5), Neuroticism (Big 5), Openness (Big 5), Government Office Region, whether smokes, political allegiance, whether diagnosed with depression before, and whether active in a listed organisation.

Table 4: Van Der Weele framework intensive margin results

	Does not go out socially when feels like it		Isolated often		Lack companionship often		Left out often		Lonely often	
	Coefficient + 95% C.I.	E-Value	Coefficient + 95% C.I.	E-Value	Coefficient + 95% C.I.	E-Value	Coefficient + 95% C.I.	E-Value	Coefficient + 95% C.I.	E-Value
Drinks: Monthly or less	0.84	1.67	0.83	1.7	1.13	1.51	0.93	1.36	0.91	1.43
	[0.673,1.046]	1	[0.61,1.13]	1	[0.84,1.51]	1	[0.68,1.28]	1	[0.69,1.21]	1
Drinks: 2-4 times a month	0.63***	2.58	0.65*	2.47	1.00	1.05	0.74	2.03	0.85	1.64
	[0.485,0.806]	1.79	[0.45,0.92]	1.39	[0.72,1.39]	1	[0.51,1.08]	1	[0.62,1.17]	1
Drinks: 2-3 times a week	0.59***	2.81	0.50**	3.38	0.84	1.68	0.63*	2.56	0.74	2.04
	[0.44,0.78]	1.9	[0.33,0.76]	1.96	[0.58,1.20]	1	[0.41,0.96]	1.23	[0.516,1.057]	1
Drinks: 4+ times a week	0.60**	2.73	0.70	2.2	0.96	1.24	0.86	1.59	0.87	1.56
	[0.43,0.83]	1.71	[0.45,1.11]	1	[0.64,1.45]	1	[0.53,1.40]	1	[0.58,1.31]	1
Prior Drinks: Every 2 months or less	0.92	1.39	0.97	1.19	0.83	1.71	1.00	1.07	0.90	1.46
	[0.73,1.16]	1	[0.71,1.33]	1	[0.61,1.12]	1	[0.71,1.40]	1	[0.67,1.21]	1
Prior Drinks: 1-2 times a month	0.76*	1.97	0.81	1.78	0.74	2.04	0.94	1.32	0.83	1.69
	[0.58,0.99]	1.12	[0.56,1.17]	1	[0.53,1.03]	1	[0.64,1.38]	1	[0.60,1.16]	1
Prior Drinks: 1-2 times a week	0.94	1.31	0.92	1.39	0.74	2.02	0.96	1.24	0.88	1.54
	[0.73,1.23]	1	[0.64,1.34]	1	[0.53,1.04]	1	[0.65,1.43]	1	[0.63,1.23]	1
Prior Drinks: 3+ times a week	0.99	1.12	1.09	1.39	0.94	1.34	1.09	1.39	0.93	1.36
	[0.74,1.32]	1	[0.71,1.65]	1	[0.65,1.35]	1	[0.70,1.69]	1	[0.64,1.34]	1
Baseline outcome	5.07***	9.61								
	[4.38,5.87]	8.22								
N	11625		11429		11430		11427		11431	

Note: Odd-ratio associated with each variable are displayed. 95% confidence intervals are in brackets. E-values for coefficient and 95% confidence interval can be found in the column to the right. Exposure, prior exposure, and baseline outcome (only model 1) are displayed. Covariates include; Highest educational qualification, total household net income, age, sex, urban/rural, self-assessed health, marital status, has child aged 16 or under, carer status, GHQ, religion, ethnicity, employed/non-employed, SF-12 Physical Component Summary (PCS), days each week eat fruit, days each week eat vegetables, Neighbourhood Social Cohesion, Number of close friends, Agreeableness (Big 5), Conscientiousness (Big 5), Extraversion (Big 5), Neuroticism (Big 5), Openness (Big 5), Government Office Region, whether smokes, political allegiance, whether diagnosed with depression before, and whether active in a listed organisation

Figures

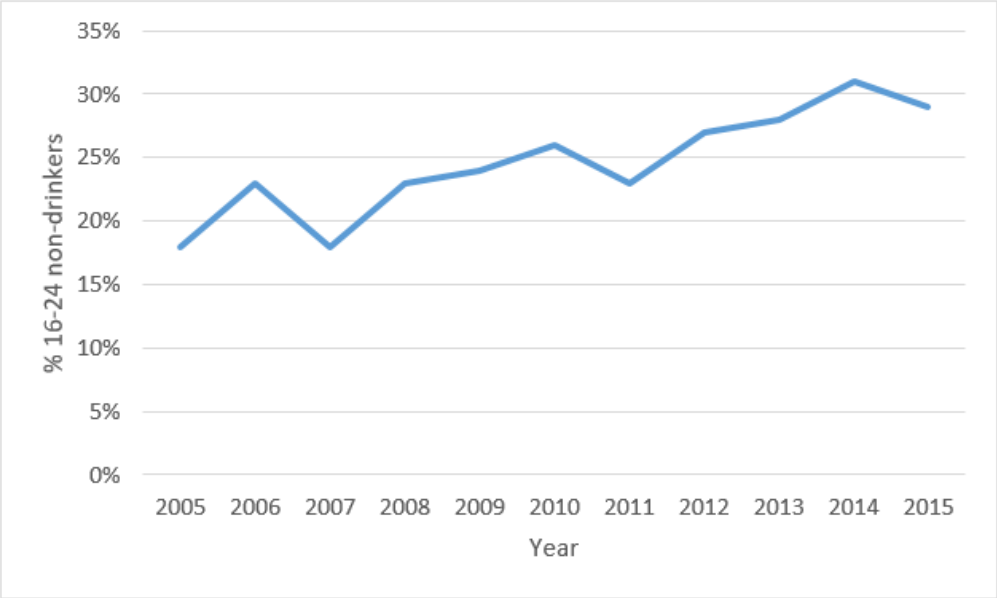

Figure 1

%16-24 Non-drinkers 2005-2015 from Ng Fat et al. (2018)

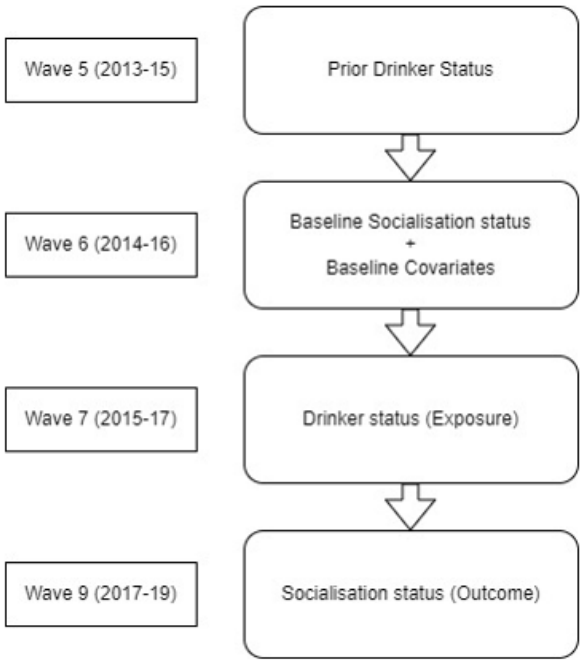

Figure 2

Flow chart of variables and the waves they are derived from

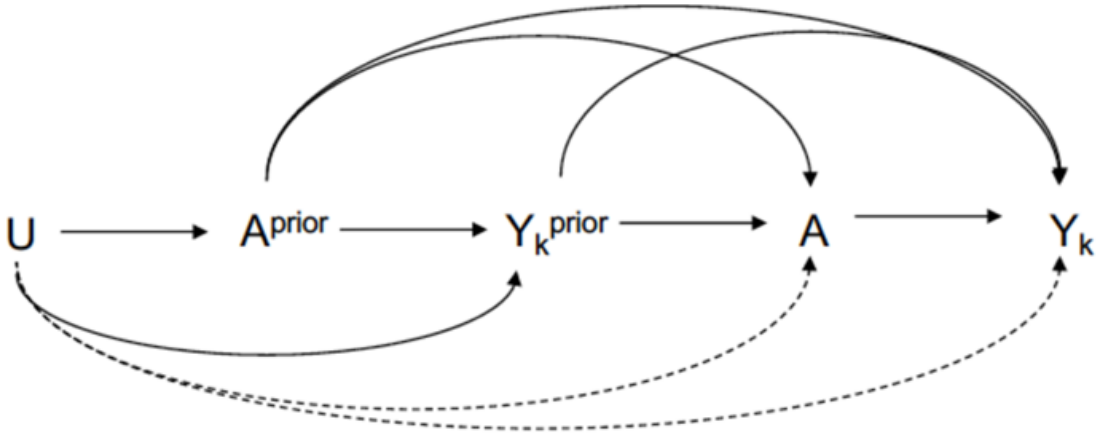

Figure 3

Diagram illustrating how controlling for prior exposure can further reduce risk of uncontrolled for confounding taken from VanDerWeele et al. (2020).

Supplementary Files

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