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Are Brief Interventions for smoking and excessive alcohol consumption in primary care affecting health inequalities? Findings from a population-based household survey in England

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ABSTRACT

Objectives

Brief Interventions [BI] for smoking and risky drinking are effective and cost-effective policy approaches to reducing alcohol harm currently used in primary care in England, however little is known about their contribution to health inequalities. This paper aims to investigate whether self-reported receipt of BI is associated with socioeconomic status and whether this differs for smoking or alcohol.

Design

Population survey of 8,978 smokers or risk drinkers in England aged 16+ taking part in the Alcohol and Smoking Toolkit Studies

Measures

Survey participants answered questions regarding whether they had received advice and support to cut down their drinking or smoking from a primary healthcare professional in the past 12 months as well as their socioeconomic status, demographic details, whether they smoke and their motivation to cut down their smoking and/or drinking. Respondents also completed the Alcohol Use Disorders Identification Test (AUDIT). Smokers were defined as those reporting any smoking in the past year. Risky drinkers were defined as those scoring 8 or more on the AUDIT.

Results

After adjusting for demographic factors and patterns in smoking and drinking, there was a positive socioeconomic gradient in BI delivery. Smokers in the lowest social class had 30% (95% CI 5%-61%) greater odds of reporting receipt of a BI than those in the highest class. The relationship for risky drinking was stronger, with those in the lowest social class having 111% (95% CI 27%-252%) greater odds of reporting BI receipt than the highest class. Rates of BI delivery were 8 times greater among smokers than risky drinkers (48.3% vs 6.1%).

Conclusions

Current delivery of Brief Interventions for smoking and drinking in primary care in England may be contributing to a reduction in socioeconomic inequalities in health. This effect could be increased if intervention rates, particularly for drinking, can be raised.

ARTICLE SUMMARY

Strengths and limitations of this study

- Used data from a large representative sample of adult smokers and drinkers in England
- Based on data on intervention receipt reported by patients, rather than practitioners
- Analysis controls for a broad range of potential confounding demographic factors
- Respondents may have underestimated or misreported their drinking or smoking
- There may be additional socioeconomic gradients in intervention effectiveness which could moderate the overall impact of Brief Interventions on health inequalities

INTRODUCTION

Tobacco smoking and the excessive consumption of alcohol are leading causes of preventable disease both in the UK and worldwide[1] and inequalities in both alcohol and tobacco-related health harms are a significant contributor to wider inequalities in health [2,3]. Underlying these inequalities are conflicting socioeconomic patterns in the behaviours themselves. Smoking prevalence and related harm both increase with deprivation [4], while alcohol consumption is typically reported to be lower in more deprived groups even though they suffer greater levels of alcohol-related harm [2,5,6], a phenomenon referred to as the 'Alcohol Harm Paradox'[5,7].

Screening and Brief Interventions, consisting of an initial case finding or screening step followed by delivery of feedback and structured advice or behaviour change counselling, delivered in primary care, is an effective and cost-effective measure to increase smoking cessation rates[8,9] and reduce harmful drinking [10,11]. Current UK clinical guidelines recommend that all patients are assessed for smoking annually, with a Brief Intervention (BI) delivered to all smokers [12]. Guidance for alcohol encourages the use of opportunistic screening and BI alongside requirements to screen all patients registering with a new primary care provider or attending a Health Check [13,14]. In spite of this guidance, BI delivery levels remain low in England [15], particularly for alcohol [16], a finding that has been replicated in many other countries [17–19].

Research across a broad range of interventions and settings has found that public health policies, including screening programmes in primary care, may exacerbate inequalities in health even while improving population health overall [20,21]. In this context it is striking that very little research to date has considered the potential for BI programmes for tobacco or alcohol to affect inequalities, particularly given the high socioeconomic variation in poor health due to both behaviours. We aimed to address this gap by examining whether there are sociodemographic gradients in BI delivery for smoking and drinking and whether these can be explained by sociodemographic or behavioural characteristics of patients attending primary care in England.

METHODS

Data Sources

The Alcohol and Smoking Toolkit Studies are large, nationally representative, monthly surveys of adults aged 16+ in England [22,23]. A sample of approximately 1,700 respondents each month participate in household computer-assisted interviews. The survey uses a form of random location sampling, representing a hybrid between random probability and simple quota sampling (see published protocols for further details [22,23]). We used data collected between March 2014 and July 2016 (N=48808) with analysis restricted to respondents who reported visiting the General Practitioner (GP) in the past 12 months and were either smokers (those reporting that they had smoked cigarettes or other tobacco products at least occasionally in the past year) or risky drinkers (those scoring at least eight on the Alcohol Use Disorders Identification Test (AUDIT) [24]). This gave a total sample of 8978 adults of whom 5004 were smokers only, 2528 were risky drinkers only, and 1446 were both.

Measures

Our primary outcome measure was self-reported receipt of a BI (or more intensive intervention) from a GP or other primary care-based health worker in the past year. Respondents who smoked were asked 'Has your GP spoken to you about smoking in the past year?' and BI receipt was

categorised as a response of at least 'Yes, he/she advised me to stop but did not offer anything'. Risky drinkers were asked 'In the last 12 months has a doctor or other health worker within your GP surgery discussed your drinking?', with BI receipt categorised as a response of at least 'Yes, a doctor or other health worker within my GP surgery offered advice about cutting down my drinking'. See supplementary material for a full list of response options.

Data was also collected on respondents' age, gender, region of England (categorised as North, Midlands or South), the number of children in the household (categorised as 0 or 1+), self-reported disability status (disability/no disability) and ethnicity (white, mixed/multiple ethnic group, Asian or British Asian, black, other). Self-reported motivation to reduce smoking and drinking was recorded and grouped into those responding 'I don't want to stop smoking/cut down on drinking', those reporting some degree of motivation to quit/cut down, and those who were highly motivated and willing to specify a time frame for cutting down – 'I really want to stop smoking and intend to in the next month/3 months').

As previous studies have identified that different measures of SES demonstrate different relationships with alcohol consumption [7,25], we examined four alternative measures of socioeconomic status (SES):
1) Social-grade, classified Using the British National Readership Survey Social-Grade Classification Tool [26]: A: higher managerial, administrative or professional; B: intermediate managerial, administrative or professional; C1: supervisory or clerical and junior managerial administrative or professional; C2: skilled manual workers; D: Semi and unskilled manual workers; E: Causal or lowest grade workers, pensioners and others who depend on the welfare state for their income.
2) Educational level, grouped as: University education, A-level and equivalent, GCSE/vocational, other/still studying, none
3) Working status, categorised as being in full-time employment or otherwise
4) Housing tenure, categorised as owner occupied (owned outright or being brought with a mortgage) or otherwise
Finally, in order to test whether higher levels of alcohol consumption increase the likelihood of receiving a BI, the risky drinker group were further subdivided according to their AUDIT score in line with World Health Organisation guidelines [24]:
8-15 - Risky drinker
16-19 – High risk drinkers
20+ - Possible alcohol dependence

Analysis

Data were weighted using an iterative 'rim weighting' technique as used in previous analyses of Smoking and Alcohol Toolkit data (e.g. [16]). Parallel analysis using unweighted data is reported in the supplementary material. Missingness was generally low for the variables of interest: age (1.4%), gender (0%), region (0.2%), children in the household (0%), disability (2.5%), ethnicity (0.5%), motivation to quit/cut down smoking (0.8%), motivation to cut down drinking (0.3%), social grade (0%), education (0.5%), working status (0.1%) and home ownership (1.9%). Missing data were imputed using Multiple Imputation with 20 datasets [27] and analytical results combined using Rubin's Rules [28]. Complete case only analyses are reported in the supplementary material. All imputation and analyses were undertaken using Stata 12 [29] following a plan pre-registered with the Open Science Framework prior to any data analysis (https://osf.io/5eq4h/). As the only continuous variable in the analysis, age was standardised and tested for non-linearity using the Box-

Tidwell approach [30]. This suggested significant non-linearity and age was therefore categorised into six groups (18-24, 25-34, 35-44. 45-54, 55-64 and 65+).

The analysis consisted of four steps:
1) we produced descriptive tables the full dataset showing rates of smoking and risky drinking (all respondents scoring AUDIT 8+) in the population and rates of GP attendance and BI receipt for those who visited their GP for both smokers and risky drinkers, stratified by the 4 socioeconomic measures to show the extent to which socioeconomic inequalities exist before adjusting for demographic and other factors.
2) to examine the extent to which variation in BI delivery can be explained by demographic characteristics alone, we fitted two multivariable logistic regression models in which receipt of a smoking or alcohol intervention was regressed on age, gender, region, number of children in the household, disability status and ethnicity. These models also include a linear (monthly) temporal trend to assess whether BI rates have increased or decreased over the data collection period.
3) to examine the extent to which drinking and smoking behaviour, and motivations to cut down can explain additional variation in BI delivery, we fitted two further multivariable models which additionally adjust for drinking status (risky versus non-risky) and motivation to stop smoking (in the smoking model) or smoking status (smoker versus non-smoker), AUDIT group and motivation to cut down drinking (in the drinking model).
4) to examine whether socioeconomic status can explain any remaining variation in BI delivery, we fitted fully-adjusted models in which each of the 4 measures of socioeconomic status was added separately.

Patients were not involved in the design of this study. STROBE guidelines were followed throughout [31].

RESULTS

Demographic characteristics for the 8978 smokers and risky drinkers included in the analytic sample are presented in Table 1. This shows a relatively even spread of both smokers and risky drinkers across the life course, except for the youngest age group (18-24 year olds) which has a greater concentration of risky drinkers. Smokers are more likely to be female and more likely to live with children or have a disability than risky drinkers. The other key distinction comes in terms of motivation to cut down or quit, with 72.7% of smokers reporting some motivation to reduce their smoking compared to only 39.8% of risky drinkers.

Table 1 - Characteristics of survey respondents included in statistical models (unweighted)

		Past year smokers (n=6450)	Risky drinkers (n=3974)
Age, n (%)	18-24	1051 (16.2%)	877 (23.2%)
	25-34	1222 (18.8%)	539 (14.2%)
	35-44	1052 (16.2%)	572 (15.1%)
	45-54	1126 (17.4%)	741 (19.6%)
	55-64	1046 (16.1%)	463 (12.2%)
	65+	991 (15.3%)	595 (15.7%)
Male, n (%)		3253 (50.4%)	2600 (65.4%)
Region, n (%)	North	2540 (39.1%)	1974 (49.7%)
	Midlands	1730 (26.6%)	716 (18.0%)
	South	2234 (34.3%)	1282 (32.3%)
Children in the household, n (%)		1406 (21.8%)	924 (23.3%)
Disability, n (%)		1275 (19.8%)	494 (12.4%)
Ethnicity, n (%)	White	5812 (89.6%)	3813 (96.3%)
	Mixed race	111 (1.7%)	59 (1.5%)
	Asian	353 (5.4%)	39 (1.0%)
	Black	147 (2.3%)	39 (1.0%)
	Arab/other	61 (0.9%)	10 (0.3%)
Motivation to cut down smoking, n (%)	None	1649 (27.3%)	
	Moderate	3415 (56.5%)	
	High	978 (16.2%)	
Risky drinker, n (%)		1446 (22.4%)	
AUDIT score, n (%)	8-15		2372 (60.2%)
	16-19		1273 (32.3%)
	20+		296 (7.5%)
Motivation to cut down drinking, n (%)	None		2329 (60.2%)
	Moderate		1247 (32.2%)
	High		292 (7.5%)
Past year smoker, n (%)			1446 (36.4%)

Descriptive analyses (Table 2) show that overall, smoking was more prevalent than risky drinking (20.5% vs. 13.1% of the adult population). There were also marked socioeconomic gradients in prevalence, with smoking increasingly common in lower socioeconomic groups (e.g. 35.7% of social grade E respondents compared to 11.5% in grade AB), while the gradient in risky drinking was less stark and in the opposite direction (11.3% in grade E compared to 14.3% in grade AB). These gradients were seen most clearly for social grade, although similar patterns existed for education, but were not evident when using employment for smokers and housing tenure for drinkers. There were no clear gradients for GP attendance, although risky drinkers were more likely than smokers to have visited their GP in the past year (64.8% vs. 54.9%). Unadjusted rates of BI receipt for those who had visited their GP (the sample used in the statistical analysis) suggest a socioeconomic gradient in BI delivery, with a greater proportion of respondents in lower SES groups reporting that they had received a BI for both smoking and drinking. There appears, however, to be a divergence in the shape of this gradient, with BI receipt for smokers increasing linearly as SES decreases, while the higher rates of BI receipt in risky drinkers are concentrated in the most deprived group. These patterns, for social grade, are illustrated in Figure 1.

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Table 2 - Descriptive analysis of prevalence, GP attendance and BI delivery rates for smokers and risky drinkers by socioeconomic status (weighted, 95% Confidence Intervals in brackets)

		Past year smokers			Risky drinkers		
		Prevalence in population	Who visited GP in past year	Who received BI | visited GP	Prevalence in population	Who visited GP in past year	Who received BI | visited GP
Population		20.5% (20.2 to 20.9)	54.9% (53.8 to 56)	48.3% (47.1 to 49.5)	13.1% (12.8 to 13.3)	64.8% (63.6 to 65.4)	6.1% (5.4 to 6.5)
Social grade	AB	11.5% (10.9 to 12.1)	57.7% (54.5 to 60.9)	45.8% (42.3 to 49.3)	14.3% (13.6 to 14.6)	67.6% (65.1 to 68.8)	5.4% (4 to 6.1)
	C1	17.8% (17.2 to 18.4)	55.6% (53.4 to 57.7)	47% (44.6 to 49.4)	14.3% (13.8 to 14.6)	65.5% (63.5 to 66.6)	4.8% (3.7 to 5.3)
	C2	24.2% (23.4 to 25.1)	49.7% (47.4 to 52)	45.7% (43.1 to 48.3)	13.3% (12.7 to 13.7)	60.8% (58 to 62.2)	5% (3.4 to 5.8)
	D	27.8% (26.8 to 28.8)	53.3% (50.9 to 55.8)	50.3% (47.6 to 53)	9.7% (9.1 to 10.1)	65.2% (61.7 to 67)	6.5% (4.2 to 7.6)
	E	35.7% (34.4 to 37)	62.6% (60.1 to 65.1)	53.9% (51.2 to 56.6)	11.3% (10.4 to 11.7)	61.6% (57.7 to 63.6)	18.1% (14 to 20.1)
Education	University	12.6% (12 to 13.1)	53.7% (51 to 56.3)	44.3% (41.3 to 47.3)	13.6% (13 to 13.9)	66.4% (64.2 to 67.6)	4.9% (3.7 to 5.6)
	A-level	21% (20.1 to 21.8)	53.5% (50.9 to 56)	48% (45.2 to 50.9)	18.6% (17.8 to 19)	59.7% (57.3 to 60.9)	4.7% (3.4 to 5.4)
	GCSE	26.1% (25.4 to 26.9)	54.8% (53 to 56.7)	47.5% (45.5 to 49.6)	13.1% (12.5 to 13.4)	65.1% (62.8 to 66.2)	6.6% (5.1 to 7.3)
	Other	18.3% (17.1 to 19.5)	56.8% (52.7 to 60.9)	49.3% (44.8 to 53.8)	11.4% (10.4 to 11.9)	70.3% (65.9 to 72.5)	7.9% (4.8 to 9.4)
	None	26.6% (25.6 to 27.5)	57.1% (54.7 to 59.5)	52.6% (50.1 to 55.2)	6.6% (6.1 to 6.9)	68.8% (64.9 to 70.8)	11.4% (8.2 to 13)
Employment	Full time	21.8% (21.2 to 22.5)	47.4% (45.6 to 49.3)	46.1% (43.9 to 48.3)	16.7% (16.1 to 17)	60.2% (58.4 to 61.2)	4.2% (3.2 to 4.7)
	Other	19.7% (19.3 to 20.1)	60.3% (59 to 61.7)	49.5% (48.1 to 51)	10.9% (10.6 to 11.1)	69% (67.5 to 69.8)	7.6% (6.5 to 8.1)
Housing tenure	Owner	13.6% (13.2 to 14)	56.3% (54.5 to 58)	48% (46.1 to 49.9)	12.3% (11.9 to 12.5)	67.5% (65.9 to 68.3)	5.2% (4.3 to 5.7)
	Renter	33.7% (33 to 34.4)	54.3% (52.8 to 55.7)	48.7% (47.1 to 50.2)	14.9% (14.4 to 15.2)	60.8% (58.9 to 61.7)	7.7% (6.4 to 8.4)

INSERT FIGURE 1 ABOUT HERE

Smoking

Results for the demographic-adjusted models for receipt of smoking BI (Table 3) show that older smokers had significantly greater odds of having received a BI than 18-24 year olds (e.g. OR 2.06 95% CI 1.68-2.51 for 65+ year olds). Significant effects were also seen for region, with smokers in the South having lower odds of receiving an intervention than those in the North (OR 0.81 95% CI 0.71-0.92) and for those with a self-reported disability having greater odds of receiving one than those without (OR 1.37 95% CI 1.19-1.57). There was no significant temporal trend in BI delivery.

The addition of behavioural factors to the model (see supplementary material for full results) did not change the magnitude or significance of the demographic coefficients, but demonstrated that smokers who were also risky drinkers had lower odds of receiving a smoking BI (OR 0.84 95% CI 0.73-0.97) and that there was a strong association with both moderate (OR 1.42 95% CI 1.25-1.63) and high levels of motivation to cut down or quit smoking (OR 2.14 95% CI 1.79-2.57) and BI receipt. Finally, the addition of socioeconomic measures to the models showed significantly increased levels of BI receipt in social grades D and E compared to grade AB (OR 1.26 95% CI 1.02-1.55 and OR 1.30 95% CI 1.05-1.61 respectively). Significant increases in BI receipt were also observed in those with A-levels and no formal qualifications compared to university-level qualifications (OR 1.24 95% CI 1.02-1.51 and OR 1.24 95% CI 1.03-1.50 respectively), but no significant association employment status or housing tenure was identified.

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Table 3 - Logistic regression results for factors associated with likelihood of receiving Brief Intervention for smoking

		Demographic-adjusted model			Behavioural and Socioeconomic-adjusted models								
		OR		95% CI	OR		95% CI	OR		95% CI	OR		95% CI
Age	18-24	Reference											
	25-34	1.39	***	1.16 to 1.67	1.38	**	1.14 to 1.68	1.38	**	1.14 to 1.68	1.37	**	1.13 to 1.66	1.36	**	1.12 to 1.65
	35-44	1.57	***	1.30 to 1.90	1.60	***	1.31 to 1.96	1.60	***	1.31 to 1.97	1.57	***	1.28 to 1.93	1.59	***	1.3 to 1.94
	45-54	2.00	***	1.66 to 2.41	2.03	***	1.67 to 2.47	2.03	***	1.66 to 2.48	2.00	***	1.64 to 2.44	2.03	***	1.67 to 2.48
	55-64	2.19	***	1.80 to 2.66	2.30	***	1.86 to 2.83	2.26	***	1.82 to 2.79	2.23	***	1.81 to 2.75	2.31	***	1.86 to 2.86
	65+	2.06	***	1.68 to 2.51	2.22	***	1.79 to 2.75	2.14	***	1.71 to 2.67	2.11	***	1.70 to 2.62	2.23	***	1.79 to 2.78
Gender	Male	Reference											
	Female	1.01		0.91 to 1.13	0.95		0.84 to 1.07	0.97		0.86 to 1.09	0.96		0.85 to 1.08	0.96		0.86 to 1.08
Region	North	Reference											
	Midlands	0.94		0.82 to 1.08	0.93		0.81 to 1.08	0.93		0.80 to 1.07	0.93		0.81 to 1.07	0.93		0.81 to 1.07
	South	0.81	**	0.71 to 0.92	0.79	**	0.69 to 0.91	0.79	***	0.69 to 0.9	0.78	***	0.68 to 0.89	0.77	***	0.68 to 0.88
Children in the household	None	Reference											
	≥1	1.14		0.99 to 1.30	1.07		0.93 to 1.23	1.08		0.93 to 1.24	1.08		0.94 to 1.24	1.08		0.94 to 1.24
Self-reported disability	No	Reference											
	Yes	1.37	***	1.19 to 1.57	1.33	***	1.14 to 1.55	1.38	***	1.19 to 1.59	1.38	***	1.19 to 1.60	1.37	***	1.18 to 1.59
Ethnicity	White	Reference											
	Mixed race	0.92		0.60 to 1.39	0.85		0.54 to 1.34	0.87		0.56 to 1.36	0.87		0.56 to 1.35	0.86		0.55 to 1.34
	Asian	0.92		0.72 to 1.18	0.84		0.65 to 1.09	0.87		0.67 to 1.12	0.86		0.67 to 1.11	0.87		0.68 to 1.13
	Black	1.20		0.83 to 1.72	0.98		0.67 to 1.46	1.01		0.68 to 1.49	1.01		0.68 to 1.49	1.00		0.67 to 1.48
	Arab/other	0.95		0.55 to 1.63	0.94		0.52 to 1.69	0.93		0.52 to 1.68	0.93		0.52 to 1.66	0.91		0.5 to 1.63
Time trend (monthly)		1.00		0.99 to 1.01	1.00		0.99 to 1.01	1.00		1.00 to 1.01	1.00		1.00 to 1.01	1.00		0.99 to 1.01
Risky drinker (AUDIT 8+)	No												
	Yes				0.86	*	0.75 to 0.99	0.85	*	0.74 to 0.98	0.85	*	0.73 to 0.97	0.85	*	0.74 to 0.98
Motivation to cut down smoking	None												
	Moderate				1.44	***	1.26 to 1.64	1.44	***	1.26 to 1.64	1.43	***	1.25 to 1.63	1.43	***	1.25 to 1.63
	High				2.19	***	1.83 to 2.63	2.16	***	1.80 to 2.59	2.15	***	1.79 to 2.58	2.15	***	1.8 to 2.58
Social grade	AB				Reference								
	C1				1.08		0.88 to 1.32						
	C2				0.96		0.78 to 1.17						
	D				1.26	*	1.02 to 1.55						
	E				1.30	*	1.05 to 1.61						
Education	University							Reference					
	A-level							1.24	*	1.02 to 1.51			
	GCSE							1.16		0.98 to 1.38			
	Other							1.20		0.93 to 1.56			
	None							1.24	*	1.03 to 1.5			
Employment status	Full-time										Reference		
	Other										1.05		0.92 to 1.2
Housing tenure	Owned												Reference

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Rented									1.10		0.97 to 1.25
Constant	0.49	0.24 to 1.02	0.34	**	0.15 to 0.75	0.31	**	0.14 to 0.69	0.36	*	0.17 to 0.78	0.35	**	0.16 to 0.76

Risky drinking

Results for the demographic-adjusted logistic regression models for alcohol BIs (Table 4) showed a similar age gradient to the smoking models, with all risky drinkers aged 35+ having odds at least twice as high of having received a BI as those under 24 (e.g. OR 2.68 95% CI 1.53-4.71 for 65+ year olds). Unlike for smoking, there was a significant gender effect, with women having lower odds of receiving an intervention (OR 0.68 95% CI 0.49-0.93). There were no significant effects for region, or time, but again, disability was a significant predictor of BI receipt (OR 3.47 95% CI 2.54-4.74). The addition of behavioural factors to the model (see supplementary material for full results) substantially increased the slope of the age gradient, with the OR for over 65s compared to 18-24 year-olds increasing to 5.00 (95% CI 2.71-9.23). The effect of disability was reduced, although still significant (OR 2.27 95% CI 1.57-3.27) and we saw an additional significant effect for Arab/other ethnic groups compared to the White group (OR 8.64 95% CI 1.81-41.21). Of the additional explanatory factors, smoking did not significantly predict BI receipt for alcohol, but motivation to reduce drinking did, with both moderate (OR 2.85 95% CI 2.00-4.05) and high levels (OR 5.17 95% CI 3.29-8.14) significantly associated with BI receipt. Level of alcohol use was also a very strong predictor of BI receipt, with high risk drinkers having almost 3 times the odds of having received a BI (OR 2.94 95% CI 1.81-4.79) and potentially dependent drinkers almost 12 times the odds (OR 11.84 95% CI 7.77-18.04).

Adding socioeconomic factors to the model did not further change the magnitude or significance of the other coefficients, but we saw a significant increase in BI receipt for the lowest social grade (E) compared to the highest (OR 2.11 95% CI 1.27-3.52). There was no significant effect of education, but not being in full-time employment (OR 1.56 95% CI 1.08-2.25) and not being a homeowner (OR 1.55 95% CI 1.09-2.20) significantly increased the likelihood of receiving a BI. The effects of all four socioeconomic measures on both smoking and alcohol BI receipt are illustrated in Figure 2, highlighting the relatively larger scale of the socioeconomic gradients for alcohol compared to smoking.

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Table 4 - Logistic regression results for factors associated with likelihood of receiving Brief Intervention for risky drinking

		Demographic-adjusted model			Behavioural and Socioeconomic-adjusted models								
		OR		95% CI	OR		95% CI	OR		95% CI	OR		95% CI	OR		95% CI
Age	18-24	Reference														
	25-34	1.56		0.84 to 2.89	1.46		0.77 to 2.78	1.46		0.76 to 2.80	1.60		0.82 to 3.14	1.51		0.79 to 2.85
	35-44	2.49	**	1.39 to 4.47	2.05	*	1.09 to 3.86	2.14	*	1.13 to 4.07	2.42	**	1.26 to 4.64	2.32	**	1.23 to 4.36
	45-54	2.74	***	1.63 to 4.62	2.86	***	1.62 to 5.07	2.98	***	1.65 to 5.39	3.33	***	1.86 to 5.97	3.43	***	1.95 to 6.01
	55-64	2.26	**	1.30 to 3.93	3.23	***	1.76 to 5.92	3.20	***	1.71 to 5.99	3.24	***	1.77 to 5.93	3.93	***	2.11 to 7.33
	65+	2.68	**	1.53 to 4.71	4.94	***	2.66 to 9.15	4.74	***	2.50 to 9.02	4.41	***	2.41 to 8.08	6.11	***	3.25 to 11.5
Gender	Male	Reference														
	Female	0.68	*	0.49 to 0.93	0.62	**	0.43 to 0.89	0.65	*	0.45 to 0.92	0.60	**	0.42 to 0.85	0.64	*	0.45 to 0.91
Region	North	Reference														
	Midlands	1.21		0.84 to 1.73	1.20		0.81 to 1.77	1.18		0.80 to 1.75	1.19		0.80 to 1.77	1.20		0.81 to 1.78
	South	0.85		0.62 to 1.16	0.84		0.58 to 1.20	0.83		0.58 to 1.18	0.78		0.55 to 1.11	0.80		0.56 to 1.15
Children in the household	None	Reference														
	≥1	0.79		0.53 to 1.17	1.06		0.69 to 1.64	1.06		0.69 to 1.62	1.06		0.69 to 1.64	1.08		0.70 to 1.65
Self-reported disability	No	Reference														
	Yes	3.47	***	2.54 to 4.74	1.97	**	1.34 to 2.90	2.16	***	1.49 to 3.14	2.09	***	1.42 to 3.06	2.09	***	1.43 to 3.04
Ethnicity	White	Reference														
	Mixed race	2.20		0.73 to 6.60	2.29		0.72 to 7.32	2.14		0.68 to 6.71	2.17		0.72 to 6.52	2.09		0.71 to 6.17
	Asian	3.44		0.98 to 12.0	3.18		0.66 to 15.4	3.47		0.69 to 17.4	3.47		0.70 to 17.2	3.17		0.65 to 15.5
	Black	0.35		0.07 to 1.86	0.17		0.02 to 1.31	0.19		0.02 to 1.63	0.17		0.02 to 1.54	0.18		0.02 to 1.51
	Arab/other	4.41		0.95 to 20.4	9.58	**	1.98 to 46.4	8.29	**	1.70 to 40.4	8.02	*	1.51 to 42.5	8.78	**	1.77 to 43.5
Time trend (monthly)		1.00		0.99 to 1.02	1.00		0.98 to 1.02	1.00		0.98 to 1.02	1.00		0.98 to 1.02	1.00		0.98 to 1.02
Past year smoker	No				Reference											
	Yes				1.09		0.79 to 1.52	1.17		0.84 to 1.62	1.16		0.84 to 1.62	1.07		0.77 to 1.49
Motivation to cut down drinking	None															
	Moderate				2.94	***	2.06 to 4.20	2.91	***	2.03 to 4.17	2.85	***	2.00 to 4.06	2.93	***	2.06 to 4.18
	High				5.26	***	3.33 to 8.30	5.27	***	3.34 to 8.32	5.01	***	3.18 to 7.90	5.18	***	3.29 to 8.14
AUDIT Score	8-15															
	16-19				2.77	***	1.68 to 4.56	2.81	***	1.72 to 4.59	2.88	***	1.76 to 4.73	2.86	***	1.75 to 4.69
	20+				10.9	***	7.12 to 16.6	11.7	***	7.67 to 17.7	11.5	***	7.54 to 17.6	11.4	***	7.47 to 17.5
Social grade	AB				Reference											
	C1				0.97		0.63 to 1.49									
	C2				0.84		0.51 to 1.36									
	D				1.20		0.68 to 2.10									
	E				2.11	**	1.27 to 3.52									
Education	University							Reference								
	A-level							1.10		0.68 to 1.79						
	GCSE							1.12		0.73 to 1.71						
	Other							1.48		0.80 to 2.72						
	None							1.45		0.86 to 2.44						
Employment status	Full-time										Reference					
	Other										1.56	*	1.08 to 2.25			
Housing tenure	Owned													Reference		
	Rented													1.55	*	1.09 to 2.20

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Constant	0.04	**	0.01 to 0.27	0.01	***	0.00 to 0.08	0.01	***	0.00 to 0.07	0.01	***	0.00 to 0.07	0.01	***	0.00 to 0.06

INSERT FIGURE 2 ABOUT HERE

DISCUSSION

Our findings show that there is a socioeconomic gradient in BI delivery for both smokers and risky drinkers, with those in the lowest socioeconomic groups more likely to receive an intervention. This gradient is not accounted for by differences in demographic characteristics or smoking and drinking behaviour and appears to be stronger for alcohol than for smoking. The analysis also illustrates that, despite clinical guidelines recommending BI for both smokers and risky drinkers, an individual who has attended primary care in the past year is 8 times more likely to report receiving an intervention if they are a smoker compared to a risky drinker. For both smoking and drinking there is a clear age gradient, with greater levels of BI delivery in older age groups, in spite of the fact that the highest rates of prevalence of risky drinking being in the youngest age group. Perhaps surprisingly, smokers who were also risky drinkers were less likely to have received a BI for their smoking than those who were not. The very heaviest drinkers, consuming at potentially dependent levels, are almost 12 times more likely to have received an alcohol intervention than those drinking at lower, but still risky, levels. These findings were robust to alternative data assumptions (see supplementary material).

Our study represents, to the best of our knowledge, the first detailed exploration of the potential of BIs for both smoking and alcohol to reduce, or increase, inequalities in health. We used data from a large, nationally representative survey and our findings are based on patients' own reporting of having received an intervention. Whilst such a measure may be subject to recall bias, it likely provides a better indicator of patient experience than routine data recorded by practitioners [32] and is not subject to known biases in practitioner recording [33]. We explored multiple measures of socioeconomic status, finding similar results across all measures, although the effect of increased BI delivery appears more closely associated with low social grade than low levels of education.

There are several important limitations to our study which should be considered alongside our findings. Firstly, our definition of what constitutes a BI is fairly broad, including anyone who reported receiving advice from a primary care practitioner and that there may be unobserved inequalities in the extent to which different groups receive different intensities of intervention or in the quality of content or delivery of the BI. Secondly, patient characteristics, including drinking/smoking status and motivation to cut down or quit, are recorded after the BI has taken place. As a result, we cannot establish whether the strong association between motivation and likelihood of BI receipt is a function of treatment-seeking behaviour in patients who are already motivated to reduce their smoking or drinking, of motivation increasing after receipt of a BI, or of more motivated patients being more likely to recall having received an intervention. Finally, whilst smoking rates in the Toolkit data are very similar to those reported in other national surveys [34], the observed prevalence of risky drinking of 13.1% is substantially lower than other estimates (e.g. 19.7% in the 2014 Adult Psychiatric Morbidity Survey [35]), although it is unclear what effect, if any, this may have on the study results.

Two, much smaller, UK studies previously looked at the relationship between occupation and rates of alcohol BI receipt in risky drinkers, finding no clear socioeconomic gradient [36,37]. Another, Finnish study also found no significant association [38]. Previous studies have found similar disparities to those we find between delivery rates of BI for smoking and risky drinking [15,39], as well as similarly higher levels of BI receipt among primary care patients at older ages [40], with greater motivation to quit or cut down [41] and for risky drinkers with higher AUDIT scores [42].

Our analysis focuses on the receipt of Brief Interventions for patients who reported attending Primary Care in the past year. There are likely to be additional socioeconomic gradients in terms of access to, use of and quality of Primary Care services which will moderate any overall impact of BIs on health inequalities [43–46]. We should also consider the potential for differential effectiveness of the intervention across socioeconomic groups. If BIs are more effective at changing the behaviour of those in higher SES groups than this may mitigate any potential

inequality-reducing effects. There is little evidence to support the existence of such a gradient in effectiveness for alcohol [47], although there is some suggestion that this may be in part because lower SES groups are more likely to drop out of BI trials [48]. For smoking, a recent study does suggest there may be some degree of inequality in longer term outcomes for smoking cessation interventions [49]. A holistic view of the full impact of SBI programmes should consider the impact of these potential SES gradients, which may attenuate the positive gradients identified in the present study, alongside existing negative gradients in alcohol- and tobacco-related harm. Such is the severity of these gradients in harm, with those in the lowest SES groups experiencing rates of harm several times greater than those in the highest groups even after adjusting for drinking and smoking behaviour [6,50], that an intervention could have a negative SES gradient in terms of its effects on alcohol consumption and/or smoking, while still reducing overall inequalities. Further research in this area is urgently needed to understand the full impact that BI programmes may be having on socioeconomic inequalities. This need is particularly acute given NHS England's recent decision to incentivise secondary care providers to deliver large scale Brief Intervention programmes under the latest Commissioning for Quality and Innovation (CQUIN) scheme.

These findings provide the first evidence that Brief Intervention programmes may help reduce inequalities in smoking- and alcohol-related health although better evidence is needed on the extent to which conflicting socioeconomic gradients in delivery and, potentially, intervention effectiveness interact with existing gradients in health. There is considerable scope for the potential effect on inequalities to be increased if intervention rates can be raised, particularly for drinking.

Author Contributions

CA conceived of and designed the study with input from all authors. CA performed the analysis and wrote the first draft of the paper. All authors commented on this and subsequent versions and read and approved the final manuscript.

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Disclaimer

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Declaration of Interests

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Data sharing statement

The dataset analysed during the current study are available from the corresponding author on reasonable request.

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FIGURE LEGENDS

Figure 1 - Unadjusted socioeconomic gradients in prevalence, GP attendance and BI receipt for smokers and risky drinkers

Figure 2 - Independent, fully-adjusted, association of socioeconomic status with Odds Ratio of receiving a Brief Intervention for smoking or risky drinking

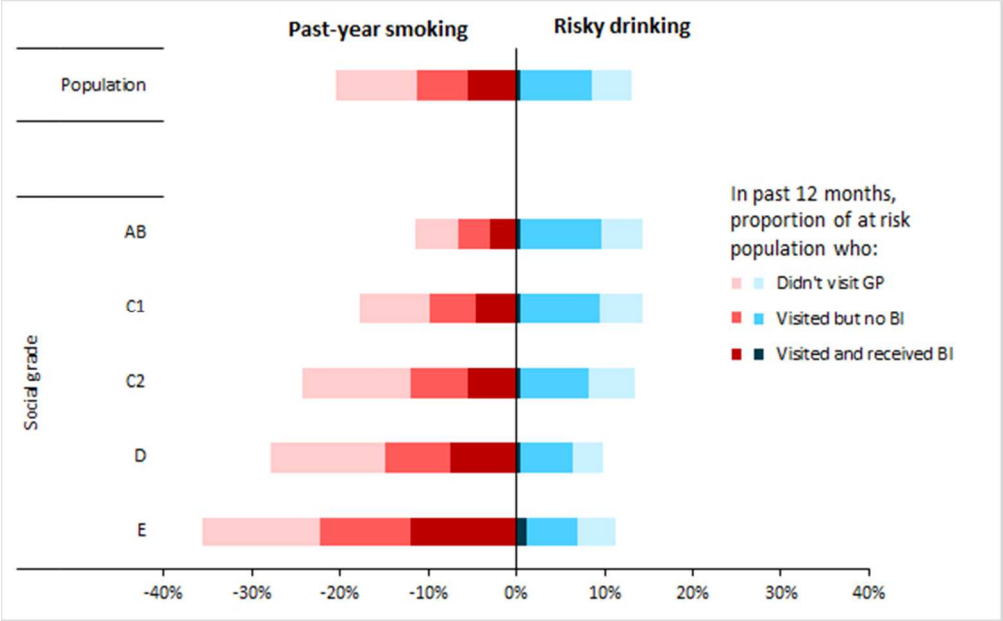

Figure 1 - Unadjusted socioeconomic gradients in prevalence, GP attendance and BI receipt for smokers and risky drinkers

166x103mm (96 x 96 DPI)

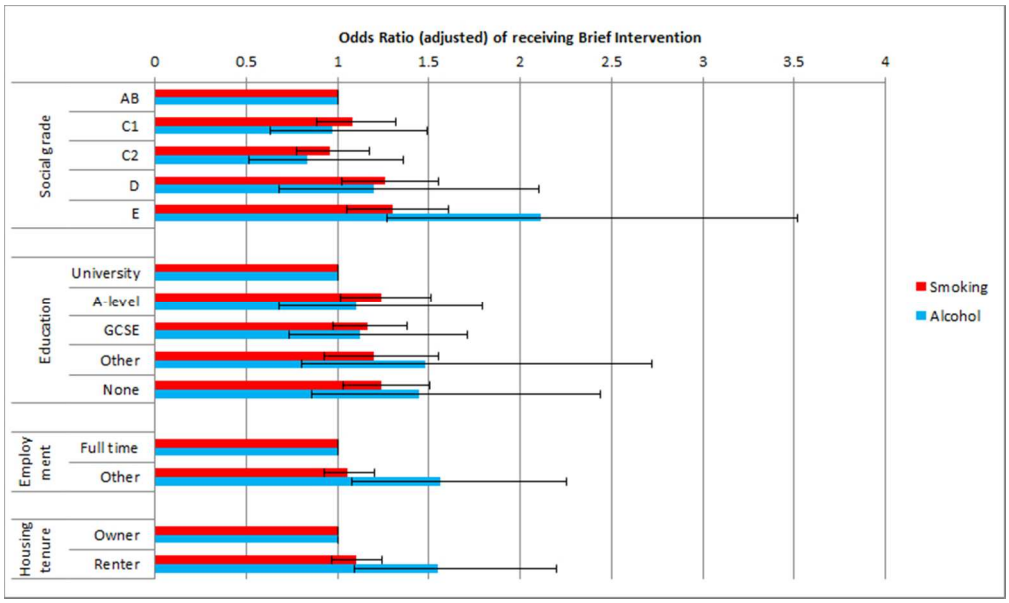

Figure 2 - Independent, fully-adjusted, association of socioeconomic status with Odds Ratio of receiving a Brief Intervention for smoking or risky drinking

211x125mm (96 x 96 DPI)

1

The association between socioeconomic status and receipt of Brief Interventions for smoking and drinking: analysis of a population-based household survey: Supplementary material

Outcome measures

Among smokers, BI receipt was assessed by asking 'Has your GP spoken to you about smoking in the past year (i.e. last 12 months)?' Respondents were encouraged to select all options that applied and were classified into those who received a BI (those selecting at least one of four options: i) 'Yes, he/she advised me to stop but did not offer anything'; ii) 'Yes, he/she suggested that I go to a specialist stop smoking advisor or group'; iii) 'Yes, he/she suggested that I see a nurse in the practice'; iv) 'Yes, he/she offered me a prescription for Champix/Zyban, a nicotine patch, nicotine gum or other nicotine product') and those who did not (i.e. those who did not select any of options i) to iv) but did select one of 'No, I have seen my GP in the last year but he/she has not spoken to me about smoking' or 'Yes, he/she asked me about my smoking but did not advise me to stop smoking').

Among risky drinkers, BI receipt was assessed by asking 'In the last 12 months, has a doctor or other health worker within your GP surgery discussed your drinking?' Respondents were encouraged to select all options that applied and were classified into those who received a BI (those selecting at least one of three options: i) 'Yes, a doctor or other health worker within my GP surgery offered advice about cutting down my drinking'; ii) 'Yes, a doctor or other health worker within my GP surgery offered help or support within the surgery to help me cut down'; iii) 'Yes, a doctor or other health working within my GP surgery referred me to an alcohol service or advised me to seek specialist help') and those who did not (i.e. those who did not select any of options i) to iii) but did select one of 'No, I have seen a doctor or health worker within my GP surgery but did not discuss my drinking' or 'Yes, a doctor or other health worker within my GP surgery asked about my drinking').

2

Behaviour-adjusted model results for smoking

Table S1 – Logistic regression results for factors associated with likelihood of receiving Brief Intervention for smoking

		Behaviour-adjusted model		
		OR		95% CI
Age	18-24			
	25-34	1.36	**	1.12 to 1.65
	35-44	1.56	***	1.28 to 1.91
	45-54	1.98	***	1.63 to 2.41
	55-64	2.23	***	1.81 to 2.75
	65+	2.14	***	1.73 to 2.65
Gender	Male			
	Female	0.97		0.86 to 1.09
Region	North			
	Midlands	0.93		0.81 to 1.07
	South	0.78	***	0.68 to 0.89
Children in the household	None			
	≥1	1.08		0.94 to 1.25
Self-reported disability	No			
	Yes	1.40	***	1.21 to 1.62
Ethnicity	White			
	Mixed race	0.87		0.56 to 1.35
	Asian	0.86		0.67 to 1.11
	Black	1.00		0.68 to 1.49
	Arab/other	0.92		0.51 to 1.66
Time trend (monthly)		1.00		1 to 1.01
Risky drinker (AUDIT 8+)	No	Reference		
	Yes	0.84	*	0.73 to 0.97
Motivation to cut down smoking	None	Reference		
	Moderate	1.42	***	1.25 to 1.63
	High	2.14	***	1.79 to 2.57
Constant		0.37	*	0.17 to 0.8

3

Behaviour-adjusted model results for risky drinking

Table S2 – Logistic regression results for factors associated with likelihood of receiving Brief Intervention for risky drinking

		Behaviour-adjusted model		
		OR		95% CI
Age	18-24			
	25-34	1.44		0.76 to 2.75
	35-44	2.11	*	1.12 to 3.96
	45-54	3.00	***	1.72 to 5.23
	55-64	3.30	***	1.8 to 6.03
	65+	5.00	***	2.71 to 9.23
Gender	Male			
	Female	0.64	*	0.45 to 0.91
Region	North			
	Midlands	1.18		0.8 to 1.75
	South	0.80		0.56 to 1.13
Children in the household	None			
	≥1	1.06		0.69 to 1.63
Self-reported disability	No			
	Yes	2.27	***	1.57 to 3.27
Ethnicity	White			
	Mixed race	2.19		0.7 to 6.86
	Asian	3.38		0.68 to 16.88
	Black	0.19		0.02 to 1.62
	Arab/other	8.64	**	1.81 to 41.21
Time trend (monthly)		1.00		0.98 to 1.02
Past year smoker	No	Reference		
	Yes	1.20		0.86 to 1.66
Motivation to cut down drinking	None	Reference		
	Moderate	2.85	***	2 to 4.05
	High	5.17	***	3.29 to 8.14
AUDIT Score	8-15	Reference		
	16-19	2.94	***	1.81 to 4.79
	20+	11.84	***	7.77 to 18.04
Constant		0.01	***	0 to 0.08

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Analysis using unweighted data

Table S3 - Descriptive analysis of prevalence, GP attendance and BI delivery rates for smokers and risky drinkers by socioeconomic status (unweighted, 95% Confidence Intervals in brackets)

		Past year smokers			Risky drinkers		
		Prevalence in population	Visited GP in past year	Received BI | visited GP	Prevalence in population	Visited GP in past year	Received BI | visited GP
Population		20.6% (20.3 to 21)	64.8% (63.9 to 65.7)	49.7% (48.5 to 50.9)	12.6% (12.3 to 12.7)	65.4% (64.2 to 66)	6.5% (5.7 to 6.9)
Social grade	AB	11.2% (10.6 to 11.8)	65.1% (62.4 to 67.9)	47.5% (43.9 to 51)	13.6% (12.9 to 13.9)	69.4% (67 to 70.7)	5.6% (4.2 to 6.4)
	C1	17.5% (16.9 to 18.1)	64.4% (62.6 to 66.3)	48.6% (46.2 to 51)	14.3% (13.8 to 14.6)	66% (64 to 67)	5% (3.9 to 5.6)
	C2	23.4% (22.5 to 24.2)	61.3% (59.3 to 63.3)	46.6% (44.1 to 49.2)	12.2% (11.5 to 12.5)	61.9% (59.2 to 63.3)	5.2% (3.6 to 6.1)
	D	26.8% (25.8 to 27.8)	63.9% (61.8 to 66)	50.5% (47.8 to 53.2)	9.3% (8.7 to 9.7)	65.3% (61.8 to 67)	6.9% (4.6 to 8)
	E	34.3% (33 to 35.5)	70.5% (68.5 to 72.6)	55.2% (52.4 to 57.9)	10.9% (10.1 to 11.4)	60.5% (56.5 to 62.5)	17% (13.1 to 19.1)
Education	University	12.7% (12.2 to 13.3)	61.9% (59.6 to 64.2)	45.8% (42.8 to 48.8)	12.7% (12.1 to 13)	67.1% (64.9 to 68.2)	5.5% (4.2 to 6.2)
	A-level	20.8% (20 to 21.6)	62.1% (59.9 to 64.3)	49.3% (46.4 to 52.1)	18.7% (17.9 to 19.1)	58.8% (56.4 to 60)	4.8% (3.5 to 5.5)
	GCSE	25.7% (25 to 26.4)	65.4% (63.8 to 66.9)	48.4% (46.4 to 50.5)	12.6% (12 to 12.9)	66.8% (64.5 to 67.9)	7% (5.5 to 7.8)
	Other	18.2% (17 to 19.5)	66.5% (63 to 69.9)	51.3% (46.8 to 55.8)	10.9% (9.9 to 11.4)	71.2% (66.8 to 73.4)	7.6% (4.6 to 9.2)
	None	25.9% (25 to 26.9)	67.8% (65.9 to 69.8)	54% (51.5 to 56.6)	6.7% (6.1 to 6.9)	70.7% (66.9 to 72.6)	11% (7.9 to 12.5)
Employment	Full time	22.1% (21.4 to 22.7)	57.2% (55.5 to 58.8)	46.9% (44.8 to 49.1)	15.9% (15.3 to 16.2)	60.7% (58.8 to 61.6)	4.3% (3.3 to 4.8)
	Other	19.9% (19.5 to 20.4)	69.1% (67.9 to 70.2)	51% (49.5 to 52.5)	10.9% (10.5 to 11.1)	68.8% (67.3 to 69.6)	7.8% (6.8 to 8.4)
Housing tenure	Owner	13.2% (12.8 to 13.6)	65.8% (64.3 to 67.3)	49.2% (47.2 to 51.1)	11.6% (11.2 to 11.8)	68.9% (67.3 to 69.7)	5.4% (4.5 to 5.9)
	Renter	32.5% (31.8 to 33.2)	64.5% (63.3 to 65.7)	50.2% (48.6 to 51.8)	14.2% (13.7 to 14.5)	61.1% (59.3 to 62.1)	8.1% (6.7 to 8.8)

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Table S4 – Unweighted logistic regression results for factors associated with likelihood of receiving Brief Intervention for smoking: demographic- and behaviour-adjusted models

		Demographic-adjusted model			Behaviour-adjusted model		
		OR		95% CI	OR		95% CI
Age	18-24	Reference					
	25-34	1.36	***	1.14 to 1.61	1.32	**	1.1 to 1.59
	35-44	1.59	***	1.33 to 1.9	1.60	***	1.33 to 1.93
	45-54	2.02	***	1.7 to 2.41	2.01	***	1.67 to 2.42
	55-64	2.25	***	1.88 to 2.7	2.31	***	1.9 to 2.8
	65+	2.06	***	1.71 to 2.48	2.16	***	1.77 to 2.63
Gender	Male	Reference					
	Female	1.00		0.91 to 1.11	0.98		0.88 to 1.09
Region	North	Reference					
	Midlands	0.93		0.82 to 1.06	0.92		0.81 to 1.05
	South	0.87	*	0.78 to 0.98	0.86	*	0.76 to 0.97
Children in the household	None	Reference					
	≥1	1.12		0.99 to 1.26	1.07		0.94 to 1.21
Self-reported disability	No	Reference					
	Yes	1.43	***	1.25 to 1.62	1.45	***	1.26 to 1.66
Ethnicity	White	Reference					
	Mixed race	0.83		0.56 to 1.22	0.78		0.52 to 1.17
	Asian	0.94		0.75 to 1.18	0.89		0.7 to 1.12
	Black	1.29		0.92 to 1.81	1.12		0.78 to 1.61
	Arab/other	1.04		0.62 to 1.73	1.00		0.57 to 1.76
Time trend (monthly)		1.00		0.99 to 1	1.00		0.99 to 1.01
Risky drinker (AUDIT 8+)	No				Reference		
	Yes				0.89		0.78 to 1.01
Motivation to cut down smoking	None				Reference		
	Moderate				1.42	***	1.25 to 1.6
	High				2.21	***	1.87 to 2.61
Constant		0.60		0.31 to 1.19	0.46	*	0.23 to 0.95

Key: * p<0.05, ** p<0.01, ***, p<0.001

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Table S5 - Unweighted logistic regression results for factors associated with likelihood of receiving Brief Intervention for smoking: socioeconomic adjusted models 1 & 2

		Socioeconomic-adjusted models 1 & 2					
		OR		95% CI	OR		95% CI
Age	18-24	Reference					
	25-34	1.35	**	1.12 to 1.62	1.34	**	1.12 to 1.61
	35-44	1.64	***	1.36 to 1.98	1.63	***	1.35 to 1.97
	45-54	2.05	***	1.7 to 2.47	2.04	***	1.7 to 2.46
	55-64	2.36	***	1.94 to 2.87	2.31	***	1.89 to 2.81
	65+	2.22	***	1.82 to 2.72	2.13	***	1.73 to 2.62
Gender	Male	Reference					
	Female	0.96		0.86 to 1.08	0.98		0.88 to 1.09
Region	North	Reference					
	Midlands	0.93		0.82 to 1.06	0.92		0.81 to 1.05
	South	0.87	*	0.77 to 0.99	0.86	*	0.76 to 0.98
Children in the household	None	Reference					
	≥1	1.05		0.92 to 1.2	1.06		0.93 to 1.21
Self-reported disability	No	Reference					
	Yes	1.38	***	1.2 to 1.58	1.42	***	1.24 to 1.63
Ethnicity	White	Reference					
	Mixed race	0.77		0.51 to 1.16	0.79		0.52 to 1.19
	Asian	0.86		0.68 to 1.09	0.89		0.7 to 1.12
	Black	1.10		0.77 to 1.58	1.12		0.78 to 1.62
	Arab/other	1.01		0.58 to 1.78	1.01		0.57 to 1.76
Time trend (monthly)		1.00		0.99 to 1.01	1.00		0.99 to 1.01
Risky drinker (AUDIT 8+)	No	Reference					
	Yes	0.90		0.79 to 1.03	0.90		0.79 to 1.02
Motivation to cut down smoking	None	Reference					
	Moderate	1.43	***	1.26 to 1.62	1.43	***	1.26 to 1.61
	High	2.25	***	1.9 to 2.66	2.23	***	1.89 to 2.64
Social grade	AB	Reference					
	C1	1.09		0.9 to 1.31			
	C2	0.92		0.76 to 1.12			
	D	1.21		0.99 to 1.47			
	E	1.29	*	1.06 to 1.58			
Education	University				Reference		
	A-level				1.20	*	1 to 1.45
	GCSE				1.10		0.94 to 1.29
	Other				1.16		0.92 to 1.48
	None				1.22	*	1.02 to 1.46
Constant		0.44	*	0.21 to 0.92	0.41	*	0.19 to 0.85

Key: * p<0.05, ** p<0.01, ***, p<0.001

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Table S6 - Unweighted logistic regression results for factors associated with likelihood of receiving Brief Intervention for smoking: socioeconomic-adjusted models 3 & 4

		Socioeconomic-adjusted models 3 & 4					
		OR		95% CI	OR		95% CI
Age	18-24	Reference					
	25-34	1.34	**	1.12 to 1.61	1.32	**	1.11 to 1.59
	35-44	1.62	***	1.34 to 1.96	1.63	***	1.35 to 1.97
	45-54	2.03	***	1.69 to 2.45	2.07	***	1.72 to 2.5
	55-64	2.31	***	1.9 to 2.8	2.41	***	1.97 to 2.94
	65+	2.12	***	1.73 to 2.59	2.27	***	1.85 to 2.78
Gender	Male	Reference					
	Female	0.97		0.87 to 1.08	0.98		0.87 to 1.09
Region	North	Reference					
	Midlands	0.93		0.81 to 1.06	0.93		0.81 to 1.06
	South	0.86	*	0.76 to 0.97	0.85	*	0.75 to 0.96
Children in the household	None	Reference					
	≥1	1.06		0.93 to 1.21	1.06		0.93 to 1.21
Self-reported disability	No	Reference					
	Yes	1.42	***	1.24 to 1.63	1.41	***	1.22 to 1.62
Ethnicity	White	Reference					
	Mixed race	0.78		0.52 to 1.17	0.77		0.51 to 1.16
	Asian	0.88		0.7 to 1.12	0.91		0.71 to 1.15
	Black	1.12		0.78 to 1.61	1.11		0.77 to 1.6
	Arab/other	1.01		0.58 to 1.77	0.98		0.56 to 1.73
Time trend (monthly)		1.00		0.99 to 1.01	1.00		0.99 to 1.01
Risky drinker (AUDIT 8+)	No	Reference					
	Yes	0.89		0.78 to 1.02	0.89		0.78 to 1.02
Motivation to cut down smoking	None	Reference					
	Moderate	1.42	***	1.26 to 1.61	1.43	***	1.26 to 1.61
	High	2.22	***	1.88 to 2.62	2.22	***	1.88 to 2.63
Employment status	Full-time	Reference					
	Other	1.07		0.95 to 1.22			
Housing tenure	Owned				Reference		
	Rented				1.14	*	1.01 to 1.27
Constant		0.45	*	0.22 to 0.92	0.43	*	0.21 to 0.88

Key: * p<0.05, ** p<0.01, ***, p<0.001

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Table S7 - Unweighted logistic regression results for factors associated with likelihood of receiving Brief Intervention for risky alcohol use: demographic- and behaviour-adjusted models

		Demographic-adjusted model			Behaviour-adjusted model		
		OR		95% CI	OR		95% CI
Age	18-24	Reference					
	25-34	1.77		1 to 3.15	1.62		0.87 to 3.03
	35-44	2.92	***	1.7 to 5	2.52	**	1.41 to 4.53
	45-54	3.22	***	1.98 to 5.24	3.44	***	2.03 to 5.82
	55-64	2.41	**	1.45 to 4.01	3.52	***	2.03 to 6.13
	65+	2.54	***	1.52 to 4.25	4.72	***	2.68 to 8.3
Gender	Male	Reference					
	Female	0.72	*	0.53 to 0.96	0.67	*	0.48 to 0.93
Region	North	Reference					
	Midlands	1.26		0.9 to 1.75	1.30		0.9 to 1.88
	South	1.01		0.75 to 1.36	0.96		0.69 to 1.34
Children in the household	None	Reference					
	≥1	0.72		0.5 to 1.04	0.95		0.64 to 1.41
Self-reported disability	No	Reference					
	Yes	2.91	***	2.16 to 3.91	1.91	***	1.36 to 2.68
Ethnicity	White	Reference					
	Mixed race	1.45		0.5 to 4.19	1.61		0.51 to 5.09
	Asian	2.15		0.73 to 6.28	1.76		0.51 to 6.08
	Black	0.78		0.18 to 3.33	0.61		0.13 to 2.88
	Arab/other	3.90		0.76 to 20.07	7.04	*	1.27 to 38.91
Time trend (monthly)		1.00		0.99 to 1.02	1.00		0.99 to 1.02
Past year smoker	No				Reference		
	Yes				1.20		0.88 to 1.64
Motivation to cut down drinking	None				Reference		
	Moderate				2.64	***	1.91 to 3.65
	High				4.54	***	2.96 to 6.96
AUDIT Score	8-15				Reference		
	16-19				2.78	***	1.79 to 4.33
	20+				11.88	***	8.18 to 17.26
Constant		0.04	***	0.01 to 0.22	0.01	***	0 to 0.06

Key: * p<0.05, ** p<0.01, ***, p<0.001

Table S8 - Unweighted logistic regression results for factors associated with likelihood of receiving Brief Intervention for risky alcohol use: socioeconomic-adjusted models 1 & 2

		Socioeconomic-adjusted models 1 & 2					
		OR		95% CI	OR		95% CI
Age	18-24	Reference					
	25-34	1.59		0.85 to 2.99	1.63		0.86 to 3.1
	35-44	2.40	**	1.33 to 4.33	2.54	**	1.39 to 4.64
	45-54	3.22	***	1.88 to 5.51	3.40	***	1.96 to 5.89
	55-64	3.38	***	1.93 to 5.92	3.43	***	1.93 to 6.09
	65+	4.64	***	2.61 to 8.23	4.51	***	2.49 to 8.16
Gender	Male	Reference					
	Female	0.66	*	0.47 to 0.91	0.68	*	0.49 to 0.94
Region	North	Reference					
	Midlands	1.31		0.91 to 1.9	1.29		0.9 to 1.87
	South	1.01		0.73 to 1.41	0.99		0.71 to 1.38
Children in the household	None	Reference					
	≥1	0.96		0.64 to 1.43	0.95		0.64 to 1.41
Self-reported disability	No	Reference					
	Yes	1.67	**	1.17 to 2.38	1.84	**	1.3 to 2.6
Ethnicity	White	Reference					
	Mixed race	1.60		0.5 to 5.08	1.57		0.49 to 4.99
	Asian	1.69		0.5 to 5.73	1.80		0.52 to 6.22
	Black	0.52		0.11 to 2.47	0.61		0.13 to 2.88
	Arab/other	7.78	*	1.43 to 42.22	6.80	*	1.21 to 38.21
Time trend (monthly)		1.00		0.99 to 1.02	1.00		0.99 to 1.02
Past year smoker	No	Reference					
	Yes	1.08		0.78 to 1.49	1.17		0.85 to 1.6
Motivation to cut down drinking	None	Reference					
	Moderate	2.74	***	1.98 to 3.8	2.70	***	1.95 to 3.73
	High	4.66	***	3.03 to 7.17	4.61	***	3 to 7.08
AUDIT Score	8-15	Reference					
	16-19	2.62	***	1.68 to 4.09	2.70	***	1.74 to 4.21
	20+	10.77	***	7.38 to 15.73	11.69	***	8.04 to 17
Social grade	AB	Reference					
	C1	1.05		0.71 to 1.55			
	C2	0.89		0.56 to 1.42			
	D	1.32		0.79 to 2.2			
	E	2.09	**	1.28 to 3.41			
Education	University				Reference		
	A-level				1.09		0.7 to 1.69
	GCSE				1.12		0.76 to 1.65
	Other				1.32		0.76 to 2.3
	None				1.36		0.84 to 2.2
Constant		0.01	***	0 to 0.06	0.01	***	0 to 0.05

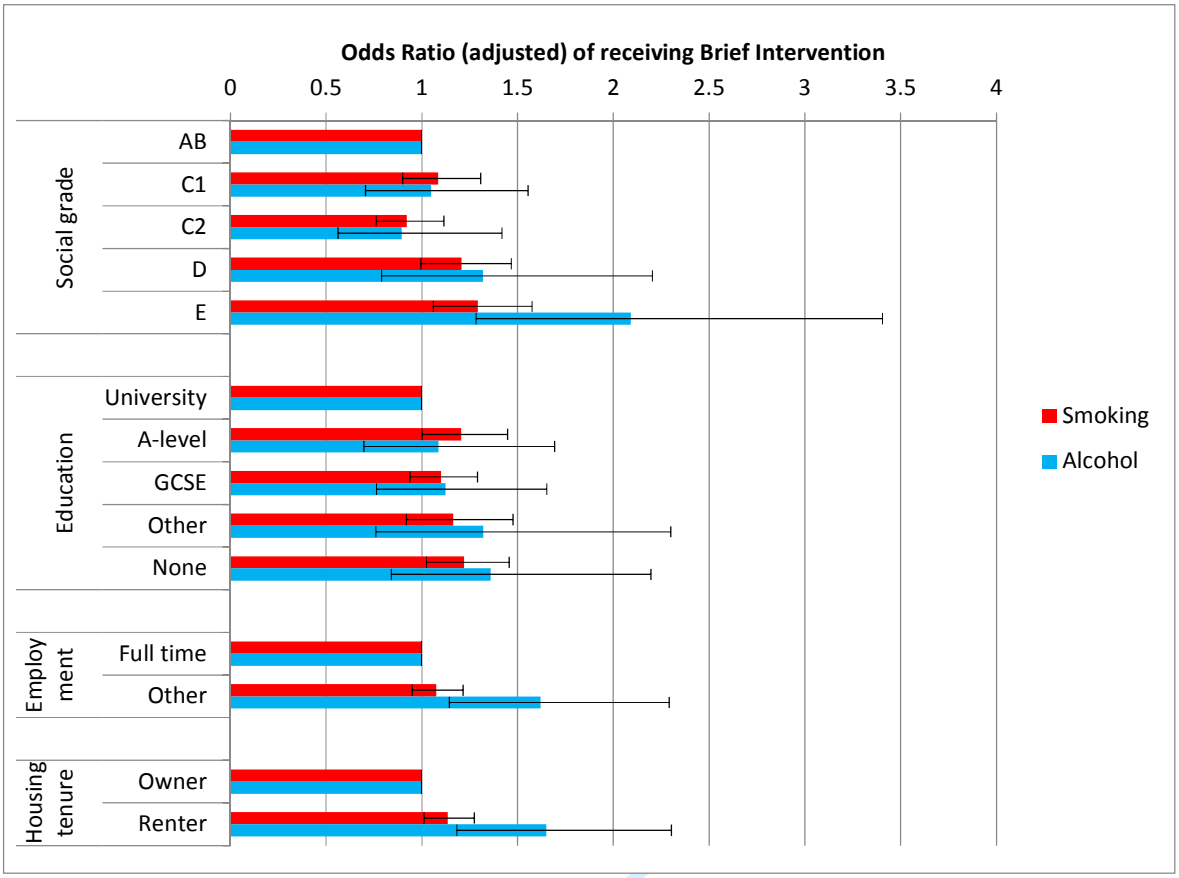
Key: * p<0.05, ** p<0.01, ***, p<0.001

Table S9 - Unweighted logistic regression results for factors associated with likelihood of receiving Brief Intervention for risky alcohol use: socioeconomic-adjusted models 3 & 4

		Socioeconomic-adjusted models 3 & 4					
		OR		95% CI	OR		95% CI
Age	18-24	Reference					
	25-34	1.83		0.97 to 3.45	1.70		0.91 to 3.18
	35-44	2.91	***	1.6 to 5.27	2.83	**	1.57 to 5.12
	45-54	3.86	***	2.26 to 6.6	3.98	***	2.33 to 6.82
	55-64	3.53	***	2.03 to 6.13	4.30	***	2.43 to 7.61
	65+	4.19	***	2.37 to 7.4	5.94	***	3.3 to 10.69
Gender	Male	Reference					
	Female	0.63	**	0.45 to 0.88	0.67	*	0.48 to 0.93
Region	North	Reference					
	Midlands	1.32		0.91 to 1.9	1.32		0.92 to 1.91
	South	0.95		0.68 to 1.32	0.98		0.7 to 1.36
Children in the household	None	Reference					
	≥1	0.96		0.64 to 1.43	0.96		0.65 to 1.44
Self-reported disability	No	Reference					
	Yes	1.75	**	1.24 to 2.47	1.72	**	1.22 to 2.44
Ethnicity	White	Reference					
	Mixed race	1.58		0.5 to 5.03	1.53		0.49 to 4.81
	Asian	1.84		0.54 to 6.26	1.66		0.48 to 5.74
	Black	0.57		0.12 to 2.73	0.57		0.12 to 2.7
	Arab/other	6.66	*	1.16 to 38.28	7.28	*	1.28 to 41.44
Time trend (monthly)		1.00		0.99 to 1.02	1.00		0.99 to 1.02
Past year smoker	No	Reference					
	Yes	1.17		0.85 to 1.6	1.05		0.76 to 1.45
Motivation to cut down drinking	None	Reference					
	Moderate	2.64	***	1.91 to 3.65	2.73	***	1.97 to 3.78
	High	4.38	***	2.85 to 6.73	4.58	***	2.99 to 7.02
AUDIT Score	8-15	Reference					
	16-19	2.73	***	1.76 to 4.25	2.72	***	1.75 to 4.23
	20+	11.43	***	7.86 to 16.64	11.32	***	7.78 to 16.48
Employment status	Full-time	Reference					
	Other	1.62	**	1.14 to 2.29			
Housing tenure	Owned				Reference		
	Rented				1.65	**	1.18 to 2.3
Constant		0.01	***	0 to 0.05	0.01	***	0 to 0.04

Key: * p<0.05, ** p<0.01, ***, p<0.001

Figure S1 – Unweighted independent effects of four measures of socioeconomic status on Odds Ratio of receiving a Brief Intervention for smoking or risky drinking



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Analysis using complete cases only

Table S10 - Logistic regression results for factors associated with likelihood of receiving Brief Intervention for smoking: demographic- and behaviour-adjusted models

		Demographic-adjusted model			Behaviour-adjusted model		
		OR		95% CI	OR		95% CI
Age	18-24	Reference					
	25-34	1.37	**	1.14 to 1.65	1.34	**	1.1 to 1.63
	35-44	1.54	***	1.27 to 1.87	1.53	***	1.25 to 1.88
	45-54	2.00	***	1.66 to 2.42	1.98	***	1.63 to 2.42
	55-64	2.17	***	1.78 to 2.64	2.19	***	1.77 to 2.71
	65+	2.04	***	1.67 to 2.49	2.13	***	1.71 to 2.64
Gender	Male	Reference					
	Female	1.01		0.91 to 1.13	0.97		0.86 to 1.09
Region	North	Reference					
	Midlands	0.94		0.82 to 1.07	0.93		0.81 to 1.07
	South	0.80	**	0.7 to 0.91	0.78	***	0.68 to 0.89
Children in the household	None	Reference					
	≥1	1.14		1 to 1.31	1.08		0.94 to 1.25
Self-reported disability	No	Reference					
	Yes	1.39	***	1.21 to 1.6	1.42	***	1.23 to 1.64
Ethnicity	White	Reference					
	Mixed race	0.93		0.61 to 1.41	0.86		0.55 to 1.34
	Asian	0.88		0.69 to 1.12	0.81		0.63 to 1.05
	Black	1.14		0.79 to 1.64	0.94		0.64 to 1.4
	Arab/other	0.97		0.56 to 1.67	0.94		0.52 to 1.71
Time trend (monthly)		1.00		0.99 to 1.01	1.00		1 to 1.01
Risky drinker (AUDIT 8+)	No				Reference		
	Yes				0.86	*	0.74 to 0.99
Motivation to cut down smoking	None				Reference		
	Moderate				1.40	***	1.22 to 1.6
	High				2.13	***	1.77 to 2.55
Constant		0.45	*	0.21 to 0.93	0.33	**	0.15 to 0.73

Key: * p<0.05, ** p<0.01, ***, p<0.001

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Table S11 - Logistic regression results for factors associated with likelihood of receiving Brief Intervention for smoking: socioeconomic-adjusted models 1 & 2

		Socioeconomic-adjusted models 1 & 2					
		OR		95% CI	OR		95% CI
Age	18-24	Reference					
	25-34	1.36	**	1.12 to 1.66	1.37	**	1.12 to 1.66
	35-44	1.58	***	1.29 to 1.94	1.58	***	1.28 to 1.94
	45-54	2.03	***	1.66 to 2.48	2.04	***	1.67 to 2.5
	55-64	2.26	***	1.83 to 2.79	2.22	***	1.79 to 2.75
	65+	2.21	***	1.77 to 2.75	2.11	***	1.69 to 2.65
Gender	Male	Reference					
	Female	0.95		0.84 to 1.07	0.96		0.86 to 1.09
Region	North	Reference					
	Midlands	0.94		0.81 to 1.08	0.92		0.79 to 1.06
	South	0.79	**	0.69 to 0.91	0.78	***	0.68 to 0.89
Children in the household	None	Reference					
	≥1	1.07		0.93 to 1.23	1.08		0.93 to 1.24
Self-reported disability	No	Reference					
	Yes	1.35	***	1.16 to 1.57	1.39	***	1.2 to 1.61
Ethnicity	White	Reference					
	Mixed race	0.84		0.54 to 1.33	0.83		0.53 to 1.3
	Asian	0.80		0.62 to 1.03	0.83		0.64 to 1.08
	Black	0.93		0.62 to 1.37	0.97		0.65 to 1.44
	Arab/other	0.96		0.53 to 1.74	0.92		0.51 to 1.68
Time trend (monthly)		1.00		1 to 1.01	1.00		1 to 1.01
Risky drinker (AUDIT 8+)	No	Reference					
	Yes	0.87		0.76 to 1.01	0.87		0.75 to 1
Motivation to cut down smoking	None	Reference					
	Moderate	1.42	***	1.24 to 1.62	1.41	***	1.23 to 1.62
	High	2.18	***	1.81 to 2.62	2.14	***	1.78 to 2.58
Social grade	AB	Reference					
	C1	1.09		0.89 to 1.33			
	C2	0.95		0.77 to 1.17			
	D	1.27	*	1.03 to 1.57			
	E	1.32	*	1.06 to 1.63			
Education	University				Reference		
	A-level				1.23	*	1.01 to 1.51
	GCSE				1.14		0.96 to 1.36
	Other				1.19		0.92 to 1.55
	None				1.24	*	1.02 to 1.5
Constant		0.31	**	0.14 to 0.69	0.28	**	0.13 to 0.64

Key: * p<0.05, ** p<0.01, ***, p<0.001

Table S12 - Logistic regression results for factors associated with likelihood of receiving Brief Intervention for smoking: socioeconomic-adjusted models 3 & 4

		Socioeconomic-adjusted models 3 & 4					
		OR		95% CI	OR		95% CI
Age	18-24	Reference					
	25-34	1.35	**	1.11 to 1.65	1.35	**	1.11 to 1.64
	35-44	1.55	***	1.26 to 1.9	1.59	***	1.3 to 1.96
	45-54	1.99	***	1.63 to 2.43	2.03	***	1.66 to 2.49
	55-64	2.19	***	1.78 to 2.71	2.24	***	1.8 to 2.79
	65+	2.10	***	1.69 to 2.61	2.24	***	1.79 to 2.8
Gender	Male	Reference					
	Female	0.96		0.85 to 1.08	0.99		0.87 to 1.11
Region	North	Reference					
	Midlands	0.93		0.81 to 1.08	0.93		0.8 to 1.07
	South	0.78	***	0.68 to 0.89	0.77	***	0.67 to 0.88
Children in the household	None	Reference					
	≥1	1.08		0.94 to 1.25	1.07		0.92 to 1.23
Self-reported disability	No	Reference					
	Yes	1.40	***	1.2 to 1.62	1.41	***	1.21 to 1.64
Ethnicity	White	Reference					
	Mixed race	0.86		0.55 to 1.34	0.86		0.55 to 1.33
	Asian	0.81		0.63 to 1.05	0.86		0.66 to 1.12
	Black	0.95		0.64 to 1.4	0.95		0.63 to 1.44
	Arab/other	0.95		0.52 to 1.72	0.94		0.52 to 1.7
Time trend (monthly)		1.00		1 to 1.01	1.00		1 to 1.01
Risky drinker (AUDIT 8+)	No	Reference					
	Yes	0.86	*	0.74 to 0.99	0.86	*	0.75 to 1
Motivation to cut down smoking	None	Reference					
	Moderate	1.40	***	1.22 to 1.6	1.39	***	1.21 to 1.59
	High	2.13	***	1.77 to 2.56	2.08	***	1.73 to 2.49
Employment status	Full-time	Reference					
	Other	1.05		0.92 to 1.2			
Housing tenure	Owned				Reference		
	Rented				1.10		0.97 to 1.24
Constant		0.33	**	0.15 to 0.72	0.31	**	0.14 to 0.69

Key: * p<0.05, ** p<0.01, ***, p<0.001

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Table S13 - Logistic regression results for factors associated with likelihood of receiving Brief Intervention for risky alcohol use: demographic- and behaviour-adjusted models

		Demographic-adjusted model			Behaviour-adjusted model		
		OR		95% CI	OR		95% CI
Age	18-24	Reference					
	25-34	1.59		0.84 to 3.01	1.45		0.74 to 2.83
	35-44	2.65	**	1.45 to 4.82	2.28	*	1.2 to 4.31
	45-54	2.82	***	1.65 to 4.82	3.22	***	1.83 to 5.65
	55-64	2.37	**	1.35 to 4.17	3.53	***	1.93 to 6.48
	65+	2.76	**	1.55 to 4.92	5.45	***	2.95 to 10.09
Gender	Male	Reference					
	Female	0.65	*	0.47 to 0.9	0.62	**	0.43 to 0.89
Region	North	Reference					
	Midlands	1.23		0.86 to 1.78	1.21		0.81 to 1.8
	South	0.82		0.6 to 1.14	0.77		0.54 to 1.1
Children in the household	None	Reference					
	≥1	0.79		0.53 to 1.18	1.07		0.7 to 1.65
Self-reported disability	No	Reference					
	Yes	3.52	***	2.57 to 4.83	2.27	***	1.57 to 3.28
Ethnicity	White	Reference					
	Mixed race	2.22		0.74 to 6.63	2.19		0.7 to 6.87
	Asian	1.06		0.27 to 4.24	0.65		0.13 to 3.33
	Black	0.32		0.08 to 1.36	0.17		0.02 to 1.16
	Arab/other	4.61		1 to 21.21	9.03	**	1.87 to 43.55
Time trend (monthly)		1.01		0.99 to 1.02	1.01		0.99 to 1.02
Past year smoker	No				Reference		
	Yes				1.25		0.9 to 1.73
Motivation to cut down drinking	None				Reference		
	Moderate				2.85	***	1.99 to 4.08
	High				5.27	***	3.32 to 8.36
AUDIT Score	8-15				Reference		
	16-19				2.94	***	1.79 to 4.82
	20+				11.76	***	7.68 to 18.02
Constant		0.03	***	0 to 0.21	0.01	***	0 to 0.06

Key: * p<0.05, ** p<0.01, ***, p<0.001

Table S14 - Logistic regression results for factors associated with likelihood of receiving Brief Intervention for risky alcohol use: socioeconomic-adjusted models 1 & 2

		Socioeconomic-adjusted models 1 & 2					
		OR		95% CI	OR		95% CI
Age	18-24	Reference					
	25-34	1.49		0.76 to 2.91	1.49		0.76 to 2.89
	35-44	2.25	*	1.19 to 4.26	2.33	*	1.23 to 4.41
	45-54	3.12	***	1.76 to 5.54	3.22	***	1.79 to 5.79
	55-64	3.50	***	1.91 to 6.43	3.35	***	1.8 to 6.24
	65+	5.47	***	2.96 to 10.13	5.23	***	2.78 to 9.85
Gender	Male	Reference					
	Female	0.60	**	0.42 to 0.87	0.63	*	0.44 to 0.9
Region	North	Reference					
	Midlands	1.22		0.82 to 1.81	1.22		0.82 to 1.81
	South	0.80		0.56 to 1.16	0.81		0.56 to 1.16
Children in the household	None	Reference					
	≥1	1.07		0.69 to 1.66	1.07		0.7 to 1.64
Self-reported disability	No	Reference					
	Yes	2.01	***	1.37 to 2.95	2.18	***	1.49 to 3.18
Ethnicity	White	Reference					
	Mixed race	2.28		0.71 to 7.33	2.11		0.68 to 6.59
	Asian	0.64		0.13 to 3.15	0.66		0.13 to 3.34
	Black	0.15	*	0.02 to 0.98	0.17		0.02 to 1.22
	Arab/other	9.81	**	2.03 to 47.41	8.65	**	1.74 to 42.91
Time trend (monthly)		1.00		0.99 to 1.02	1.00		0.99 to 1.02
Past year smoker	No	Reference					
	Yes	1.13		0.81 to 1.58	1.22		0.88 to 1.71
Motivation to cut down drinking	None	Reference					
	Moderate	2.94	***	2.04 to 4.23	2.95	***	2.04 to 4.26
	High	5.35	***	3.36 to 8.53	5.47	***	3.42 to 8.73
AUDIT Score	8-15	Reference					
	16-19	2.78	***	1.67 to 4.64	2.76	***	1.67 to 4.55
	20+	10.91	***	7.1 to 16.78	11.20	***	7.32 to 17.13
Social grade	AB	Reference					
	C1	1.02		0.66 to 1.58			
	C2	0.88		0.53 to 1.44			
	D	1.29		0.73 to 2.26			
	E	2.03	**	1.2 to 3.42			
Education	University				Reference		
	A-level				1.16		0.72 to 1.88
	GCSE				1.17		0.76 to 1.79
	Other				1.50		0.81 to 2.81
	None				1.52		0.9 to 2.58
Constant		0.01	***	0 to 0.06	0.01	***	0 to 0.06

Key: * p<0.05, ** p<0.01, ***, p<0.001

Table S15 - Logistic regression results for factors associated with likelihood of receiving Brief Intervention for risky alcohol use: socioeconomic-adjusted models 3 & 4

		Socioeconomic-adjusted models 3 & 4					
		OR		95% CI	OR		95% CI
Age	18-24	Reference					
	25-34	1.60		0.8 to 3.21	1.59		0.81 to 3.12
	35-44	2.49	**	1.29 to 4.82	2.69	**	1.4 to 5.15
	45-54	3.48	***	1.94 to 6.25	3.81	***	2.13 to 6.82
	55-64	3.44	***	1.88 to 6.3	4.18	***	2.19 to 7.97
	65+	4.78	***	2.6 to 8.8	6.78	***	3.54 to 13.01
Gender	Male	Reference					
	Female	0.58	**	0.4 to 0.84	0.60	**	0.42 to 0.87
Region	North	Reference					
	Midlands	1.19		0.8 to 1.78	1.23		0.82 to 1.83
	South	0.76		0.53 to 1.08	0.77		0.53 to 1.1
Children in the household	None	Reference					
	≥1	1.09		0.7 to 1.69	1.03		0.66 to 1.59
Self-reported disability	No	Reference					
	Yes	2.10	***	1.43 to 3.09	2.10	***	1.43 to 3.08
Ethnicity	White	Reference					
	Mixed race	2.18		0.73 to 6.52	2.15		0.72 to 6.41
	Asian	0.69		0.14 to 3.5	0.62		0.12 to 3.24
	Black	0.15		0.02 to 1.11	0.16		0.02 to 1.1
	Arab/other	8.36	*	1.55 to 45.13	9.37	**	1.86 to 47.14
Time trend (monthly)		1.00		0.98 to 1.02	1.00		0.98 to 1.02
Past year smoker	No	Reference					
	Yes	1.20		0.86 to 1.67	1.08		0.77 to 1.51
Motivation to cut down drinking	None	Reference					
	Moderate	2.93	***	2.04 to 4.22	2.88	***	2 to 4.14
	High	5.25	***	3.3 to 8.37	5.28	***	3.31 to 8.4
AUDIT Score	8-15	Reference					
	16-19	2.88	***	1.74 to 4.76	2.95	***	1.77 to 4.9
	20+	11.09	***	7.2 to 17.1	12.06	***	7.81 to 18.62
Employment status	Full-time	Reference					
	Other	1.53	*	1.06 to 2.21			
Housing tenure	Owned				Reference		
	Rented				1.49	*	1.05 to 2.13
Constant		0.01	***	0 to 0.06	0.01	***	0 to 0.06

Key: * p<0.05, ** p<0.01, ***, p<0.001

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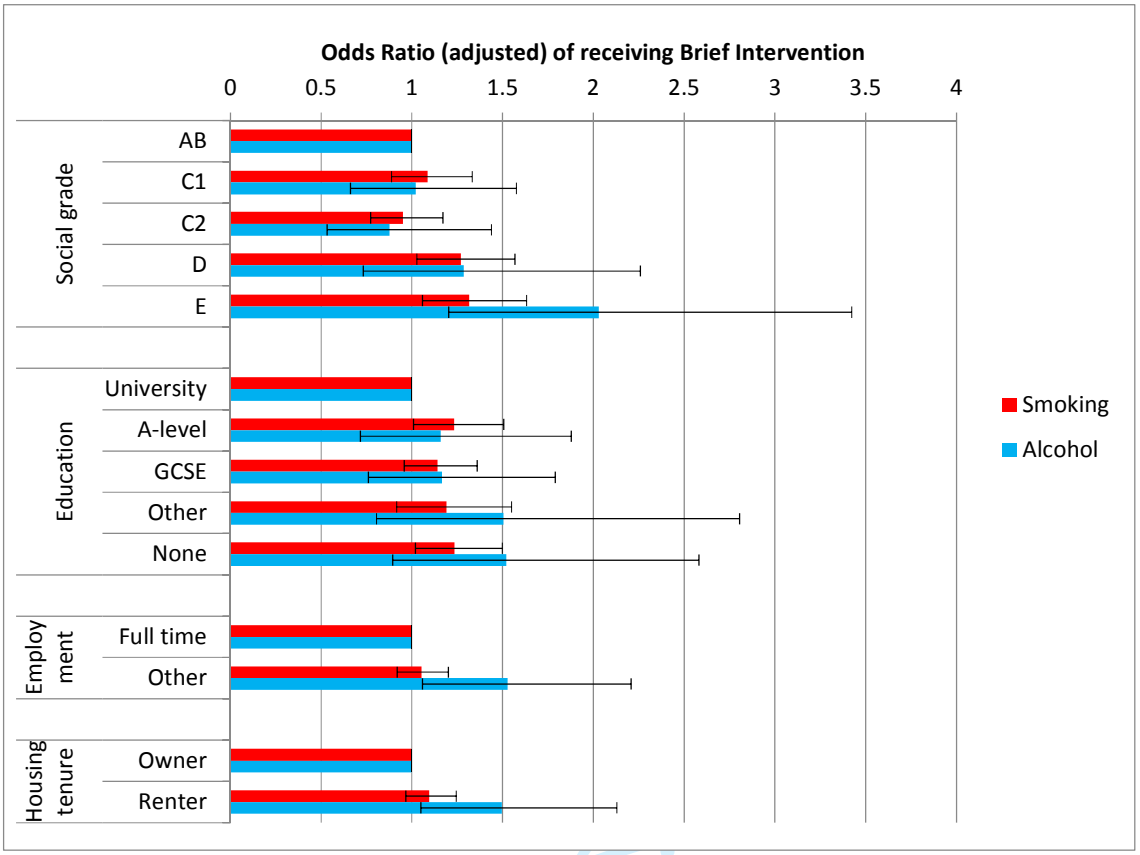
Figure S2 - Independent effects of four measures of socioeconomic status on Odds Ratio of receiving a Brief Intervention for smoking or risky drinking



Reporting checklist for cross sectional study.

Based on the STROBE cross sectional guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

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In your methods section, say that you used the STROBE cross sectional reporting guidelines, and cite them as:

von Elm E, Altman DG, Egger M, Pocock SJ, Gotzsche PC, Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for reporting observational studies.

		Reporting Item	Page Number
Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	1
Abstract	#1b	Provide in the abstract an informative and balanced summary of what was done and what was found	2
Background / rationale	#2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	#3	State specific objectives, including any prespecified hypotheses	3
Study design	#4	Present key elements of study design early in the paper	3
Setting	#5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	3
Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants.	3

	#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	3-4
Data sources / measurement	#8	For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give information separately for for exposed and unexposed groups if applicable.	4
Bias	#9	Describe any efforts to address potential sources of bias	4
Study size	#10	Explain how the study size was arrived at	6
Quantitative variables	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	3-4
Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	4-5
	#12b	Describe any methods used to examine subgroups and interactions	n/a
	#12c	Explain how missing data were addressed	4
	#12d	If applicable, describe analytical methods taking account of sampling strategy	4
	#12e	Describe any sensitivity analyses	4
Participants	#13a	Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give information separately for for exposed and unexposed groups if applicable.	6
	#13b	Give reasons for non-participation at each stage	n/a
	#13c	Consider use of a flow diagram	n/a
Descriptive data	#14a	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.	6

	#14b	Indicate number of participants with missing data for each variable of interest	4
Outcome data	#15	Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable.	6
Main results	#16a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	7, 9, 12
	#16b	Report category boundaries when continuous variables were categorized	5
	#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	14
Key results	#18	Summarise key results with reference to study objectives	14
Limitations	#19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	14
Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	14-15
Generalisability	#21	Discuss the generalisability (external validity) of the study results	14-15
Funding	#22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	15

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Are Brief Interventions for smoking and excessive alcohol consumption in primary care affecting health inequalities? Findings from a population-based household survey in England

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Are Brief Interventions for smoking and excessive alcohol consumption in primary care affecting health inequalities? Findings from a population-based household survey in England

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ABSTRACT

Objectives

Brief Interventions [BI] for smoking and risky drinking are effective and cost-effective policy approaches to reducing alcohol harm currently used in primary care in England, however little is known about their contribution to health inequalities. This paper aims to investigate whether self-reported receipt of BI is associated with socioeconomic position and whether this differs for smoking or alcohol.

Design

Population survey of 8,978 smokers or risky drinkers in England aged 16+ taking part in the Alcohol and Smoking Toolkit Studies

Measures

Survey participants answered questions regarding whether they had received advice and support to cut down their drinking or smoking from a primary healthcare professional in the past 12 months as well as their socioeconomic position, demographic details, whether they smoke and their motivation to cut down their smoking and/or drinking. Respondents also completed the Alcohol Use Disorders Identification Test (AUDIT). Smokers were defined as those reporting any smoking in the past year. Risky drinkers were defined as those scoring 8 or more on the AUDIT.

Results

After adjusting for demographic factors and patterns in smoking and drinking, BI delivery was highest in lower socioeconomic groups. Smokers in the lowest social grade had 30% (95% CI 5% to 61%) greater odds of reporting receipt of a BI than those in the highest grade. The relationship for risky drinking appeared stronger, with those in the lowest social grade having 111% (95% CI 27% to 252%) greater odds of reporting BI receipt than the highest grade. Rates of BI delivery were 8 times greater among smokers than risky drinkers (48.3% vs 6.1%).

Conclusions

Current delivery of Brief Interventions for smoking and drinking in primary care in England may be contributing to a reduction in socioeconomic inequalities in health. This effect could be increased if intervention rates, particularly for drinking, were raised.

ARTICLE SUMMARY

Strengths and limitations of this study

- Used data from a large representative sample of adult smokers and drinkers in England
- Based on data on intervention receipt reported by patients, rather than practitioners
- Analysis controls for a broad range of potential confounding demographic factors
- Respondents may have underestimated or misreported their drinking or smoking
- There may be additional socioeconomic gradients in intervention effectiveness which could moderate the overall impact of Brief Interventions on health inequalities

INTRODUCTION

Tobacco smoking and the excessive consumption of alcohol are leading causes of preventable disease both in the UK and worldwide[1] and inequalities in both alcohol and tobacco-related health harms are a significant contributor to wider inequalities in health [2,3]. Underlying these inequalities are conflicting socioeconomic patterns in the behaviours themselves. Smoking prevalence and related harm both increase with deprivation [4], while for alcohol consumption the picture is more complex. Those in more deprived groups are more likely to abstain from drinking, and those who drink are more likely to drink within UK drinking guidelines compared to less deprived groups [5], while those in more deprived groups who drink heavily drink more on average than heavy drinkers in less deprived groups [6]. As a result, numerous studies have found alcohol consumption to be lower in more deprived groups even though they suffer greater levels of alcohol-related harm [2,7,8], a phenomenon referred to as the 'Alcohol Harm Paradox'[7,9].

Screening and Brief Interventions, consisting of an initial case finding or screening step followed by delivery of feedback and structured advice or behaviour change counselling, delivered in primary care, is an effective and cost-effective measure to increase smoking cessation rates[10,11] and reduce harmful drinking [12,13]. Current UK clinical guidelines recommend that all patients are assessed for smoking annually, with a Brief Intervention (BI) delivered to all smokers [14]. Guidance for alcohol encourages the use of opportunistic screening and BI alongside requirements to screen all patients registering with a new primary care provider or attending a Health Check [15,16]. In spite of this guidance, BI delivery levels remain low in England [17], particularly for alcohol [18], a finding that has been replicated in many other countries [19–21].

Research across a broad range of interventions and settings has found that public health policies, including screening programmes in primary care, may exacerbate inequalities in health even while improving population health overall [22,23]. In this context it is striking that very little research to date has considered the potential for BI programmes for tobacco or alcohol to affect inequalities, particularly given the high socioeconomic variation in poor health due to both behaviours. We aimed to address this gap by examining whether there are sociodemographic gradients in BI delivery for smoking and drinking and whether these can be explained by sociodemographic or behavioural characteristics of patients attending primary care in England.

METHODS

Data Sources

The Alcohol and Smoking Toolkit Studies are large, nationally representative, monthly surveys of adults aged 16+ in England [24,25]. A sample of approximately 1,700 respondents each month participate in household computer-assisted interviews. The survey uses a form of random location sampling, representing a hybrid between random probability and simple quota sampling (see published protocols for further details [24,25]). We used data collected between March 2014 and July 2016 (N=48808) with analysis restricted to respondents who reported visiting the General Practitioner (GP) in the past 12 months and were either smokers (those reporting that they had smoked cigarettes or other tobacco products at least occasionally in the past year – see supplementary file for full details) or risky drinkers (those scoring at least eight on the Alcohol Use Disorders Identification Test (AUDIT) [26]). This gave a total sample of 9042 adults of whom 5004 were smokers only, 2528 were risky drinkers only, and 1446 were both (data on the smoking status of one risky drinker and the drinking status of 63 smokers were missing).

Measures

Our primary outcome measure was self-reported receipt of a BI (or more intensive intervention) from a GP or other primary care-based health worker in the past year. Respondents who smoked were asked 'Has your GP spoken to you about smoking in the past year?' and BI receipt was categorised as a response of at least 'Yes, he/she advised me to stop but did not offer anything'. Risky drinkers were asked 'In the last 12 months has a doctor or other health worker within your GP surgery discussed your drinking?', with BI receipt categorised as a response of at least 'Yes, a doctor or other health worker within my GP surgery offered advice about cutting down my drinking'. Note that this definition includes referral to specialist treatment as recommended for those with potential alcohol dependence. See supplementary file for a full list of response options.

Data was also collected on respondents' age, gender, region of England (categorised as North, Midlands or South), the number of children in the household (categorised as 0 or 1+), self-reported disability status (disability/no disability) and ethnicity (white, mixed/multiple ethnic group, Asian or British Asian, black, other). Self-reported motivation to reduce smoking and drinking was recorded and grouped into those responding 'I don't want to stop smoking/cut down on drinking', those reporting some degree of motivation to quit/cut down, and those who were highly motivated and willing to specify a time frame for cutting down – 'I really want to stop smoking and intend to in the next month/3 months').

As previous studies have identified that different measures of socioeconomic position (SEP) demonstrate different relationships with alcohol consumption [6,9], we examined four alternative measures SEP:
1) Social grade, classified Using the British National Readership Survey Social-Grade Classification Tool [27]: A: higher managerial, administrative or professional; B: intermediate managerial, administrative or professional; C1: supervisory or clerical and junior managerial administrative or professional; C2: skilled manual workers; D: Semi and unskilled manual workers; E: Causal or lowest grade workers, pensioners and others who depend on the welfare state for their income.
2) Educational level, grouped as: University education, A-level and equivalent, GCSE/vocational, other/still studying, none
3) Working status, categorised as being in full-time employment or otherwise
4) Housing tenure, categorised as owner occupied (owned outright or being brought with a mortgage) or otherwise
Finally, in order to test whether higher levels of alcohol consumption increase the likelihood of receiving a BI, the risky drinker group were further subdivided according to their AUDIT score in line with World Health Organization guidelines [26]:
8-15 - Risky drinker
16-19 – High risk drinkers
20+ - Possible alcohol dependence

Analysis

Data were weighted using an iterative 'rim weighting' technique as used in previous analyses of Smoking and Alcohol Toolkit data (e.g. [18]). Parallel analysis using unweighted data is reported in the supplementary file (Tables S1-S7 & Figure S1). Missing data were imputed using Multiple Imputation with 20 datasets [28] and analytical results combined using Rubin's Rules [29]. Complete case only analyses are reported in the supplementary material (Tables S8-S13 & Figure S2). All

imputation and analyses were undertaken using Stata 12 [30] following a plan pre-registered with the Open Science Framework prior to any data analysis (https://osf.io/5eq4h/). As the only continuous variable in the analysis, age was standardised and tested for non-linearity using the Box-Tidwell approach [31]. This suggested significant non-linearity and age was therefore categorised into six groups (18-24, 25-34, 35-44, 45-54, 55-64 and 65+).

The analysis consisted of four steps:
1) we produced descriptive tables the full dataset showing rates of smoking and risky drinking (all respondents scoring AUDIT 8+) in the population and rates of GP attendance and BI receipt for those who visited their GP for both smokers and risky drinkers, stratified by the 4 socioeconomic measures to show the extent to which socioeconomic inequalities exist before adjusting for demographic and other factors.
2) to examine the extent to which variation in BI delivery among those at risk and attending primary care in the past year can be explained by demographic characteristics alone, we fitted two multivariable logistic regression models in which receipt of a smoking or alcohol intervention was regressed on age, gender, region, number of children in the household, disability status and ethnicity. These models also include a linear (monthly) temporal trend to assess whether BI rates have increased or decreased over the data collection period.
3) to examine the extent to which drinking and smoking behaviour, and motivations to cut down can explain additional variation in BI delivery, we fitted two further multivariable models which additionally adjust for drinking status (risky versus non-risky) and motivation to stop smoking (in the smoking model) or smoking status (smoker versus non-smoker), AUDIT group and motivation to cut down drinking (in the drinking model).
4) to examine whether socioeconomic position can explain any remaining variation in BI delivery, we fitted fully-adjusted models in which each of the 4 measures of socioeconomic position was added separately.

Patient and Public Involvement

Neither patients nor the public were involved in the design of this study. STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines were followed throughout [32].

RESULTS

Descriptive statistics

Demographic characteristics for the 9042 smokers and risky drinkers included in the analytic sample are presented in Table 1. This shows a relatively even spread of both smokers and risky drinkers across the life course, except for the youngest age group (18-24 year olds) which has a greater concentration of risky drinkers. Smokers are more likely to be female and more likely to live with children or have a disability than risky drinkers. The other key distinction comes in terms of motivation to cut down or quit, with 67.4% of smokers reporting some motivation to reduce their smoking compared to only 39.4% of risky drinkers.

Table 1 - Characteristics of survey respondents included in statistical models (unweighted)

		Past year smokers (n=6513)	Risky drinkers (n=3975)
Age, n (%)	18-24	1051 (16.1%)	877 (22.1%)
	25-34	1222 (18.8%)	539 (13.6%)
	35-44	1052 (16.2%)	572 (14.4%)
	45-54	1126 (17.3%)	741 (18.6%)
	55-64	1046 (16.1%)	643 (16.2%)
	65+	991 (15.2%)	595 (15%)
	Missing	25 (0.4%)	8 (0.2%)
Sex, n (%)	Male	3253 (49.9%)	2600 (65.4%)
	Female	3260 (50.1%)	1375 (34.6%)
	Missing	0 (0%)	0 (0%)
Region, n (%)	North	2540 (39%)	1974 (49.7%)
	Midlands	1730 (26.6%)	716 (18%)
	South	2234 (34.3%)	1282 (32.3%)
	Missing	9 (0.1%)	3 (0.1%)
Children in the household, n (%)	Yes	4308 (66.1%)	3030 (76.2%)
	No	2205 (33.9%)	945 (23.8%)
	Missing	0 (0%)	0 (0%)
Disability, n (%)	Yes	5121 (78.6%)	3420 (86%)
	No	1275 (19.6%)	494 (12.4%)
	Missing	117 (1.8%)	61 (1.5%)
Ethnicity, n (%)	White	5812 (89.2%)	3813 (95.9%)
	Mixed race	111 (1.7%)	59 (1.5%)
	Asian	353 (5.4%)	39 (1%)
	Black	147 (2.3%)	39 (1%)
	Arab/other	61 (0.9%)	10 (0.3%)
	Missing	29 (0.4%)	15 (0.4%)
Motivation to cut down smoking, n (%)	None	1649 (25.3%)	
	Moderate	3415 (52.4%)	
	High	978 (15%)	
	Missing	471 (7.2%)	
Risky drinker, n (%)	Yes	5004 (76.8%)	
	No	1446 (22.2%)	
	Missing	63 (1%)	
AUDIT score, n (%)	8-15		3504 (88.2%)
	16-19		251 (6.3%)
	20+		220 (5.5%)
	Missing		0 (0%)
Motivation to cut down drinking, n (%)	None		2372 (59.7%)
	Moderate		1273 (32%)
	High		296 (7.4%)
	Missing		34 (0.9%)
Past year smoker, n (%)	Yes		2528 (63.6%)
	No		1446 (36.4%)
	Missing		1 (0%)

Descriptive analyses (Table 2) show that overall, smoking was more prevalent than risky drinking (20.5% vs. 13.1% of the adult population). There were also marked socioeconomic gradients in prevalence, with smoking increasingly common in lower socioeconomic groups (e.g. 35.7% of social grade E respondents compared to 11.5% in grade AB), while the gradient in risky drinking was less stark and in the opposite direction (11.3% in grade E compared to 14.3% in grade AB). These gradients were seen most clearly for social grade, although similar patterns existed for education, but were not evident when using employment for smokers and housing tenure for drinkers. There were no clear gradients for GP attendance, although risky drinkers were more likely than smokers to have visited their GP in the past year (64.8% vs. 54.9%). Observed rates of BI receipt for those who had visited their GP (the sample used in the statistical analysis) suggest a socioeconomic gradient in BI delivery, with a greater proportion of respondents in lower SEP groups reporting that they had received a BI for both smoking and drinking. There appears, however, to be a divergence in the shape of this gradient, with BI receipt for smokers increasing linearly as SEP decreases, while the higher rates of BI receipt in risky drinkers are concentrated in the most deprived group. These patterns, for social grade, are illustrated in Figure 1.

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Table 2 - Descriptive analysis of prevalence, GP attendance and BI delivery rates for smokers and risky drinkers by socioeconomic position (weighted, 95% Confidence Intervals in brackets)

		Past year smokers			Risky drinkers		
		Prevalence in population	Who visited GP in past year	Who received BI | visited GP	Prevalence in population	Who visited GP in past year	Who received BI | visited GP
Population		20.5% (20.2 to 20.9)	54.9% (53.8 to 56)	48.3% (47.1 to 49.5)	13.1% (12.8 to 13.3)	64.8% (63.6 to 65.4)	6.1% (5.4 to 6.5)
Social grade	AB	11.5% (10.9 to 12.1)	57.7% (54.5 to 60.9)	45.8% (42.3 to 49.3)	14.3% (13.6 to 14.6)	67.6% (65.1 to 68.8)	5.4% (4 to 6.1)
	C1	17.8% (17.2 to 18.4)	55.6% (53.4 to 57.7)	47% (44.6 to 49.4)	14.3% (13.8 to 14.6)	65.5% (63.5 to 66.6)	4.8% (3.7 to 5.3)
	C2	24.2% (23.4 to 25.1)	49.7% (47.4 to 52)	45.7% (43.1 to 48.3)	13.3% (12.7 to 13.7)	60.8% (58 to 62.2)	5% (3.4 to 5.8)
	D	27.8% (26.8 to 28.8)	53.3% (50.9 to 55.8)	50.3% (47.6 to 53)	9.7% (9.1 to 10.1)	65.2% (61.7 to 67)	6.5% (4.2 to 7.6)
	E	35.7% (34.4 to 37)	62.6% (60.1 to 65.1)	53.9% (51.2 to 56.6)	11.3% (10.4 to 11.7)	61.6% (57.7 to 63.6)	18.1% (14 to 20.1)
Education	University	12.6% (12 to 13.1)	53.7% (51 to 56.3)	44.3% (41.3 to 47.3)	13.6% (13 to 13.9)	66.4% (64.2 to 67.6)	4.9% (3.7 to 5.6)
	A-level	21% (20.1 to 21.8)	53.5% (50.9 to 56)	48% (45.2 to 50.9)	18.6% (17.8 to 19)	59.7% (57.3 to 60.9)	4.7% (3.4 to 5.4)
	GCSE	26.1% (25.4 to 26.9)	54.8% (53 to 56.7)	47.5% (45.5 to 49.6)	13.1% (12.5 to 13.4)	65.1% (62.8 to 66.2)	6.6% (5.1 to 7.3)
	Other	18.3% (17.1 to 19.5)	56.8% (52.7 to 60.9)	49.3% (44.8 to 53.8)	11.4% (10.4 to 11.9)	70.3% (65.9 to 72.5)	7.9% (4.8 to 9.4)
	None	26.6% (25.6 to 27.5)	57.1% (54.7 to 59.5)	52.6% (50.1 to 55.2)	6.6% (6.1 to 6.9)	68.8% (64.9 to 70.8)	11.4% (8.2 to 13)
Employment	Full time	21.8% (21.2 to 22.5)	47.4% (45.6 to 49.3)	46.1% (43.9 to 48.3)	16.7% (16.1 to 17)	60.2% (58.4 to 61.2)	4.2% (3.2 to 4.7)
	Other	19.7% (19.3 to 20.1)	60.3% (59 to 61.7)	49.5% (48.1 to 51)	10.9% (10.6 to 11.1)	69% (67.5 to 69.8)	7.6% (6.5 to 8.1)
Housing tenure	Owner	13.6% (13.2 to 14)	56.3% (54.5 to 58)	48% (46.1 to 49.9)	12.3% (11.9 to 12.5)	67.5% (65.9 to 68.3)	5.2% (4.3 to 5.7)
	Renter	33.7% (33 to 34.4)	54.3% (52.8 to 55.7)	48.7% (47.1 to 50.2)	14.9% (14.4 to 15.2)	60.8% (58.9 to 61.7)	7.7% (6.4 to 8.4)

Unweighted sample sizes can be found in online supplementary Table S14

INSERT FIGURE 1 ABOUT HERE

Adjusted models for smoking

Results for the demographic-adjusted models for receipt of smoking BI (Table 3) show that older smokers had significantly greater odds of having received a BI than 18-24 year olds (e.g. OR 2.06 95% CI 1.68 to 2.51 for 65+ year olds). Significant effects were also seen for region, with smokers in the South having lower odds of receiving an intervention than those in the North (OR 0.81 95% CI 0.71 to 0.92) and for those with a self-reported disability having greater odds of receiving one than those without (OR 1.37 95% CI 1.19 to 1.57). There was no significant temporal trend in BI delivery.

The addition of behavioural factors to the model (see supplementary material Table S15 for full results) did not change the magnitude or significance of the demographic coefficients, but demonstrated that smokers who were also risky drinkers had lower odds of receiving a smoking BI (OR 0.84 95% CI 0.73 to 0.97) and that there was a strong association with both moderate (OR 1.42 95% CI 1.25 to 1.63) and high levels of motivation to cut down or quit smoking (OR 2.14 95% CI 1.79 to 2.57) and BI receipt. Finally, the addition of socioeconomic measures to the models showed significantly increased levels of BI receipt in social grades D and E compared to grade AB (OR 1.26 95% CI 1.02 to 1.55 and OR 1.30 95% CI 1.05 to 1.61 respectively). Significant increases in BI receipt were also observed in those with A-levels and no formal qualifications compared to university-level qualifications (OR 1.24 95% CI 1.02 to 1.51 and OR 1.24 95% CI 1.03 to 1.50 respectively), but no significant association employment status or housing tenure was identified.

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Table 3 - Logistic regression results for factors associated with likelihood of receiving Brief Intervention for smoking

		Demographic-adjusted model			Behavioural and Socioeconomic-adjusted models								
		OR		95% CI	OR		95% CI	OR		95% CI	OR		95% CI
Age	18-24	Reference											
	25-34	1.39	***	1.16 to 1.67	1.38	**	1.14 to 1.68	1.38	**	1.14 to 1.68	1.37	**	1.13 to 1.66	1.36	**	1.12 to 1.65
	35-44	1.57	***	1.30 to 1.90	1.60	***	1.31 to 1.96	1.60	***	1.31 to 1.97	1.57	***	1.28 to 1.93	1.59	***	1.30 to 1.94
	45-54	2.00	***	1.66 to 2.41	2.03	***	1.67 to 2.47	2.03	***	1.66 to 2.48	2.00	***	1.64 to 2.44	2.03	***	1.67 to 2.48
	55-64	2.19	***	1.80 to 2.66	2.30	***	1.86 to 2.83	2.26	***	1.82 to 2.79	2.23	***	1.81 to 2.75	2.31	***	1.86 to 2.86
	65+	2.06	***	1.68 to 2.51	2.22	***	1.79 to 2.75	2.14	***	1.71 to 2.67	2.11	***	1.70 to 2.62	2.23	***	1.79 to 2.78
Gender	Male	Reference											
	Female	1.01		0.91 to 1.13	0.95		0.84 to 1.07	0.97		0.86 to 1.09	0.96		0.85 to 1.08	0.96		0.86 to 1.08
Region	North	Reference											
	Midlands	0.94		0.82 to 1.08	0.93		0.81 to 1.08	0.93		0.80 to 1.07	0.93		0.81 to 1.07	0.93		0.81 to 1.07
	South	0.81	**	0.71 to 0.92	0.79	**	0.69 to 0.91	0.79	***	0.69 to 0.90	0.78	***	0.68 to 0.89	0.77	***	0.68 to 0.88
Children in the household	None	Reference											
	≥1	1.14		0.99 to 1.30	1.07		0.93 to 1.23	1.08		0.93 to 1.24	1.08		0.94 to 1.24	1.08		0.94 to 1.24
Self-reported disability	No	Reference											
	Yes	1.37	***	1.19 to 1.57	1.33	***	1.14 to 1.55	1.38	***	1.19 to 1.59	1.38	***	1.19 to 1.60	1.37	***	1.18 to 1.59
Ethnicity	White	Reference											
	Mixed race	0.92		0.60 to 1.39	0.85		0.54 to 1.34	0.87		0.56 to 1.36	0.87		0.56 to 1.35	0.86		0.55 to 1.34
	Asian	0.92		0.72 to 1.18	0.84		0.65 to 1.09	0.87		0.67 to 1.12	0.86		0.67 to 1.11	0.87		0.68 to 1.13
	Black	1.20		0.83 to 1.72	0.98		0.67 to 1.46	1.01		0.68 to 1.49	1.01		0.68 to 1.49	1.00		0.67 to 1.48
	Arab/other	0.95		0.55 to 1.63	0.94		0.52 to 1.69	0.93		0.52 to 1.68	0.93		0.52 to 1.66	0.91		0.50 to 1.63
Time trend (monthly)		1.00		0.99 to 1.01	1.00		0.99 to 1.01	1.00		1.00 to 1.01	1.00		1.00 to 1.01	1.00		0.99 to 1.01
Risky drinker (AUDIT 8+)	No												
	Yes				0.86	*	0.75 to 0.99	0.85	*	0.74 to 0.98	0.85	*	0.73 to 0.97	0.85	*	0.74 to 0.98
Motivation to cut down smoking	None												
	Moderate				1.44	***	1.26 to 1.64	1.44	***	1.26 to 1.64	1.43	***	1.25 to 1.63	1.43	***	1.25 to 1.63
	High				2.19	***	1.83 to 2.63	2.16	***	1.80 to 2.59	2.15	***	1.79 to 2.58	2.15	***	1.80 to 2.58
Social grade	AB				Reference								
	C1				1.08		0.88 to 1.32						
	C2				0.96		0.78 to 1.17						
	D				1.26	*	1.02 to 1.55						
	E				1.30	*	1.05 to 1.61						
Education	University							Reference					
	A-level							1.24	*	1.02 to 1.51			
	GCSE							1.16		0.98 to 1.38			
	Other							1.20		0.93 to 1.56			
	None							1.24	*	1.03 to 1.50			
Employment status	Full-time										Reference		
	Other										1.05		0.92 to 1.20
Housing tenure	Owned												Reference

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Rented										1.10		0.97 to 1.25
Constant	0.49	0.24 to 1.02	0.34	**	0.15 to 0.75	0.31	**	0.14 to 0.69	0.36 *	0.17 to 0.78	0.35	** 0.16 to 0.76

Adjusted models for risky drinking

Results for the demographic-adjusted logistic regression models for alcohol BIs (Table 4) showed a similar age gradient to the smoking models, with all risky drinkers aged 35+ having odds at least twice as high of having received a BI as those under 24 (e.g. OR 2.68 95% CI 1.53 to 4.71 for 65+ year olds). Unlike for smoking, there was a significant gender effect, with women having lower odds of receiving an intervention (OR 0.68 95% CI 0.49 to 0.93). There were no significant effects for region, or time, but again, disability was a significant predictor of BI receipt (OR 3.47 95% CI 2.54 to 4.74).

The addition of behavioural factors to the model (see supplementary material Table S16 for full results) substantially increased the slope of the age gradient, with the OR for over 65s compared to 18-24 year-olds increasing to 5.00 (95% CI 2.71 to 9.23). The effect of disability was reduced, although still significant (OR 2.27 95% CI 1.57 to 3.27) and we saw an additional significant effect for Arab/other ethnic groups compared to the White group (OR 8.64 95% CI 1.81 to 41.21). Of the additional explanatory factors, smoking did not significantly predict BI receipt for alcohol, but motivation to reduce drinking did, with both moderate (OR 2.85 95% CI 2.00 to 4.05) and high levels (OR 5.17 95% CI 3.29 to 8.14) significantly associated with BI receipt. Level of alcohol use was also a very strong predictor of BI receipt, with high risk drinkers having almost 3 times the odds of having received a BI (OR 2.94 95% CI 1.81 to 4.79) and potentially dependent drinkers almost 12 times the odds (OR 11.84 95% CI 7.77 to 18.04).

Adding socioeconomic factors to the model did not further change the magnitude or significance of the other coefficients, but we saw a significant increase in BI receipt for the lowest social grade (E) compared to the highest (OR 2.11 95% CI 1.27 to 3.52). There was no significant effect of education, but not being in full-time employment (OR 1.56 95% CI 1.08 to 2.25) and not being a homeowner (OR 1.55 95% CI 1.09 to 2.20) significantly increased the likelihood of receiving a BI. The effects of all four socioeconomic measures on both smoking and alcohol BI receipt are illustrated in Figure 2, highlighting the relatively larger scale of the socioeconomic gradients for alcohol compared to smoking.

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Table 4 - Logistic regression results for factors associated with likelihood of receiving Brief Intervention for risky drinking

		Demographic-adjusted model			Behavioural and Socioeconomic-adjusted models								
		OR		95% CI	OR		95% CI	OR		95% CI	OR		95% CI	OR		95% CI
Age	18-24	Reference														
	25-34	1.56		0.84 to 2.89	1.46		0.77 to 2.78	1.46		0.76 to 2.80	1.60		0.82 to 3.14	1.51		0.79 to 2.85
	35-44	2.49	**	1.39 to 4.47	2.05	*	1.09 to 3.86	2.14	*	1.13 to 4.07	2.42	**	1.26 to 4.64	2.32	**	1.23 to 4.36
	45-54	2.74	***	1.63 to 4.62	2.86	***	1.62 to 5.07	2.98	***	1.65 to 5.39	3.33	***	1.86 to 5.97	3.43	***	1.95 to 6.01
	55-64	2.26	**	1.30 to 3.93	3.23	***	1.76 to 5.92	3.20	***	1.71 to 5.99	3.24	***	1.77 to 5.93	3.93	***	2.11 to 7.33
	65+	2.68	**	1.53 to 4.71	4.94	***	2.66 to 9.15	4.74	***	2.50 to 9.02	4.41	***	2.41 to 8.08	6.11	***	3.25 to 11.5
Gender	Male	Reference														
	Female	0.68	*	0.49 to 0.93	0.62	**	0.43 to 0.89	0.65	*	0.45 to 0.92	0.60	**	0.42 to 0.85	0.64	*	0.45 to 0.91
Region	North	Reference														
	Midlands	1.21		0.84 to 1.73	1.20		0.81 to 1.77	1.18		0.80 to 1.75	1.19		0.80 to 1.77	1.20		0.81 to 1.78
	South	0.85		0.62 to 1.16	0.84		0.58 to 1.20	0.83		0.58 to 1.18	0.78		0.55 to 1.11	0.80		0.56 to 1.15
Children in the household	None	Reference														
	≥1	0.79		0.53 to 1.17	1.06		0.69 to 1.64	1.06		0.69 to 1.62	1.06		0.69 to 1.64	1.08		0.70 to 1.65
Self-reported disability	No	Reference														
	Yes	3.47	***	2.54 to 4.74	1.97	**	1.34 to 2.90	2.16	***	1.49 to 3.14	2.09	***	1.42 to 3.06	2.09	***	1.43 to 3.04
Ethnicity	White	Reference														
	Mixed race	2.20		0.73 to 6.60	2.29		0.72 to 7.32	2.14		0.68 to 6.71	2.17		0.72 to 6.52	2.09		0.71 to 6.17
	Asian	3.44		0.98 to 12.0	3.18		0.66 to 15.4	3.47		0.69 to 17.4	3.47		0.70 to 17.2	3.17		0.65 to 15.5
	Black	0.35		0.07 to 1.86	0.17		0.02 to 1.31	0.19		0.02 to 1.63	0.17		0.02 to 1.54	0.18		0.02 to 1.51
	Arab/other	4.41		0.95 to 20.4	9.58	**	1.98 to 46.4	8.29	**	1.70 to 40.4	8.02	*	1.51 to 42.5	8.78	**	1.77 to 43.5
Time trend (monthly)		1.00		0.99 to 1.02	1.00		0.98 to 1.02	1.00		0.98 to 1.02	1.00		0.98 to 1.02	1.00		0.98 to 1.02
Past year smoker	No				Reference											
	Yes				1.09		0.79 to 1.52	1.17		0.84 to 1.62	1.16		0.84 to 1.62	1.07		0.77 to 1.49
Motivation to cut down drinking	None															
	Moderate				2.94	***	2.06 to 4.20	2.91	***	2.03 to 4.17	2.85	***	2.00 to 4.06	2.93	***	2.06 to 4.18
	High				5.26	***	3.33 to 8.30	5.27	***	3.34 to 8.32	5.01	***	3.18 to 7.90	5.18	***	3.29 to 8.14
AUDIT Score	8-15															
	16-19				2.77	***	1.68 to 4.56	2.81	***	1.72 to 4.59	2.88	***	1.76 to 4.73	2.86	***	1.75 to 4.69
	20+				10.9	***	7.12 to 16.6	11.7	***	7.67 to 17.7	11.5	***	7.54 to 17.6	11.4	***	7.47 to 17.5
Social grade	AB				Reference											
	C1				0.97		0.63 to 1.49									
	C2				0.84		0.51 to 1.36									
	D				1.20		0.68 to 2.10									
	E				2.11	**	1.27 to 3.52									
Education	University							Reference								
	A-level							1.10		0.68 to 1.79						
	GCSE							1.12		0.73 to 1.71						
	Other							1.48		0.80 to 2.72						
	None							1.45		0.86 to 2.44						
Employment status	Full-time										Reference					
	Other										1.56	*	1.08 to 2.25			
Housing tenure	Owned													Reference		
	Rented													1.55	*	1.09 to 2.20

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Constant	0.04	**	0.01 to 0.27	0.01	***	0.00 to 0.08	0.01	***	0.00 to 0.07	0.01	***	0.00 to 0.07	0.01	***	0.00 to 0.06

INSERT FIGURE 2 ABOUT HERE

DISCUSSION

Our findings show that there is a socioeconomic gradient in BI delivery for both smokers and risky drinkers, with those in the lowest socioeconomic groups more likely to receive an intervention, although there is considerable uncertainty around the exact slope of this gradient. This gradient is not accounted for by differences in demographic characteristics or smoking and drinking behaviour and appears to be stronger for alcohol than for smoking. The analysis also illustrates that, despite clinical guidelines recommending BI for both smokers and risky drinkers, an individual who has attended primary care in the past year is 8 times more likely to report receiving an intervention if they are a smoker compared to a risky drinker. For both smoking and drinking there is a clear age gradient, with greater levels of BI delivery in older age groups, in spite of the fact that the highest rates of prevalence of risky drinking being in the youngest age group. Perhaps surprisingly, smokers who were also risky drinkers were less likely to have received a BI for their smoking than those who were not. The very heaviest drinkers, consuming at potentially dependent levels, are almost 12 times more likely to have received an alcohol intervention than those drinking at lower, but still risky, levels. These findings were robust to alternative data assumptions (see supplementary material).

Our study represents, to the best of our knowledge, the first detailed exploration of the potential of BIs for both smoking and alcohol to reduce, or increase, inequalities in health. We used data from a large, nationally representative survey and our findings are based on patients' own reporting of having received an intervention. Whilst such a measure may be subject to recall bias, it likely provides a better indicator of patient experience than routine data recorded by practitioners [33] and is not subject to known biases in practitioner recording [34]. We explored multiple measures of socioeconomic position, finding similar results across all measures, although the effect of increased BI delivery appears more closely associated with low social grade than low levels of education.

There are several important limitations to our study which should be considered alongside our findings. Firstly, our definition of what constitutes a BI is fairly broad, including anyone who reported receiving advice from a primary care practitioner and that there may be unobserved inequalities in the extent to which different groups receive different intensities of intervention or in the quality of content or delivery of the BI. Secondly, patient characteristics, including drinking/smoking status and motivation to cut down or quit, are recorded after the BI has taken place. As a result, we cannot establish whether the strong association between motivation and likelihood of BI receipt is a function of treatment-seeking behaviour in patients who are already motivated to reduce their smoking or drinking, of motivation increasing after receipt of a BI, or of more motivated patients being more likely to recall having received an intervention. Finally, whilst smoking rates in the Toolkit data are very similar to those reported in other national surveys [35], the observed prevalence of risky drinking of 13.1% is substantially lower than other estimates (e.g. 19.7% in the 2014 Adult Psychiatric Morbidity Survey [36]), although it is unclear what effect, if any, this may have on the study results.

Two, much smaller, UK studies conducted in 1996 looked at the relationship between occupation and rates of alcohol BI receipt in risky drinkers, finding no clear socioeconomic gradient [37,38]. Another, Finnish study also found no significant association [39], perhaps suggesting that socioeconomic gradients in BI delivery may not be consistent across different contexts. Previous studies have found similar disparities to those we find between delivery rates of BI for smoking and risky drinking [17,40], as well as similarly higher levels of BI receipt among primary care patients at older ages [41], with greater motivation to quit or cut down [42] and for risky drinkers with higher AUDIT scores [43]. Numerous explanations for the relatively low rate of BI delivery for risky drinking have been suggested, including a lack of training and resources and the attitudes and beliefs of both practitioners and patients [44–46].

It is not clear why BI delivery appeared highest in lower socioeconomic groups after adjustment for a range of socio-demographic, drinking and smoking characteristics. Presenting with a chronic disease – likely related to smoking or alcohol – is associated with receipt of brief intervention [17]. The underlying reason for the GP visit was not recorded in the current study but it is possible that smoking or alcohol-related illness is more likely to present in low compared with high SEP smokers or risky drinkers respectively [47].

Our analysis focuses on the receipt of Brief Interventions for patients who reported attending Primary Care in the past year. There are likely to be additional socioeconomic gradients in terms of access to, use of and quality of Primary Care services which will moderate any overall impact of BIs on health inequalities [48–51]. We should also consider the potential for differential effectiveness of the intervention across socioeconomic groups. If BIs are more effective at changing the behaviour of those in higher SEP groups then this may mitigate any potential inequality-reducing effects. There is little evidence to support the existence of such a gradient in effectiveness for alcohol [52], although there is some suggestion that this may be in part because lower SEP groups are more likely to drop out of BI trials [53]. For smoking, a recent study does suggest there may be some degree of inequality in longer term outcomes for smoking cessation interventions [54]. A holistic view of the full impact of SBI programmes should consider the impact of these potential SEP gradients, which may attenuate the positive gradients identified in the present study, alongside existing negative gradients in alcohol- and tobacco-related harm. Such is the severity of these gradients in harm, with those in the lowest SEP groups experiencing rates of harm several times greater than those in the highest groups even after adjusting for drinking and smoking behaviour [8,55], that an intervention could have a negative SEP gradient in terms of its effects on alcohol consumption and/or smoking, while still reducing overall inequalities. Further research in this area is urgently needed to understand the full impact that BI programmes may be having on socioeconomic inequalities. This need is particularly acute given NHS England's recent decision to incentivise secondary care providers to deliver large scale Brief Intervention programmes for both smoking and risky drinking under the latest Commissioning for Quality and Innovation (CQUIN) scheme. Although similar gradients in the prevalence of both smoking and risky drinking as well as associated harm have been observed in many countries [56,57], primary care systems can vary widely and it is therefore unclear how generalisable our findings are beyond England. Future research into this area, particularly in Low and Middle Income Countries, could help design SBI programmes to maximise their potential to reduce inequalities in health.

These findings provide the first evidence that Brief Intervention programmes may help reduce inequalities in smoking- and alcohol-related health although better evidence is needed on the extent to which conflicting socioeconomic gradients in delivery and, potentially, intervention effectiveness interact with existing gradients in health. There is considerable scope for the potential effect on inequalities to be increased if intervention rates can be raised, particularly for drinking.

Author Contributions

CA conceived of and designed the study with input from JB, EB, DG, PB, EK, SM & PM. CA performed the analysis and wrote the first draft of the paper. All authors commented on this and subsequent versions and read and approved the final manuscript.

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Disclaimer

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Declaration of Interests

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Ethics approval

Ethical approval for the Smoking Toolkit Study (STS) was originally granted by the UCL Ethics Committee (ID 0498/001). Approval for the ATS was granted by the same committee as an extension of the STS. The data were collected by Ipsos Mori and anonymised when received by study authors. Explicit verbal agreement and willingness to answer questions voluntarily were recorded electronically by Ipsos Mori. Participants were also given a printed information sheet. This standard was agreed by the UCL ethics committee.

Data sharing statement

The dataset analysed during the current study are available from the corresponding author on reasonable request.

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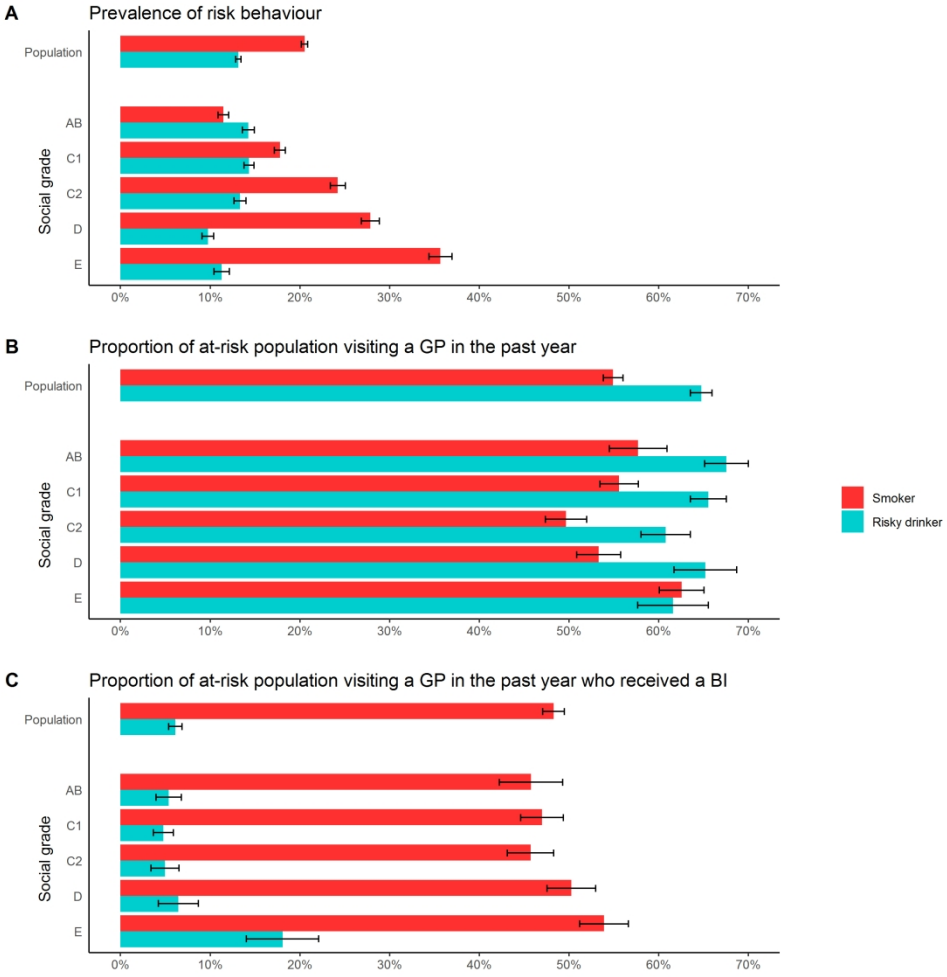
FIGURE LEGENDS

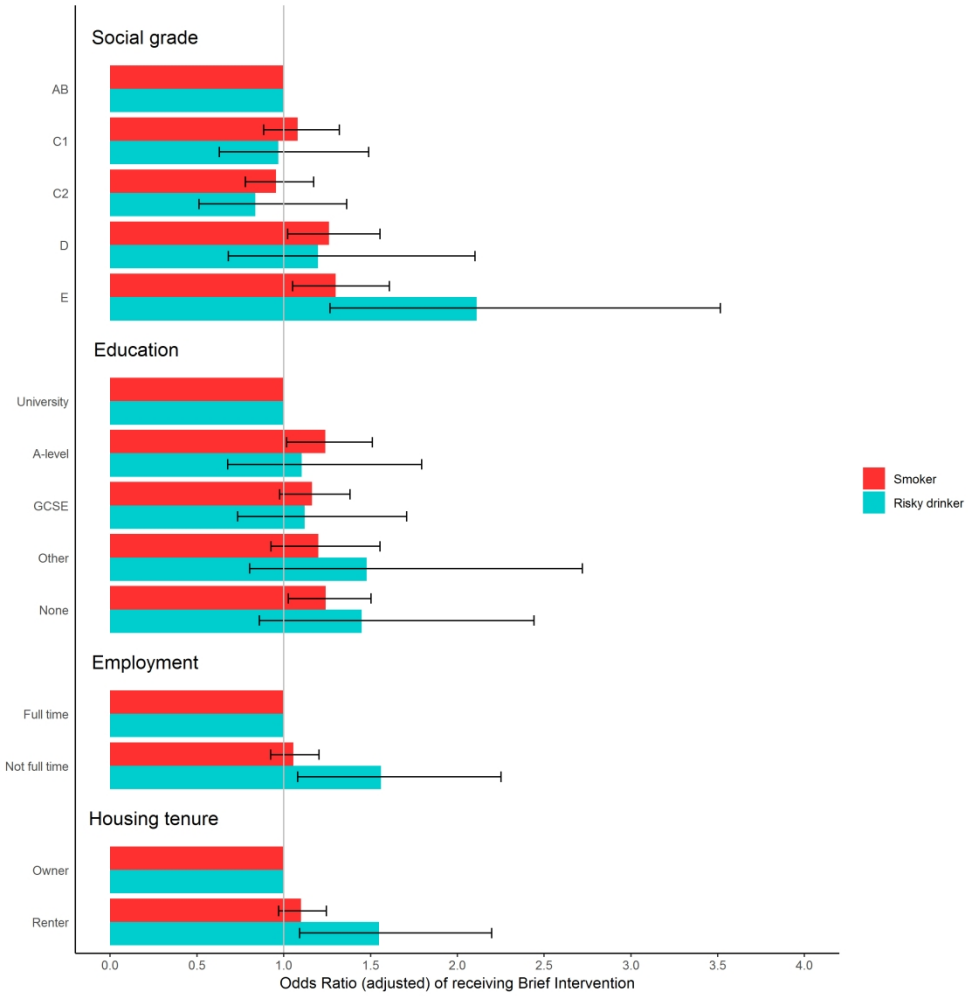
Figure 1 - Unadjusted socioeconomic gradients in prevalence, GP attendance and BI receipt for smokers and risky drinkers

Figure 2 - Independent, fully-adjusted, association of socioeconomic position with Odds Ratio of receiving a Brief Intervention for smoking or risky drinking



Unadjusted socioeconomic gradients in prevalence, GP attendance and BI receipt for smokers and risky drinkers

254x254mm (300 x 300 DPI)



Independent, fully-adjusted, association of socioeconomic position with Odds Ratio of receiving a Brief Intervention for smoking or risky drinking

254x254mm (300 x 300 DPI)

Reporting checklist for cross sectional study.

Based on the STROBE cross sectional guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

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von Elm E, Altman DG, Egger M, Pocock SJ, Gotzsche PC, Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for reporting observational studies.

		Reporting Item	Page Number
Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	1
Abstract	#1b	Provide in the abstract an informative and balanced summary of what was done and what was found	2
Background / rationale	#2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	#3	State specific objectives, including any prespecified hypotheses	3
Study design	#4	Present key elements of study design early in the paper	3
Setting	#5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	3

Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants.	3
	#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	3-4
Data sources / measurement	#8	For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give information separately for for exposed and unexposed groups if applicable.	4
Bias	#9	Describe any efforts to address potential sources of bias	4
Study size	#10	Explain how the study size was arrived at	6
Quantitative variables	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	3-4
Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	4-5
	#12b	Describe any methods used to examine subgroups and interactions	n/a
	#12c	Explain how missing data were addressed	4
	#12d	If applicable, describe analytical methods taking account of sampling strategy	4
	#12e	Describe any sensitivity analyses	4
Participants	#13a	Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give information separately for for exposed and unexposed groups if applicable.	6
	#13b	Give reasons for non-participation at each stage	n/a
	#13c	Consider use of a flow diagram	n/a

Descriptive data	#14a	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.	6
	#14b	Indicate number of participants with missing data for each variable of interest	4
Outcome data	#15	Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable.	6
Main results	#16a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	7, 9, 12
	#16b	Report category boundaries when continuous variables were categorized	5
	#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	14
Key results	#18	Summarise key results with reference to study objectives	14
Limitations	#19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	14
Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	14-15
Generalisability	#21	Discuss the generalisability (external validity) of the study results	14-15
Funding	#22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	15

BMJ Open

Socioeconomic inequalities in the delivery of Brief Interventions for smoking and excessive drinking: Findings from a cross-sectional household survey in England

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Socioeconomic inequalities in the delivery of Brief Interventions for smoking and excessive drinking: Findings from a cross-sectional household survey in England

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ABSTRACT

Objectives

Brief Interventions [BI] for smoking and risky drinking are effective and cost-effective policy approaches to reducing alcohol harm currently used in primary care in England, however little is known about their contribution to health inequalities. This paper aims to investigate whether self-reported receipt of BI is associated with socioeconomic position and whether this differs for smoking or alcohol.

Design

Population survey of 8,978 smokers or risky drinkers in England aged 16+ taking part in the Alcohol and Smoking Toolkit Studies

Measures

Survey participants answered questions regarding whether they had received advice and support to cut down their drinking or smoking from a primary healthcare professional in the past 12 months as well as their socioeconomic position, demographic details, whether they smoke and their motivation to cut down their smoking and/or drinking. Respondents also completed the Alcohol Use Disorders Identification Test (AUDIT). Smokers were defined as those reporting any smoking in the past year. Risky drinkers were defined as those scoring 8 or more on the AUDIT.

Results

After adjusting for demographic factors and patterns in smoking and drinking, BI delivery was highest in lower socioeconomic groups. Smokers in the lowest social grade had 30% (95% CI 5% to 61%) greater odds of reporting receipt of a BI than those in the highest grade. The relationship for risky drinking appeared stronger, with those in the lowest social grade having 111% (95% CI 27% to 252%) greater odds of reporting BI receipt than the highest grade. Rates of BI delivery were 8 times greater among smokers than risky drinkers (48.3% vs 6.1%).

Conclusions

Current delivery of Brief Interventions for smoking and drinking in primary care in England may be contributing to a reduction in socioeconomic inequalities in health. This effect could be increased if intervention rates, particularly for drinking, were raised.

ARTICLE SUMMARY

Strengths and limitations of this study

- Used data from a large representative sample of adult smokers and drinkers in England
- Based on data on intervention receipt reported by patients, rather than practitioners
- Analysis controls for a broad range of potential confounding demographic factors
- Respondents may have underestimated or misreported their drinking or smoking
- There may be additional socioeconomic gradients in intervention effectiveness which could moderate the overall impact of Brief Interventions on health inequalities

INTRODUCTION

Tobacco smoking and the excessive consumption of alcohol are leading causes of preventable disease both in the UK and worldwide[1] and inequalities in both alcohol and tobacco-related health harms are a significant contributor to wider inequalities in health [2,3]. Underlying these inequalities are conflicting socioeconomic patterns in the behaviours themselves. Smoking prevalence and related harm both increase with deprivation [4], while for alcohol consumption the picture is more complex. Those in more deprived groups are more likely to abstain from drinking, and those who drink are more likely to drink within UK drinking guidelines compared to less deprived groups [5], while those in more deprived groups who drink heavily drink more on average than heavy drinkers in less deprived groups [6]. This, in part, has meant that numerous studies have found alcohol consumption to be lower in more deprived groups even though they suffer greater levels of alcohol-related harm [2,7,8], a phenomenon referred to as the 'Alcohol Harm Paradox'[7,9].

Screening and Brief Interventions, consisting of an initial case finding or screening step followed by delivery of feedback and structured advice or behaviour change counselling, delivered in primary care, is an effective and cost-effective measure to increase smoking cessation rates[10,11] and reduce harmful drinking [12,13]. Current UK clinical guidelines recommend that all patients are assessed for smoking annually, with a Brief Intervention (BI) delivered to all smokers [14]. Guidance for alcohol encourages the use of opportunistic screening and BI alongside requirements to screen all patients registering with a new primary care provider or attending a Health Check [15,16]. In spite of this guidance, BI delivery levels remain low in England [17], particularly for alcohol [18], a finding that has been replicated in many other countries [19–21].

Research across a broad range of interventions and settings has found that public health policies, including screening programmes in primary care, may exacerbate inequalities in health even while improving population health overall [22,23]. In this context it is striking that very little research to date has considered the potential for BI programmes for tobacco or alcohol to affect inequalities, particularly given the high socioeconomic variation in poor health due to both behaviours. We aimed to address this gap by examining whether there are sociodemographic gradients in BI delivery for smoking and drinking and whether these can be explained by sociodemographic or behavioural characteristics of patients attending primary care in England.

METHODS

Data Sources

The Alcohol and Smoking Toolkit Studies are large, nationally representative, monthly surveys of adults aged 16+ in England [24,25]. A sample of approximately 1,700 respondents each month participate in household computer-assisted interviews. The survey uses a form of random location sampling, representing a hybrid between random probability and simple quota sampling (see published protocols for further details [24,25]). We used data collected between March 2014 and July 2016 (N=48,808) with analysis restricted to respondents who reported visiting the General Practitioner (GP) in the past 12 months and were either smokers (those reporting that they had smoked cigarettes or other tobacco products at least occasionally in the past year – see supplementary file for full details) or risky drinkers (those scoring at least eight on the Alcohol Use Disorders Identification Test (AUDIT) [26]). This gave a total sample of 9,042 adults of whom 5,004 were smokers only, 2,528 were risky drinkers only, and 1,446 were both (data on the smoking status of one risky drinker and the drinking status of 63 smokers were missing).

Measures

Our primary outcome measure was self-reported receipt of a BI (or more intensive intervention) from a GP or other primary care-based health worker in the past year. Respondents who smoked were asked 'Has your GP spoken to you about smoking in the past year?' and BI receipt was categorised as a response of at least 'Yes, he/she advised me to stop but did not offer anything'. Risky drinkers were asked 'In the last 12 months has a doctor or other health worker within your GP surgery discussed your drinking?', with BI receipt categorised as a response of at least 'Yes, a doctor or other health worker within my GP surgery offered advice about cutting down my drinking'. Note that this definition includes referral to specialist treatment as recommended for those with potential alcohol dependence. See supplementary file for a full list of response options.

Data was also collected on respondents' age, gender, region of England (categorised as North, Midlands or South), the number of children in the household (categorised as 0 or 1+), self-reported disability status (disability/no disability) and ethnicity (white, mixed/multiple ethnic group, Asian or British Asian, black, other). Self-reported motivation to reduce smoking and drinking was recorded and grouped into those responding 'I don't want to stop smoking/cut down on drinking', those reporting some degree of motivation to quit/cut down, and those who were highly motivated and willing to specify a time frame for cutting down – 'I really want to stop smoking and intend to in the next month/3 months').

As previous studies have identified that different measures of socioeconomic position (SEP) demonstrate different relationships with alcohol consumption [6,9], we examined four alternative measures SEP:
1) Social grade, classified Using the British National Readership Survey Social-Grade Classification Tool [27]: A: higher managerial, administrative or professional; B: intermediate managerial, administrative or professional; C1: supervisory or clerical and junior managerial administrative or professional; C2: skilled manual workers; D: Semi and unskilled manual workers; E: Causal or lowest grade workers, pensioners and others who depend on the welfare state for their income.
2) Educational level, grouped as: University education, A-level and equivalent, GCSE/vocational, other/still studying, none
3) Working status, categorised as being in full-time employment or otherwise
4) Housing tenure, categorised as owner occupied (owned outright or being brought with a mortgage) or otherwise
Finally, in order to test whether higher levels of alcohol consumption increase the likelihood of receiving a BI, the risky drinker group were further subdivided according to their AUDIT score in line with World Health Organization guidelines [26]:
8-15 - Risky drinker
16-19 – High risk drinkers
20+ - Possible alcohol dependence

Analysis

Data were weighted using an iterative 'rim weighting' technique as used in previous analyses of Smoking and Alcohol Toolkit data (e.g. [18]). Parallel analysis using unweighted data is reported in the supplementary file (Tables S1-S7 & Figure S1). Missing data were imputed using Multiple Imputation with 20 datasets [28] and analytical results combined using Rubin's Rules [29]. Complete case only analyses are reported in the supplementary material (Tables S8-S13 & Figure S2). All

imputation and analyses were undertaken using Stata 12 [30] following a plan pre-registered with the Open Science Framework prior to any data analysis (https://osf.io/5eq4h/). As the only continuous variable in the analysis, age was standardised and tested for non-linearity using the Box-Tidwell approach [31]. This suggested significant non-linearity and age was therefore categorised into six groups (18-24, 25-34, 35-44, 45-54, 55-64 and 65+).

The analysis consisted of four steps:
1) we produced descriptive tables the full dataset showing rates of smoking and risky drinking (all respondents scoring AUDIT 8+) in the population and rates of GP attendance and BI receipt for those who visited their GP for both smokers and risky drinkers, stratified by the 4 socioeconomic measures to show the extent to which socioeconomic inequalities exist before adjusting for demographic and other factors.
2) to examine the extent to which variation in BI delivery among those at risk and attending primary care in the past year can be explained by demographic characteristics alone, we fitted two multivariable logistic regression models in which receipt of a smoking or alcohol intervention was regressed on age, gender, region, number of children in the household, disability status and ethnicity. These models also include a linear (monthly) temporal trend to assess whether BI rates have increased or decreased over the data collection period.
3) to examine the extent to which drinking and smoking behaviour, and motivations to cut down can explain additional variation in BI delivery, we fitted two further multivariable models which additionally adjust for drinking status (risky versus non-risky) and motivation to stop smoking (in the smoking model) or smoking status (smoker versus non-smoker), AUDIT group and motivation to cut down drinking (in the drinking model).
4) to examine whether socioeconomic position can explain any remaining variation in BI delivery, we fitted fully-adjusted models in which each of the 4 measures of socioeconomic position was added separately.

Patient and Public Involvement

Neither patients nor the public were involved in the design of this study. STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines were followed throughout [32].

RESULTS

Descriptive statistics

Demographic characteristics for the 9,042 smokers and risky drinkers included in the analytic sample are presented in Table 1. This shows a relatively even spread of both smokers and risky drinkers across the life course, except for the youngest age group (18-24 year olds) which has a greater concentration of risky drinkers. Smokers are more likely to be female and more likely to live with children or have a disability than risky drinkers. The other key distinction comes in terms of motivation to cut down or quit, with 67.4% of smokers reporting some motivation to reduce their smoking compared to only 39.4% of risky drinkers.

Table 1 - Characteristics of survey respondents included in statistical models (unweighted)

		Past year smokers (n=6513)	Risky drinkers (n=3975)
Age, n (%)	18-24	1051 (16.1%)	877 (22.1%)
	25-34	1222 (18.8%)	539 (13.6%)
	35-44	1052 (16.2%)	572 (14.4%)
	45-54	1126 (17.3%)	741 (18.6%)
	55-64	1046 (16.1%)	643 (16.2%)
	65+	991 (15.2%)	595 (15%)
	Missing	25 (0.4%)	8 (0.2%)
Sex, n (%)	Male	3253 (49.9%)	2600 (65.4%)
	Female	3260 (50.1%)	1375 (34.6%)
	Missing	0 (0%)	0 (0%)
Region, n (%)	North	2540 (39%)	1974 (49.7%)
	Midlands	1730 (26.6%)	716 (18%)
	South	2234 (34.3%)	1282 (32.3%)
	Missing	9 (0.1%)	3 (0.1%)
Children in the household, n (%)	Yes	4308 (66.1%)	3030 (76.2%)
	No	2205 (33.9%)	945 (23.8%)
	Missing	0 (0%)	0 (0%)
Disability, n (%)	Yes	5121 (78.6%)	3420 (86%)
	No	1275 (19.6%)	494 (12.4%)
	Missing	117 (1.8%)	61 (1.5%)
Ethnicity, n (%)	White	5812 (89.2%)	3813 (95.9%)
	Mixed race	111 (1.7%)	59 (1.5%)
	Asian	353 (5.4%)	39 (1%)
	Black	147 (2.3%)	39 (1%)
	Arab/other	61 (0.9%)	10 (0.3%)
	Missing	29 (0.4%)	15 (0.4%)
Motivation to cut down smoking, n (%)	None	1649 (25.3%)	
	Moderate	3415 (52.4%)	
	High	978 (15%)	
	Missing	471 (7.2%)	
Risky drinker, n (%)	Yes	5004 (76.8%)	
	No	1446 (22.2%)	
	Missing	63 (1%)	
AUDIT score, n (%)	8-15		3504 (88.2%)
	16-19		251 (6.3%)
	20+		220 (5.5%)
	Missing		0 (0%)
Motivation to cut down drinking, n (%)	None		2372 (59.7%)
	Moderate		1273 (32%)
	High		296 (7.4%)
	Missing		34 (0.9%)
Past year smoker, n (%)	Yes		2528 (63.6%)
	No		1446 (36.4%)
	Missing		1 (0%)

Descriptive analyses (Table 2) show that overall, smoking was more prevalent than risky drinking (20.5% vs. 13.1% of the adult population). There were also marked socioeconomic gradients in prevalence, with smoking increasingly common in lower socioeconomic groups (e.g. 35.7% of social grade E respondents compared to 11.5% in grade AB), while the gradient in risky drinking was less stark and in the opposite direction (11.3% in grade E compared to 14.3% in grade AB). These gradients were seen most clearly for social grade, although similar patterns existed for education, but were not evident when using employment for smokers and housing tenure for drinkers. There were no clear gradients for GP attendance, although risky drinkers were more likely than smokers to have visited their GP in the past year (64.8% vs. 54.9%). Observed rates of BI receipt for those who had visited their GP (the sample used in the statistical analysis) suggest a socioeconomic gradient in BI delivery, with a greater proportion of respondents in lower SEP groups reporting that they had received a BI for both smoking and drinking. There appears, however, to be a divergence in the shape of this gradient, with BI receipt for smokers increasing linearly as SEP decreases, while the higher rates of BI receipt in risky drinkers are concentrated in the most deprived group. These patterns, for social grade, are illustrated in Figure 1.

Table 2 - Descriptive analysis of prevalence, GP attendance and BI delivery rates for smokers and risky drinkers by socioeconomic position (weighted, 95% Confidence Intervals in brackets)

		Past year smokers			Risky drinkers		
		Prevalence in population	Who visited GP in past year	Who received BI | visited GP	Prevalence in population	Who visited GP in past year	Who received BI | visited GP
Population		20.5% (20.2 to 20.9)	54.9% (53.8 to 56)	48.3% (47.1 to 49.5)	13.1% (12.8 to 13.3)	64.8% (63.6 to 65.4)	6.1% (5.4 to 6.5)
Social grade	AB	11.5% (10.9 to 12.1)	57.7% (54.5 to 60.9)	45.8% (42.3 to 49.3)	14.3% (13.6 to 14.6)	67.6% (65.1 to 68.8)	5.4% (4 to 6.1)
	C1	17.8% (17.2 to 18.4)	55.6% (53.4 to 57.7)	47% (44.6 to 49.4)	14.3% (13.8 to 14.6)	65.5% (63.5 to 66.6)	4.8% (3.7 to 5.3)
	C2	24.2% (23.4 to 25.1)	49.7% (47.4 to 52)	45.7% (43.1 to 48.3)	13.3% (12.7 to 13.7)	60.8% (58 to 62.2)	5% (3.4 to 5.8)
	D	27.8% (26.8 to 28.8)	53.3% (50.9 to 55.8)	50.3% (47.6 to 53)	9.7% (9.1 to 10.1)	65.2% (61.7 to 67)	6.5% (4.2 to 7.6)
	E	35.7% (34.4 to 37)	62.6% (60.1 to 65.1)	53.9% (51.2 to 56.6)	11.3% (10.4 to 11.7)	61.6% (57.7 to 63.6)	18.1% (14 to 20.1)
Education	University	12.6% (12 to 13.1)	53.7% (51 to 56.3)	44.3% (41.3 to 47.3)	13.6% (13 to 13.9)	66.4% (64.2 to 67.6)	4.9% (3.7 to 5.6)
	A-level	21% (20.1 to 21.8)	53.5% (50.9 to 56)	48% (45.2 to 50.9)	18.6% (17.8 to 19)	59.7% (57.3 to 60.9)	4.7% (3.4 to 5.4)
	GCSE	26.1% (25.4 to 26.9)	54.8% (53 to 56.7)	47.5% (45.5 to 49.6)	13.1% (12.5 to 13.4)	65.1% (62.8 to 66.2)	6.6% (5.1 to 7.3)
	Other	18.3% (17.1 to 19.5)	56.8% (52.7 to 60.9)	49.3% (44.8 to 53.8)	11.4% (10.4 to 11.9)	70.3% (65.9 to 72.5)	7.9% (4.8 to 9.4)
	None	26.6% (25.6 to 27.5)	57.1% (54.7 to 59.5)	52.6% (50.1 to 55.2)	6.6% (6.1 to 6.9)	68.8% (64.9 to 70.8)	11.4% (8.2 to 13)
Employment	Full time	21.8% (21.2 to 22.5)	47.4% (45.6 to 49.3)	46.1% (43.9 to 48.3)	16.7% (16.1 to 17)	60.2% (58.4 to 61.2)	4.2% (3.2 to 4.7)
	Other	19.7% (19.3 to 20.1)	60.3% (59 to 61.7)	49.5% (48.1 to 51)	10.9% (10.6 to 11.1)	69% (67.5 to 69.8)	7.6% (6.5 to 8.1)
Housing tenure	Owner	13.6% (13.2 to 14)	56.3% (54.5 to 58)	48% (46.1 to 49.9)	12.3% (11.9 to 12.5)	67.5% (65.9 to 68.3)	5.2% (4.3 to 5.7)
	Renter	33.7% (33 to 34.4)	54.3% (52.8 to 55.7)	48.7% (47.1 to 50.2)	14.9% (14.4 to 15.2)	60.8% (58.9 to 61.7)	7.7% (6.4 to 8.4)

Unweighted sample sizes can be found in online supplementary Table S14

INSERT FIGURE 1 ABOUT HERE

Adjusted models for smoking

Results for the demographic-adjusted models for receipt of smoking BI (Table 3) show that older smokers had significantly greater odds of having received a BI than 18-24 year olds (e.g. OR 2.06 95% CI 1.68 to 2.51 for 65+ year olds). Significant effects were also seen for region, with smokers in the South having lower odds of receiving an intervention than those in the North (OR 0.81 95% CI 0.71 to 0.92) and for those with a self-reported disability having greater odds of receiving one than those without (OR 1.37 95% CI 1.19 to 1.57). There was no significant temporal trend in BI delivery.

The addition of behavioural factors to the model (see supplementary material Table S15 for full results) did not change the magnitude or significance of the demographic coefficients, but demonstrated that smokers who were also risky drinkers had lower odds of receiving a smoking BI (OR 0.84 95% CI 0.73 to 0.97) and that there was a strong association with both moderate (OR 1.42 95% CI 1.25 to 1.63) and high levels of motivation to cut down or quit smoking (OR 2.14 95% CI 1.79 to 2.57) and BI receipt. Finally, the addition of socioeconomic measures to the models showed significantly increased levels of BI receipt in social grades D and E compared to grade AB (OR 1.26 95% CI 1.02 to 1.55 and OR 1.30 95% CI 1.05 to 1.61 respectively). Significant increases in BI receipt were also observed in those with A-levels and no formal qualifications compared to university-level qualifications (OR 1.24 95% CI 1.02 to 1.51 and OR 1.24 95% CI 1.03 to 1.50 respectively), but no significant association employment status or housing tenure was identified.

Table 3 - Logistic regression results for factors associated with likelihood of receiving Brief Intervention for smoking

		Demographic-adjusted model			Behavioural and Socioeconomic-adjusted models											
		OR		95% CI	OR		95% CI	OR		95% CI	OR		95% CI	OR		95% CI
Age	18-24	Reference														
	25-34	1.39	***	1.16 to 1.67	1.38	**	1.14 to 1.68	1.38	**	1.14 to 1.68	1.37	**	1.13 to 1.66	1.36	**	1.12 to 1.65
	35-44	1.57	***	1.30 to 1.90	1.60	***	1.31 to 1.96	1.60	***	1.31 to 1.97	1.57	***	1.28 to 1.93	1.59	***	1.30 to 1.94
	45-54	2.00	***	1.66 to 2.41	2.03	***	1.67 to 2.47	2.03	***	1.66 to 2.48	2.00	***	1.64 to 2.44	2.03	***	1.67 to 2.48
	55-64	2.19	***	1.80 to 2.66	2.30	***	1.86 to 2.83	2.26	***	1.82 to 2.79	2.23	***	1.81 to 2.75	2.31	***	1.86 to 2.86
	65+	2.06	***	1.68 to 2.51	2.22	***	1.79 to 2.75	2.14	***	1.71 to 2.67	2.11	***	1.70 to 2.62	2.23	***	1.79 to 2.78
Gender	Male	Reference														
	Female	1.01		0.91 to 1.13	0.95		0.84 to 1.07	0.97		0.86 to 1.09	0.96		0.85 to 1.08	0.96		0.86 to 1.08
Region	North	Reference														
	Midlands	0.94		0.82 to 1.08	0.93		0.81 to 1.08	0.93		0.80 to 1.07	0.93		0.81 to 1.07	0.93		0.81 to 1.07
	South	0.81	**	0.71 to 0.92	0.79	**	0.69 to 0.91	0.79	***	0.69 to 0.90	0.78	***	0.68 to 0.89	0.77	***	0.68 to 0.88
Children in the household	None	Reference														
	≥1	1.14		0.99 to 1.30	1.07		0.93 to 1.23	1.08		0.93 to 1.24	1.08		0.94 to 1.24	1.08		0.94 to 1.24
Self-reported disability	No	Reference														
	Yes	1.37	***	1.19 to 1.57	1.33	***	1.14 to 1.55	1.38	***	1.19 to 1.59	1.38	***	1.19 to 1.60	1.37	***	1.18 to 1.59
Ethnicity	White	Reference														
	Mixed race	0.92		0.60 to 1.39	0.85		0.54 to 1.34	0.87		0.56 to 1.36	0.87		0.56 to 1.35	0.86		0.55 to 1.34
	Asian	0.92		0.72 to 1.18	0.84		0.65 to 1.09	0.87		0.67 to 1.12	0.86		0.67 to 1.11	0.87		0.68 to 1.13
	Black	1.20		0.83 to 1.72	0.98		0.67 to 1.46	1.01		0.68 to 1.49	1.01		0.68 to 1.49	1.00		0.67 to 1.48
	Arab/other	0.95		0.55 to 1.63	0.94		0.52 to 1.69	0.93		0.52 to 1.68	0.93		0.52 to 1.66	0.91		0.50 to 1.63
Time trend (monthly)		1.00		0.99 to 1.01	1.00		0.99 to 1.01	1.00		1.00 to 1.01	1.00		1.00 to 1.01	1.00		0.99 to 1.01
Risky drinker (AUDIT 8+)	No															
	Yes				0.86	*	0.75 to 0.99	0.85	*	0.74 to 0.98	0.85	*	0.73 to 0.97	0.85	*	0.74 to 0.98
Motivation to cut down smoking	None															
	Moderate				1.44	***	1.26 to 1.64	1.44	***	1.26 to 1.64	1.43	***	1.25 to 1.63	1.43	***	1.25 to 1.63
	High				2.19	***	1.83 to 2.63	2.16	***	1.80 to 2.59	2.15	***	1.79 to 2.58	2.15	***	1.80 to 2.58
Social grade	AB				Reference											
	C1				1.08		0.88 to 1.32									
	C2				0.96		0.78 to 1.17									
	D				1.26	*	1.02 to 1.55									
	E				1.30	*	1.05 to 1.61									
Education	University							Reference								
	A-level							1.24	*	1.02 to 1.51						
	GCSE							1.16		0.98 to 1.38						
	Other							1.20		0.93 to 1.56						
	None							1.24	*	1.03 to 1.50						
Employment status	Full-time										Reference					
	Other										1.05		0.92 to 1.20			
Housing tenure	Owned													Reference		

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Rented										1.10		0.97 to 1.25
Constant	0.49	0.24 to 1.02	0.34	**	0.15 to 0.75	0.31	**	0.14 to 0.69	0.36 *	0.17 to 0.78	0.35	** 0.16 to 0.76

Adjusted models for risky drinking

Results for the demographic-adjusted logistic regression models for alcohol BIs (Table 4) showed a similar age gradient to the smoking models, with all risky drinkers aged 35+ having odds at least twice as high of having received a BI as those under 24 (e.g. OR 2.68 95% CI 1.53 to 4.71 for 65+ year olds). Unlike for smoking, there was a significant gender effect, with women having lower odds of receiving an intervention (OR 0.68 95% CI 0.49 to 0.93). There were no significant effects for region, or time, but again, disability was a significant predictor of BI receipt (OR 3.47 95% CI 2.54 to 4.74).

The addition of behavioural factors to the model (see supplementary material Table S16 for full results) substantially increased the slope of the age gradient, with the OR for over 65s compared to 18-24 year-olds increasing to 5.00 (95% CI 2.71 to 9.23). The effect of disability was reduced, although still significant (OR 2.27 95% CI 1.57 to 3.27) and we saw an additional significant effect for Arab/other ethnic groups compared to the White group (OR 8.64 95% CI 1.81 to 41.21). Of the additional explanatory factors, smoking did not significantly predict BI receipt for alcohol, but motivation to reduce drinking did, with both moderate (OR 2.85 95% CI 2.00 to 4.05) and high levels (OR 5.17 95% CI 3.29 to 8.14) significantly associated with BI receipt. Level of alcohol use was also a very strong predictor of BI receipt, with high risk drinkers having almost 3 times the odds of having received a BI (OR 2.94 95% CI 1.81 to 4.79) and potentially dependent drinkers almost 12 times the odds (OR 11.84 95% CI 7.77 to 18.04).

Adding socioeconomic factors to the model did not further change the magnitude or significance of the other coefficients, but we saw a significant increase in BI receipt for the lowest social grade (E) compared to the highest (OR 2.11 95% CI 1.27 to 3.52). There was no significant effect of education, but not being in full-time employment (OR 1.56 95% CI 1.08 to 2.25) and not being a homeowner (OR 1.55 95% CI 1.09 to 2.20) significantly increased the likelihood of receiving a BI. The effects of all four socioeconomic measures on both smoking and alcohol BI receipt are illustrated in Figure 2, highlighting the relatively larger scale of the socioeconomic gradients for alcohol compared to smoking.

Table 4 - Logistic regression results for factors associated with likelihood of receiving Brief Intervention for risky drinking

		Demographic-adjusted model		Behavioural and Socioeconomic-adjusted models							
		OR	95% CI	OR		95% CI	OR		95% CI	OR		95% CI	OR		95% CI
Age	18-24	Reference													
	25-34	1.56	0.84 to 2.89	1.46		0.77 to 2.78	1.46		0.76 to 2.80	1.60		0.82 to 3.14	1.51		0.79 to 2.85
	35-44	2.49	** 1.39 to 4.47	2.05	*	1.09 to 3.86	2.14	*	1.13 to 4.07	2.42	**	1.26 to 4.64	2.32	**	1.23 to 4.36
	45-54	2.74	*** 1.63 to 4.62	2.86	***	1.62 to 5.07	2.98	***	1.65 to 5.39	3.33	***	1.86 to 5.97	3.43	***	1.95 to 6.01
	55-64	2.26	** 1.30 to 3.93	3.23	***	1.76 to 5.92	3.20	***	1.71 to 5.99	3.24	***	1.77 to 5.93	3.93	***	2.11 to 7.33
	65+	2.68	** 1.53 to 4.71	4.94	***	2.66 to 9.15	4.74	***	2.50 to 9.02	4.41	***	2.41 to 8.08	6.11	***	3.25 to 11.5
Gender	Male	Reference													
	Female	0.68	* 0.49 to 0.93	0.62	**	0.43 to 0.89	0.65	*	0.45 to 0.92	0.60	**	0.42 to 0.85	0.64	*	0.45 to 0.91
Region	North	Reference													
	Midlands	1.21	0.84 to 1.73	1.20		0.81 to 1.77	1.18		0.80 to 1.75	1.19		0.80 to 1.77	1.20		0.81 to 1.78
	South	0.85	0.62 to 1.16	0.84		0.58 to 1.20	0.83		0.58 to 1.18	0.78		0.55 to 1.11	0.80		0.56 to 1.15
Children in the household	None	Reference													
	≥1	0.79	0.53 to 1.17	1.06		0.69 to 1.64	1.06		0.69 to 1.62	1.06		0.69 to 1.64	1.08		0.70 to 1.65
Self-reported disability	No	Reference													
	Yes	3.47	*** 2.54 to 4.74	1.97	**	1.34 to 2.90	2.16	***	1.49 to 3.14	2.09	***	1.42 to 3.06	2.09	***	1.43 to 3.04
Ethnicity	White	Reference													
	Mixed race	2.20	0.73 to 6.60	2.29		0.72 to 7.32	2.14		0.68 to 6.71	2.17		0.72 to 6.52	2.09		0.71 to 6.17
	Asian	3.44	0.98 to 12.0	3.18		0.66 to 15.4	3.47		0.69 to 17.4	3.47		0.70 to 17.2	3.17		0.65 to 15.5
	Black	0.35	0.07 to 1.86	0.17		0.02 to 1.31	0.19		0.02 to 1.63	0.17		0.02 to 1.54	0.18		0.02 to 1.51
	Arab/other	4.41	0.95 to 20.4	9.58	**	1.98 to 46.4	8.29	**	1.70 to 40.4	8.02	*	1.51 to 42.5	8.78	**	1.77 to 43.5
Time trend (monthly)		1.00	0.99 to 1.02	1.00		0.98 to 1.02	1.00		0.98 to 1.02	1.00		0.98 to 1.02	1.00		0.98 to 1.02
Past year smoker	No			Reference											
	Yes			1.09		0.79 to 1.52	1.17		0.84 to 1.62	1.16		0.84 to 1.62	1.07		0.77 to 1.49
Motivation to cut down drinking	None														
	Moderate			2.94	***	2.06 to 4.20	2.91	***	2.03 to 4.17	2.85	***	2.00 to 4.06	2.93	***	2.06 to 4.18
	High			5.26	***	3.33 to 8.30	5.27	***	3.34 to 8.32	5.01	***	3.18 to 7.90	5.18	***	3.29 to 8.14
AUDIT Score	8-15														
	16-19			2.77	***	1.68 to 4.56	2.81	***	1.72 to 4.59	2.88	***	1.76 to 4.73	2.86	***	1.75 to 4.69
	20+			10.9	***	7.12 to 16.6	11.7	***	7.67 to 17.7	11.5	***	7.54 to 17.6	11.4	***	7.47 to 17.5
Social grade	AB			Reference											
	C1			0.97		0.63 to 1.49									
	C2			0.84		0.51 to 1.36									
	D			1.20		0.68 to 2.10									
	E			2.11	**	1.27 to 3.52									
Education	University						Reference								
	A-level						1.10		0.68 to 1.79						
	GCSE						1.12		0.73 to 1.71						
	Other						1.48		0.80 to 2.72						
	None						1.45		0.86 to 2.44						
Employment status	Full-time									Reference					
	Other									1.56	*	1.08 to 2.25			
Housing tenure	Owned												Reference		
	Rented												1.55	*	1.09 to 2.20

Constant	0.04	**	0.01 to 0.27	0.01	***	0.00 to 0.08	0.01	***	0.00 to 0.07	0.01	***	0.00 to 0.07	0.01	***	0.00 to 0.06

INSERT FIGURE 2 ABOUT HERE

DISCUSSION

Our findings show that there is a socioeconomic gradient in BI delivery for both smokers and risky drinkers, with those in the lowest socioeconomic groups more likely to receive an intervention, although there is considerable uncertainty around the exact slope of this gradient. This gradient is not accounted for by differences in demographic characteristics or smoking and drinking behaviour and appears to be stronger for alcohol than for smoking. The analysis also illustrates that, despite clinical guidelines recommending BI for both smokers and risky drinkers, an individual who has attended primary care in the past year is 8 times more likely to report receiving an intervention if they are a smoker compared to a risky drinker. For both smoking and drinking there is a clear age gradient, with greater levels of BI delivery in older age groups, in spite of the fact that the highest rates of prevalence of risky drinking being in the youngest age group. Perhaps surprisingly, smokers who were also risky drinkers were less likely to have received a BI for their smoking than those who were not. The very heaviest drinkers, consuming at potentially dependent levels, are almost 12 times more likely to have received an alcohol intervention than those drinking at lower, but still risky, levels. These findings were robust to alternative data assumptions (see supplementary material).

Our study represents, to the best of our knowledge, the first detailed exploration of the potential of BIs for both smoking and alcohol to reduce, or increase, inequalities in health. We used data from a large, nationally representative survey and our findings are based on patients' own reporting of having received an intervention. Whilst such a measure may be subject to recall bias, it likely provides a better indicator of patient experience than routine data recorded by practitioners [33] and is not subject to known biases in practitioner recording [34]. We explored multiple measures of socioeconomic position, finding similar results across all measures, although the effect of increased BI delivery appears more closely associated with low social grade than low levels of education.

There are several important limitations to our study which should be considered alongside our findings. Firstly, our definition of what constitutes a BI is fairly broad, including anyone who reported receiving advice from a primary care practitioner and that there may be unobserved inequalities in the extent to which different groups receive different intensities of intervention or in the quality of content or delivery of the BI. Secondly, patient characteristics, including drinking/smoking status and motivation to cut down or quit, are recorded after the BI has taken place. As a result, we cannot establish whether the strong association between motivation and likelihood of BI receipt is a function of treatment-seeking behaviour in patients who are already motivated to reduce their smoking or drinking, of motivation increasing after receipt of a BI, or of more motivated patients being more likely to recall having received an intervention. Finally, whilst smoking rates in the Toolkit data are very similar to those reported in other national surveys [35], the observed prevalence of risky drinking of 13.1% is substantially lower than other estimates (e.g. 19.7% in the 2014 Adult Psychiatric Morbidity Survey [36]), although it is unclear what effect, if any, this may have on the study results.

Two, much smaller, UK studies conducted in 1996 looked at the relationship between occupation and rates of alcohol BI receipt in risky drinkers, finding no clear socioeconomic gradient [37,38]. Another, Finnish study also found no significant association [39], perhaps suggesting that socioeconomic gradients in BI delivery may not be consistent across different contexts. Previous studies have found similar disparities to those we find between delivery rates of BI for smoking and risky drinking [17,40], as well as similarly higher levels of BI receipt among primary care patients at older ages [41], with greater motivation to quit or cut down [42] and for risky drinkers with higher AUDIT scores [43]. Numerous explanations for the relatively low rate of BI delivery for risky drinking have been suggested, including a lack of training and resources and the attitudes and beliefs of both practitioners and patients [44–46].

It is not clear why BI delivery appeared highest in lower socioeconomic groups after adjustment for a range of socio-demographic, drinking and smoking characteristics. Presenting with a chronic disease – likely related to smoking or alcohol – is associated with receipt of brief intervention [17]. The underlying reason for the GP visit was not recorded in the current study but it is possible that smoking or alcohol-related illness is more likely to present in low compared with high SEP smokers or risky drinkers respectively [47].

Our analysis focuses on the receipt of Brief Interventions for patients who reported attending Primary Care in the past year. There are likely to be additional socioeconomic gradients in terms of access to, use of and quality of Primary Care services which will moderate any overall impact of BIs on health inequalities [48–51]. We should also consider the potential for differential effectiveness of the intervention across socioeconomic groups. If BIs are more effective at changing the behaviour of those in higher SEP groups then this may mitigate any potential inequality-reducing effects. There is little evidence to support the existence of such a gradient in effectiveness for alcohol [52], although there is some suggestion that this may be in part because lower SEP groups are more likely to drop out of BI trials [53]. For smoking, a recent study does suggest there may be some degree of inequality in longer term outcomes for smoking cessation interventions [54]. A holistic view of the full impact of SBI programmes should consider the impact of these potential SEP gradients, which may attenuate the positive gradients identified in the present study, alongside existing negative gradients in alcohol- and tobacco-related harm. Such is the severity of these gradients in harm, with those in the lowest SEP groups experiencing rates of harm several times greater than those in the highest groups even after adjusting for drinking and smoking behaviour [8,55], that an intervention could have a negative SEP gradient in terms of its effects on alcohol consumption and/or smoking, while still reducing overall inequalities. Further research in this area is urgently needed to understand the full impact that BI programmes may be having on socioeconomic inequalities. This need is particularly acute given NHS England's recent decision to incentivise secondary care providers to deliver large scale Brief Intervention programmes for both smoking and risky drinking under the latest Commissioning for Quality and Innovation (CQUIN) scheme. Although similar gradients in the prevalence of both smoking and risky drinking as well as associated harm have been observed in many countries [56,57], primary care systems can vary widely and it is therefore unclear how generalisable our findings are beyond England. Future research into this area, particularly in Low and Middle Income Countries, could help design SBI programmes to maximise their potential to reduce inequalities in health.

These findings provide the first evidence that Brief Intervention programmes may help reduce inequalities in smoking- and alcohol-related health although better evidence is needed on the extent to which conflicting socioeconomic gradients in delivery and, potentially, intervention effectiveness interact with existing gradients in health. There is considerable scope for the potential effect on inequalities to be increased if intervention rates can be raised, particularly for drinking.

Author Contributions

CA conceived of and designed the study with input from JB, EB, DG, PB, EK, SM & PM. CA performed the analysis and wrote the first draft of the paper. All authors commented on this and subsequent versions and read and approved the final manuscript.

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Disclaimer

The views are those of the author(s) and not necessarily those of the NHS, NIHR or the Department of Health

Declaration of Interests

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Ethics approval

Ethical approval for the Smoking Toolkit Study (STS) was originally granted by the UCL Ethics Committee (ID 0498/001). Approval for the ATS was granted by the same committee as an extension of the STS. The data were collected by Ipsos Mori and anonymised when received by study authors. Explicit verbal agreement and willingness to answer questions voluntarily were recorded electronically by Ipsos Mori. Participants were also given a printed information sheet. This standard was agreed by the UCL ethics committee.

Data sharing statement

The dataset analysed during the current study are available from the corresponding author on reasonable request.

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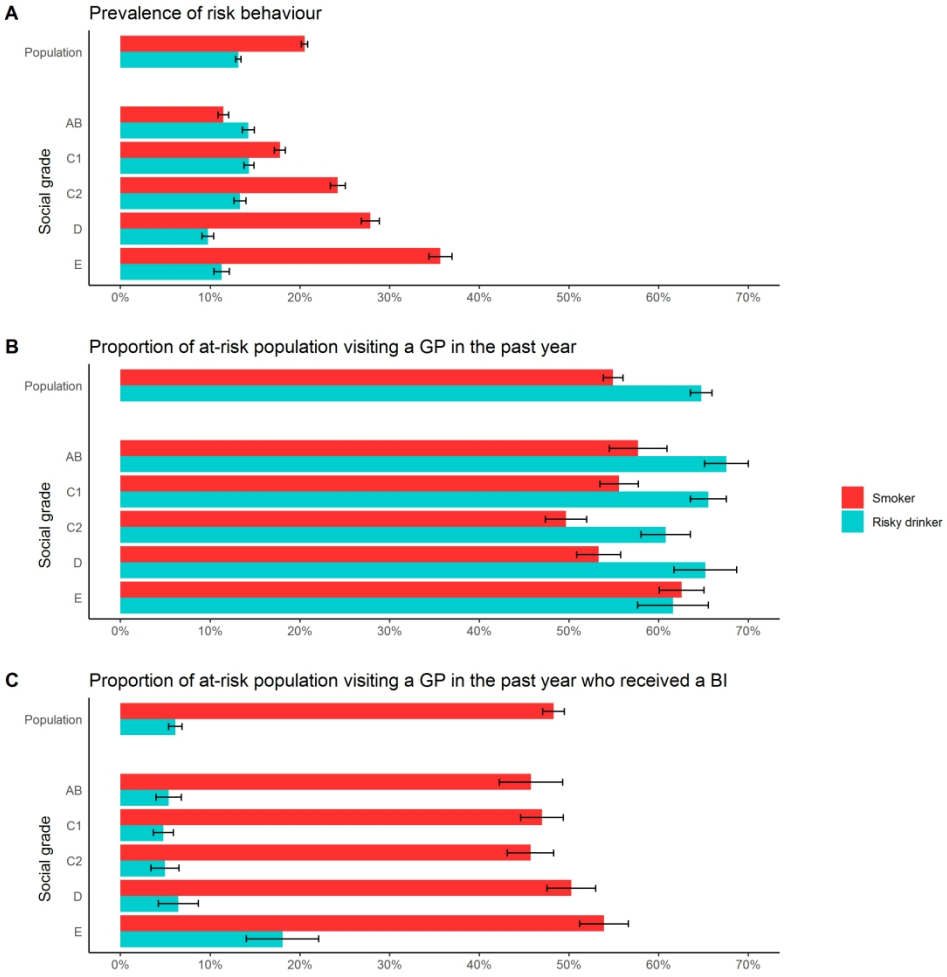
FIGURE LEGENDS

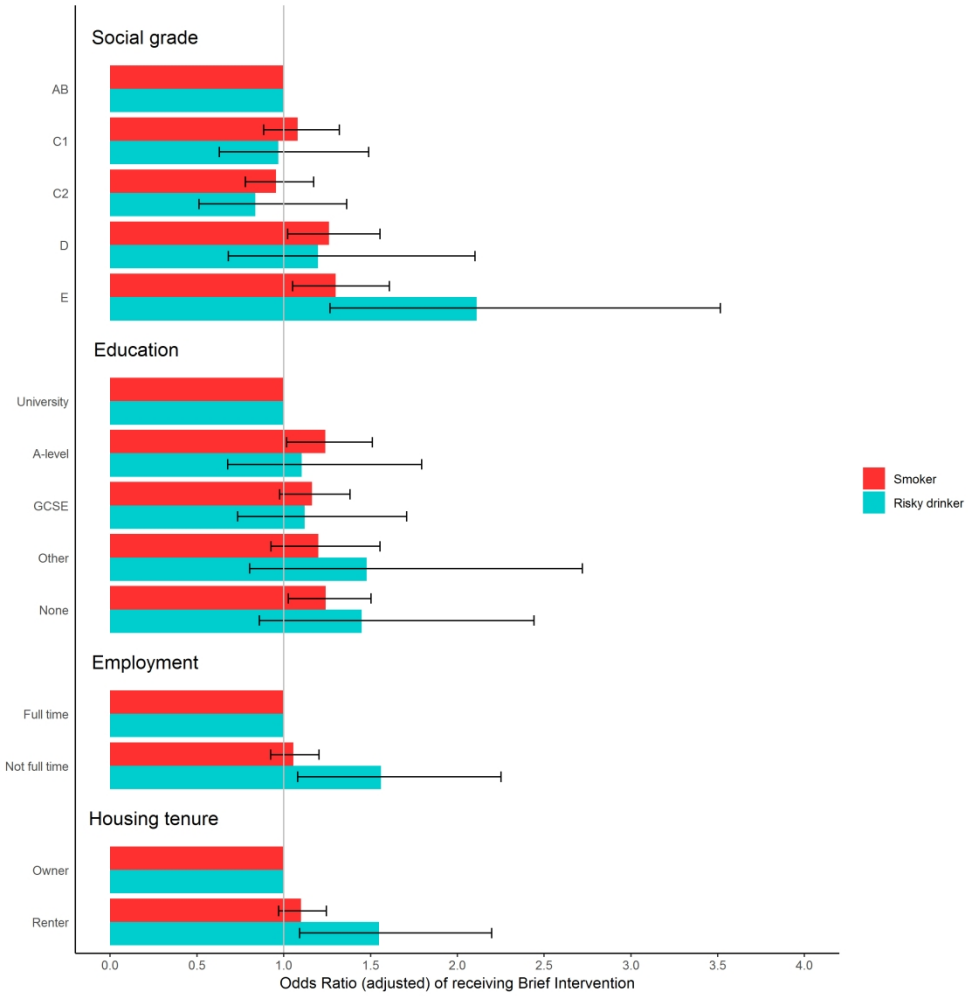
Figure 1 - Unadjusted socioeconomic gradients in prevalence, GP attendance and BI receipt for smokers and risky drinkers

Figure 2 - Independent, fully-adjusted, association of socioeconomic position with Odds Ratio of receiving a Brief Intervention for smoking or risky drinking



Unadjusted socioeconomic gradients in prevalence, GP attendance and BI receipt for smokers and risky drinkers

254x254mm (300 x 300 DPI)



Independent, fully-adjusted, association of socioeconomic position with Odds Ratio of receiving a Brief Intervention for smoking or risky drinking

254x254mm (300 x 300 DPI)

1

The association between socioeconomic status and receipt of Brief Interventions for smoking and drinking: analysis of a population-based household survey: Supplementary material

Smoker definition

'Past-year smokers' were defined as those who responded to the question 'Do you smoke or have you ever smoked' with 'I smoke cigarettes (including hand-rolled) every day', 'I smoke cigarettes (including hand-rolled), but not every day', 'I do not smoke cigarettes at all, but I do smoke tobacco of some kind (e.g. pipe, cigar or shisha)' or 'I have stopped smoking completely in the last year'. E-cigarettes were specifically excluded from the definition of cigarettes in the question. Recent quitters were included in the sample to capture individuals who may have given up following a BI received in primary care.

Outcome measures

Among smokers, BI receipt was assessed by asking 'Has your GP spoken to you about smoking in the past year (i.e. last 12 months)?' Respondents were encouraged to select all options that applied and were classified into those who received a BI (those selecting at least one of four options: i) 'Yes, he/she advised me to stop but did not offer anything'; ii) 'Yes, he/she suggested that I go to a specialist stop smoking advisor or group'; iii) 'Yes, he/she suggested that I see a nurse in the practice'; iv) 'Yes, he/she offered me a prescription for Champix/Zyban, a nicotine patch, nicotine gum or other nicotine product') and those who did not (i.e. those who did not select any of options i) to iv) but did select one of 'No, I have seen my GP in the last year but he/she has not spoken to me about smoking' or 'Yes, he/she asked me about my smoking but did not advise me to stop smoking').

Among risky drinkers, BI receipt was assessed by asking 'In the last 12 months, has a doctor or other health worker within your GP surgery discussed your drinking?' Respondents were encouraged to select all options that applied and were classified into those who received a BI (those selecting at least one of three options: i) 'Yes, a doctor or other health worker within my GP surgery offered advice about cutting down my drinking'; ii) 'Yes, a doctor or other health worker within my GP surgery offered help or support within the surgery to help me cut down'; iii) 'Yes, a doctor or other health working within my GP surgery referred me to an alcohol service or advised me to seek specialist help') and those who did not (i.e. those who did not select any of options i) to iii) but did select one of 'No, I have seen a doctor or health worker within my GP surgery but did not discuss my drinking' or 'Yes, a doctor or other health worker within my GP surgery asked about my drinking').

2

Analysis using unweighted data

Table S1 - Descriptive analysis of prevalence, GP attendance and BI delivery rates for smokers and risky drinkers by socioeconomic status (unweighted, 95% Confidence Intervals in brackets)

		Past year smokers			Risky drinkers		
		Prevalence in population	Visited GP in past year	Received BI | visited GP	Prevalence in population	Visited GP in past year	Received BI | visited GP
Population		20.6% (20.3 to 21)	64.8% (63.9 to 65.7)	49.7% (48.5 to 50.9)	12.6% (12.3 to 12.7)	65.4% (64.2 to 66)	6.5% (5.7 to 6.9)
Social grade	AB	11.2% (10.6 to 11.8)	65.1% (62.4 to 67.9)	47.5% (43.9 to 51)	13.6% (12.9 to 13.9)	69.4% (67 to 70.7)	5.6% (4.2 to 6.4)
	C1	17.5% (16.9 to 18.1)	64.4% (62.6 to 66.3)	48.6% (46.2 to 51)	14.3% (13.8 to 14.6)	66% (64 to 67)	5% (3.9 to 5.6)
	C2	23.4% (22.5 to 24.2)	61.3% (59.3 to 63.3)	46.6% (44.1 to 49.2)	12.2% (11.5 to 12.5)	61.9% (59.2 to 63.3)	5.2% (3.6 to 6.1)
	D	26.8% (25.8 to 27.8)	63.9% (61.8 to 66)	50.5% (47.8 to 53.2)	9.3% (8.7 to 9.7)	65.3% (61.8 to 67)	6.9% (4.6 to 8)
	E	34.3% (33 to 35.5)	70.5% (68.5 to 72.6)	55.2% (52.4 to 57.9)	10.9% (10.1 to 11.4)	60.5% (56.5 to 62.5)	17% (13.1 to 19.1)
Education	University	12.7% (12.2 to 13.3)	61.9% (59.6 to 64.2)	45.8% (42.8 to 48.8)	12.7% (12.1 to 13)	67.1% (64.9 to 68.2)	5.5% (4.2 to 6.2)
	A-level	20.8% (20 to 21.6)	62.1% (59.9 to 64.3)	49.3% (46.4 to 52.1)	18.7% (17.9 to 19.1)	58.8% (56.4 to 60)	4.8% (3.5 to 5.5)
	GCSE	25.7% (25 to 26.4)	65.4% (63.8 to 66.9)	48.4% (46.4 to 50.5)	12.6% (12 to 12.9)	66.8% (64.5 to 67.9)	7% (5.5 to 7.8)
	Other	18.2% (17 to 19.5)	66.5% (63 to 69.9)	51.3% (46.8 to 55.8)	10.9% (9.9 to 11.4)	71.2% (66.8 to 73.4)	7.6% (4.6 to 9.2)
	None	25.9% (25 to 26.9)	67.8% (65.9 to 69.8)	54% (51.5 to 56.6)	6.7% (6.1 to 6.9)	70.7% (66.9 to 72.6)	11% (7.9 to 12.5)
Employment	Full time	22.1% (21.4 to 22.7)	57.2% (55.5 to 58.8)	46.9% (44.8 to 49.1)	15.9% (15.3 to 16.2)	60.7% (58.8 to 61.6)	4.3% (3.3 to 4.8)
	Other	19.9% (19.5 to 20.4)	69.1% (67.9 to 70.2)	51% (49.5 to 52.5)	10.9% (10.5 to 11.1)	68.8% (67.3 to 69.6)	7.8% (6.8 to 8.4)
Housing tenure	Owner	13.2% (12.8 to 13.6)	65.8% (64.3 to 67.3)	49.2% (47.2 to 51.1)	11.6% (11.2 to 11.8)	68.9% (67.3 to 69.7)	5.4% (4.5 to 5.9)
	Renter	32.5% (31.8 to 33.2)	64.5% (63.3 to 65.7)	50.2% (48.6 to 51.8)	14.2% (13.7 to 14.5)	61.1% (59.3 to 62.1)	8.1% (6.7 to 8.8)

3

Table S2 – Unweighted logistic regression results for factors associated with likelihood of receiving Brief Intervention for smoking: demographic- and behaviour-adjusted models

		Demographic-adjusted model			Behaviour-adjusted model		
		OR		95% CI	OR		95% CI
Age	18-24	Reference					
	25-34	1.36	***	1.14 to 1.61	1.32	**	1.1 to 1.59
	35-44	1.59	***	1.33 to 1.9	1.60	***	1.33 to 1.93
	45-54	2.02	***	1.7 to 2.41	2.01	***	1.67 to 2.42
	55-64	2.25	***	1.88 to 2.7	2.31	***	1.9 to 2.8
	65+	2.06	***	1.71 to 2.48	2.16	***	1.77 to 2.63
Gender	Male	Reference					
	Female	1.00		0.91 to 1.11	0.98		0.88 to 1.09
Region	North	Reference					
	Midlands	0.93		0.82 to 1.06	0.92		0.81 to 1.05
	South	0.87	*	0.78 to 0.98	0.86	*	0.76 to 0.97
Children in the household	None	Reference					
	≥1	1.12		0.99 to 1.26	1.07		0.94 to 1.21
Self-reported disability	No	Reference					
	Yes	1.43	***	1.25 to 1.62	1.45	***	1.26 to 1.66
Ethnicity	White	Reference					
	Mixed race	0.83		0.56 to 1.22	0.78		0.52 to 1.17
	Asian	0.94		0.75 to 1.18	0.89		0.7 to 1.12
	Black	1.29		0.92 to 1.81	1.12		0.78 to 1.61
	Arab/other	1.04		0.62 to 1.73	1.00		0.57 to 1.76
Time trend (monthly)		1.00		0.99 to 1	1.00		0.99 to 1.01
Risky drinker (AUDIT 8+)	No				Reference		
	Yes				0.89		0.78 to 1.01
Motivation to cut down smoking	None				Reference		
	Moderate				1.42	***	1.25 to 1.6
	High				2.21	***	1.87 to 2.61
Constant		0.60		0.31 to 1.19	0.46	*	0.23 to 0.95

Key: * p<0.05, ** p<0.01, ***, p<0.001

4

Table S3 - Unweighted logistic regression results for factors associated with likelihood of receiving Brief Intervention for smoking: socioeconomic adjusted models 1 & 2

		Socioeconomic-adjusted models 1 & 2					
		OR		95% CI	OR		95% CI
Age	18-24	Reference					
	25-34	1.35	**	1.12 to 1.62	1.34	**	1.12 to 1.61
	35-44	1.64	***	1.36 to 1.98	1.63	***	1.35 to 1.97
	45-54	2.05	***	1.7 to 2.47	2.04	***	1.7 to 2.46
	55-64	2.36	***	1.94 to 2.87	2.31	***	1.89 to 2.81
	65+	2.22	***	1.82 to 2.72	2.13	***	1.73 to 2.62
Gender	Male	Reference					
	Female	0.96		0.86 to 1.08	0.98		0.88 to 1.09
Region	North	Reference					
	Midlands	0.93		0.82 to 1.06	0.92		0.81 to 1.05
	South	0.87	*	0.77 to 0.99	0.86	*	0.76 to 0.98
Children in the household	None	Reference					
	≥1	1.05		0.92 to 1.2	1.06		0.93 to 1.21
Self-reported disability	No	Reference					
	Yes	1.38	***	1.2 to 1.58	1.42	***	1.24 to 1.63
Ethnicity	White	Reference					
	Mixed race	0.77		0.51 to 1.16	0.79		0.52 to 1.19
	Asian	0.86		0.68 to 1.09	0.89		0.7 to 1.12
	Black	1.10		0.77 to 1.58	1.12		0.78 to 1.62
	Arab/other	1.01		0.58 to 1.78	1.01		0.57 to 1.76
Time trend (monthly)		1.00		0.99 to 1.01	1.00		0.99 to 1.01
Risky drinker (AUDIT 8+)	No	Reference					
	Yes	0.90		0.79 to 1.03	0.90		0.79 to 1.02
Motivation to cut down smoking	None	Reference					
	Moderate	1.43	***	1.26 to 1.62	1.43	***	1.26 to 1.61
	High	2.25	***	1.9 to 2.66	2.23	***	1.89 to 2.64
Social grade	AB	Reference					
	C1	1.09		0.9 to 1.31			
	C2	0.92		0.76 to 1.12			
	D	1.21		0.99 to 1.47			
	E	1.29	*	1.06 to 1.58			
Education	University				Reference		
	A-level				1.20	*	1 to 1.45
	GCSE				1.10		0.94 to 1.29
	Other				1.16		0.92 to 1.48
	None				1.22	*	1.02 to 1.46
Constant		0.44	*	0.21 to 0.92	0.41	*	0.19 to 0.85

Key: * p<0.05, ** p<0.01, ***, p<0.001

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Table S4 - Unweighted logistic regression results for factors associated with likelihood of receiving Brief Intervention for smoking: socioeconomic-adjusted models 3 & 4

		Socioeconomic-adjusted models 3 & 4					
		OR		95% CI	OR		95% CI
Age	18-24	Reference					
	25-34	1.34	**	1.12 to 1.61	1.32	**	1.11 to 1.59
	35-44	1.62	***	1.34 to 1.96	1.63	***	1.35 to 1.97
	45-54	2.03	***	1.69 to 2.45	2.07	***	1.72 to 2.5
	55-64	2.31	***	1.9 to 2.8	2.41	***	1.97 to 2.94
	65+	2.12	***	1.73 to 2.59	2.27	***	1.85 to 2.78
Gender	Male	Reference					
	Female	0.97		0.87 to 1.08	0.98		0.87 to 1.09
Region	North	Reference					
	Midlands	0.93		0.81 to 1.06	0.93		0.81 to 1.06
	South	0.86	*	0.76 to 0.97	0.85	*	0.75 to 0.96
Children in the household	None	Reference					
	≥1	1.06		0.93 to 1.21	1.06		0.93 to 1.21
Self-reported disability	No	Reference					
	Yes	1.42	***	1.24 to 1.63	1.41	***	1.22 to 1.62
Ethnicity	White	Reference					
	Mixed race	0.78		0.52 to 1.17	0.77		0.51 to 1.16
	Asian	0.88		0.7 to 1.12	0.91		0.71 to 1.15
	Black	1.12		0.78 to 1.61	1.11		0.77 to 1.6
	Arab/other	1.01		0.58 to 1.77	0.98		0.56 to 1.73
Time trend (monthly)		1.00		0.99 to 1.01	1.00		0.99 to 1.01
Risky drinker (AUDIT 8+)	No	Reference					
	Yes	0.89		0.78 to 1.02	0.89		0.78 to 1.02
Motivation to cut down smoking	None	Reference					
	Moderate	1.42	***	1.26 to 1.61	1.43	***	1.26 to 1.61
	High	2.22	***	1.88 to 2.62	2.22	***	1.88 to 2.63
Employment status	Full-time	Reference					
	Other	1.07		0.95 to 1.22			
Housing tenure	Owned				Reference		
	Rented				1.14	*	1.01 to 1.27
Constant		0.45	*	0.22 to 0.92	0.43	*	0.21 to 0.88

Key: * p<0.05, ** p<0.01, ***, p<0.001

6

Table S5 - Unweighted logistic regression results for factors associated with likelihood of receiving Brief Intervention for risky alcohol use: demographic- and behaviour-adjusted models

		Demographic-adjusted model			Behaviour-adjusted model		
		OR		95% CI	OR		95% CI
Age	18-24	Reference					
	25-34	1.77		1 to 3.15	1.62		0.87 to 3.03
	35-44	2.92	***	1.7 to 5	2.52	**	1.41 to 4.53
	45-54	3.22	***	1.98 to 5.24	3.44	***	2.03 to 5.82
	55-64	2.41	**	1.45 to 4.01	3.52	***	2.03 to 6.13
	65+	2.54	***	1.52 to 4.25	4.72	***	2.68 to 8.3
Gender	Male	Reference					
	Female	0.72	*	0.53 to 0.96	0.67	*	0.48 to 0.93
Region	North	Reference					
	Midlands	1.26		0.9 to 1.75	1.30		0.9 to 1.88
	South	1.01		0.75 to 1.36	0.96		0.69 to 1.34
Children in the household	None	Reference					
	≥1	0.72		0.5 to 1.04	0.95		0.64 to 1.41
Self-reported disability	No	Reference					
	Yes	2.91	***	2.16 to 3.91	1.91	***	1.36 to 2.68
Ethnicity	White	Reference					
	Mixed race	1.45		0.5 to 4.19	1.61		0.51 to 5.09
	Asian	2.15		0.73 to 6.28	1.76		0.51 to 6.08
	Black	0.78		0.18 to 3.33	0.61		0.13 to 2.88
	Arab/other	3.90		0.76 to 20.07	7.04	*	1.27 to 38.91
Time trend (monthly)		1.00		0.99 to 1.02	1.00		0.99 to 1.02
Past year smoker	No				Reference		
	Yes				1.20		0.88 to 1.64
Motivation to cut down drinking	None				Reference		
	Moderate				2.64	***	1.91 to 3.65
	High				4.54	***	2.96 to 6.96
AUDIT Score	8-15				Reference		
	16-19				2.78	***	1.79 to 4.33
	20+				11.88	***	8.18 to 17.26
Constant		0.04	***	0.01 to 0.22	0.01	***	0 to 0.06

Key: * p<0.05, ** p<0.01, ***, p<0.001

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Table S6 - Unweighted logistic regression results for factors associated with likelihood of receiving Brief Intervention for risky alcohol use: socioeconomic-adjusted models 1 & 2

		Socioeconomic-adjusted models 1 & 2					
		OR		95% CI	OR		95% CI
Age	18-24	Reference					
	25-34	1.59		0.85 to 2.99	1.63		0.86 to 3.1
	35-44	2.40	**	1.33 to 4.33	2.54	**	1.39 to 4.64
	45-54	3.22	***	1.88 to 5.51	3.40	***	1.96 to 5.89
	55-64	3.38	***	1.93 to 5.92	3.43	***	1.93 to 6.09
	65+	4.64	***	2.61 to 8.23	4.51	***	2.49 to 8.16
Gender	Male	Reference					
	Female	0.66	*	0.47 to 0.91	0.68	*	0.49 to 0.94
Region	North	Reference					
	Midlands	1.31		0.91 to 1.9	1.29		0.9 to 1.87
	South	1.01		0.73 to 1.41	0.99		0.71 to 1.38
Children in the household	None	Reference					
	≥1	0.96		0.64 to 1.43	0.95		0.64 to 1.41
Self-reported disability	No	Reference					
	Yes	1.67	**	1.17 to 2.38	1.84	**	1.3 to 2.6
Ethnicity	White	Reference					
	Mixed race	1.60		0.5 to 5.08	1.57		0.49 to 4.99
	Asian	1.69		0.5 to 5.73	1.80		0.52 to 6.22
	Black	0.52		0.11 to 2.47	0.61		0.13 to 2.88
	Arab/other	7.78	*	1.43 to 42.22	6.80	*	1.21 to 38.21
Time trend (monthly)		1.00		0.99 to 1.02	1.00		0.99 to 1.02
Past year smoker	No	Reference					
	Yes	1.08		0.78 to 1.49	1.17		0.85 to 1.6
Motivation to cut down drinking	None	Reference					
	Moderate	2.74	***	1.98 to 3.8	2.70	***	1.95 to 3.73
	High	4.66	***	3.03 to 7.17	4.61	***	3 to 7.08
AUDIT Score	8-15	Reference					
	16-19	2.62	***	1.68 to 4.09	2.70	***	1.74 to 4.21
	20+	10.77	***	7.38 to 15.73	11.69	***	8.04 to 17
Social grade	AB	Reference					
	C1	1.05		0.71 to 1.55			
	C2	0.89		0.56 to 1.42			
	D	1.32		0.79 to 2.2			
	E	2.09	**	1.28 to 3.41			
Education	University				Reference		
	A-level				1.09		0.7 to 1.69
	GCSE				1.12		0.76 to 1.65
	Other				1.32		0.76 to 2.3
	None				1.36		0.84 to 2.2
Constant		0.01	***	0 to 0.06	0.01	***	0 to 0.05

Key: * p<0.05, ** p<0.01, ***, p<0.001

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Table S7 - Unweighted logistic regression results for factors associated with likelihood of receiving Brief Intervention for risky alcohol use: socioeconomic-adjusted models 3 & 4

		Socioeconomic-adjusted models 3 & 4					
		OR		95% CI	OR		95% CI
Age	18-24	Reference					
	25-34	1.83		0.97 to 3.45	1.70		0.91 to 3.18
	35-44	2.91	***	1.6 to 5.27	2.83	**	1.57 to 5.12
	45-54	3.86	***	2.26 to 6.6	3.98	***	2.33 to 6.82
	55-64	3.53	***	2.03 to 6.13	4.30	***	2.43 to 7.61
	65+	4.19	***	2.37 to 7.4	5.94	***	3.3 to 10.69
Gender	Male	Reference					
	Female	0.63	**	0.45 to 0.88	0.67	*	0.48 to 0.93
Region	North	Reference					
	Midlands	1.32		0.91 to 1.9	1.32		0.92 to 1.91
	South	0.95		0.68 to 1.32	0.98		0.7 to 1.36
Children in the household	None	Reference					
	≥1	0.96		0.64 to 1.43	0.96		0.65 to 1.44
Self-reported disability	No	Reference					
	Yes	1.75	**	1.24 to 2.47	1.72	**	1.22 to 2.44
Ethnicity	White	Reference					
	Mixed race	1.58		0.5 to 5.03	1.53		0.49 to 4.81
	Asian	1.84		0.54 to 6.26	1.66		0.48 to 5.74
	Black	0.57		0.12 to 2.73	0.57		0.12 to 2.7
	Arab/other	6.66	*	1.16 to 38.28	7.28	*	1.28 to 41.44
Time trend (monthly)		1.00		0.99 to 1.02	1.00		0.99 to 1.02
Past year smoker	No	Reference					
	Yes	1.17		0.85 to 1.6	1.05		0.76 to 1.45
Motivation to cut down drinking	None	Reference					
	Moderate	2.64	***	1.91 to 3.65	2.73	***	1.97 to 3.78
	High	4.38	***	2.85 to 6.73	4.58	***	2.99 to 7.02
AUDIT Score	8-15	Reference					
	16-19	2.73	***	1.76 to 4.25	2.72	***	1.75 to 4.23
	20+	11.43	***	7.86 to 16.64	11.32	***	7.78 to 16.48
Employment status	Full-time	Reference					
	Other	1.62	**	1.14 to 2.29			
Housing tenure	Owned				Reference		
	Rented				1.65	**	1.18 to 2.3
Constant		0.01	***	0 to 0.05	0.01	***	0 to 0.04

Key: * p<0.05, ** p<0.01, ***, p<0.001

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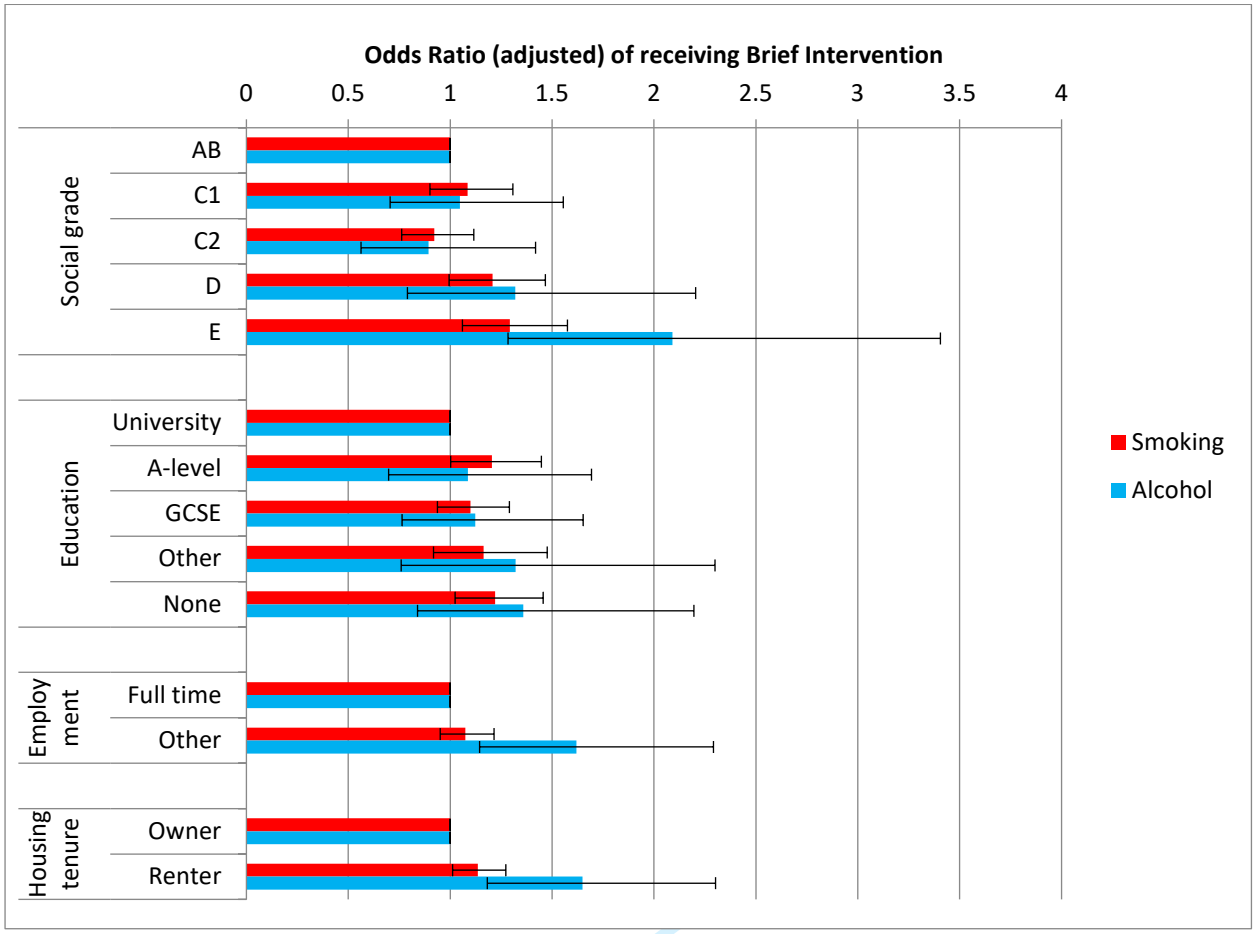
Figure S1 – Unweighted independent effects of four measures of socioeconomic status on Odds Ratio of receiving a Brief Intervention for smoking or risky drinking



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Analysis using complete cases only

Table S8 - Logistic regression results for factors associated with likelihood of receiving Brief Intervention for smoking: demographic- and behaviour-adjusted models

		Demographic-adjusted model			Behaviour-adjusted model		
		OR		95% CI	OR		95% CI
Age	18-24	Reference					
	25-34	1.37	**	1.14 to 1.65	1.34	**	1.1 to 1.63
	35-44	1.54	***	1.27 to 1.87	1.53	***	1.25 to 1.88
	45-54	2.00	***	1.66 to 2.42	1.98	***	1.63 to 2.42
	55-64	2.17	***	1.78 to 2.64	2.19	***	1.77 to 2.71
	65+	2.04	***	1.67 to 2.49	2.13	***	1.71 to 2.64
Gender	Male	Reference					
	Female	1.01		0.91 to 1.13	0.97		0.86 to 1.09
Region	North	Reference					
	Midlands	0.94		0.82 to 1.07	0.93		0.81 to 1.07
	South	0.80	**	0.7 to 0.91	0.78	***	0.68 to 0.89
Children in the household	None	Reference					
	≥1	1.14		1 to 1.31	1.08		0.94 to 1.25
Self-reported disability	No	Reference					
	Yes	1.39	***	1.21 to 1.6	1.42	***	1.23 to 1.64
Ethnicity	White	Reference					
	Mixed race	0.93		0.61 to 1.41	0.86		0.55 to 1.34
	Asian	0.88		0.69 to 1.12	0.81		0.63 to 1.05
	Black	1.14		0.79 to 1.64	0.94		0.64 to 1.4
	Arab/other	0.97		0.56 to 1.67	0.94		0.52 to 1.71
Time trend (monthly)		1.00		0.99 to 1.01	1.00		1 to 1.01
Risky drinker (AUDIT 8+)	No				Reference		
	Yes				0.86	*	0.74 to 0.99
Motivation to cut down smoking	None				Reference		
	Moderate				1.40	***	1.22 to 1.6
	High				2.13	***	1.77 to 2.55
Constant		0.45	*	0.21 to 0.93	0.33	**	0.15 to 0.73

Key: * p<0.05, ** p<0.01, ***, p<0.001

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Table S9 - Logistic regression results for factors associated with likelihood of receiving Brief Intervention for smoking: socioeconomic-adjusted models 1 & 2

		Socioeconomic-adjusted models 1 & 2					
		OR		95% CI	OR		95% CI
Age	18-24	Reference					
	25-34	1.36	**	1.12 to 1.66	1.37	**	1.12 to 1.66
	35-44	1.58	***	1.29 to 1.94	1.58	***	1.28 to 1.94
	45-54	2.03	***	1.66 to 2.48	2.04	***	1.67 to 2.5
	55-64	2.26	***	1.83 to 2.79	2.22	***	1.79 to 2.75
	65+	2.21	***	1.77 to 2.75	2.11	***	1.69 to 2.65
Gender	Male	Reference					
	Female	0.95		0.84 to 1.07	0.96		0.86 to 1.09
Region	North	Reference					
	Midlands	0.94		0.81 to 1.08	0.92		0.79 to 1.06
	South	0.79	**	0.69 to 0.91	0.78	***	0.68 to 0.89
Children in the household	None	Reference					
	≥1	1.07		0.93 to 1.23	1.08		0.93 to 1.24
Self-reported disability	No	Reference					
	Yes	1.35	***	1.16 to 1.57	1.39	***	1.2 to 1.61
Ethnicity	White	Reference					
	Mixed race	0.84		0.54 to 1.33	0.83		0.53 to 1.3
	Asian	0.80		0.62 to 1.03	0.83		0.64 to 1.08
	Black	0.93		0.62 to 1.37	0.97		0.65 to 1.44
	Arab/other	0.96		0.53 to 1.74	0.92		0.51 to 1.68
Time trend (monthly)		1.00		1 to 1.01	1.00		1 to 1.01
Risky drinker (AUDIT 8+)	No	Reference					
	Yes	0.87		0.76 to 1.01	0.87		0.75 to 1
Motivation to cut down smoking	None	Reference					
	Moderate	1.42	***	1.24 to 1.62	1.41	***	1.23 to 1.62
	High	2.18	***	1.81 to 2.62	2.14	***	1.78 to 2.58
Social grade	AB	Reference					
	C1	1.09		0.89 to 1.33			
	C2	0.95		0.77 to 1.17			
	D	1.27	*	1.03 to 1.57			
	E	1.32	*	1.06 to 1.63			
Education	University				Reference		
	A-level				1.23	*	1.01 to 1.51
	GCSE				1.14		0.96 to 1.36
	Other				1.19		0.92 to 1.55
	None				1.24	*	1.02 to 1.5
Constant		0.31	**	0.14 to 0.69	0.28	**	0.13 to 0.64

Key: * p<0.05, ** p<0.01, ***, p<0.001

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Table S10 - Logistic regression results for factors associated with likelihood of receiving Brief Intervention for smoking: socioeconomic-adjusted models 3 & 4

		Socioeconomic-adjusted models 3 & 4					
		OR		95% CI	OR		95% CI
Age	18-24	Reference					
	25-34	1.35	**	1.11 to 1.65	1.35	**	1.11 to 1.64
	35-44	1.55	***	1.26 to 1.9	1.59	***	1.3 to 1.96
	45-54	1.99	***	1.63 to 2.43	2.03	***	1.66 to 2.49
	55-64	2.19	***	1.78 to 2.71	2.24	***	1.8 to 2.79
	65+	2.10	***	1.69 to 2.61	2.24	***	1.79 to 2.8
Gender	Male	Reference					
	Female	0.96		0.85 to 1.08	0.99		0.87 to 1.11
Region	North	Reference					
	Midlands	0.93		0.81 to 1.08	0.93		0.8 to 1.07
	South	0.78	***	0.68 to 0.89	0.77	***	0.67 to 0.88
Children in the household	None	Reference					
	≥1	1.08		0.94 to 1.25	1.07		0.92 to 1.23
Self-reported disability	No	Reference					
	Yes	1.40	***	1.2 to 1.62	1.41	***	1.21 to 1.64
Ethnicity	White	Reference					
	Mixed race	0.86		0.55 to 1.34	0.86		0.55 to 1.33
	Asian	0.81		0.63 to 1.05	0.86		0.66 to 1.12
	Black	0.95		0.64 to 1.4	0.95		0.63 to 1.44
	Arab/other	0.95		0.52 to 1.72	0.94		0.52 to 1.7
Time trend (monthly)		1.00		1 to 1.01	1.00		1 to 1.01
Risky drinker (AUDIT 8+)	No	Reference					
	Yes	0.86	*	0.74 to 0.99	0.86	*	0.75 to 1
Motivation to cut down smoking	None	Reference					
	Moderate	1.40	***	1.22 to 1.6	1.39	***	1.21 to 1.59
	High	2.13	***	1.77 to 2.56	2.08	***	1.73 to 2.49
Employment status	Full-time	Reference					
	Other	1.05		0.92 to 1.2			
Housing tenure	Owned				Reference		
	Rented				1.10		0.97 to 1.24
Constant		0.33	**	0.15 to 0.72	0.31	**	0.14 to 0.69

Key: * p<0.05, ** p<0.01, ***, p<0.001

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Table S11 - Logistic regression results for factors associated with likelihood of receiving Brief Intervention for risky alcohol use: demographic- and behaviour-adjusted models

		Demographic-adjusted model			Behaviour-adjusted model		
		OR		95% CI	OR		95% CI
Age	18-24	Reference					
	25-34	1.59		0.84 to 3.01	1.45		0.74 to 2.83
	35-44	2.65	**	1.45 to 4.82	2.28	*	1.2 to 4.31
	45-54	2.82	***	1.65 to 4.82	3.22	***	1.83 to 5.65
	55-64	2.37	**	1.35 to 4.17	3.53	***	1.93 to 6.48
	65+	2.76	**	1.55 to 4.92	5.45	***	2.95 to 10.09
Gender	Male	Reference					
	Female	0.65	*	0.47 to 0.9	0.62	**	0.43 to 0.89
Region	North	Reference					
	Midlands	1.23		0.86 to 1.78	1.21		0.81 to 1.8
	South	0.82		0.6 to 1.14	0.77		0.54 to 1.1
Children in the household	None	Reference					
	≥1	0.79		0.53 to 1.18	1.07		0.7 to 1.65
Self-reported disability	No	Reference					
	Yes	3.52	***	2.57 to 4.83	2.27	***	1.57 to 3.28
Ethnicity	White	Reference					
	Mixed race	2.22		0.74 to 6.63	2.19		0.7 to 6.87
	Asian	1.06		0.27 to 4.24	0.65		0.13 to 3.33
	Black	0.32		0.08 to 1.36	0.17		0.02 to 1.16
	Arab/other	4.61		1 to 21.21	9.03	**	1.87 to 43.55
Time trend (monthly)		1.01		0.99 to 1.02	1.01		0.99 to 1.02
Past year smoker	No				Reference		
	Yes				1.25		0.9 to 1.73
Motivation to cut down drinking	None				Reference		
	Moderate				2.85	***	1.99 to 4.08
	High				5.27	***	3.32 to 8.36
AUDIT Score	8-15				Reference		
	16-19				2.94	***	1.79 to 4.82
	20+				11.76	***	7.68 to 18.02
Constant		0.03	***	0 to 0.21	0.01	***	0 to 0.06

Key: * p<0.05, ** p<0.01, ***, p<0.001

Table S12 - Logistic regression results for factors associated with likelihood of receiving Brief Intervention for risky alcohol use: socioeconomic-adjusted models 1 & 2

		Socioeconomic-adjusted models 1 & 2					
		OR		95% CI	OR		95% CI
Age	18-24	Reference					
	25-34	1.49		0.76 to 2.91	1.49		0.76 to 2.89
	35-44	2.25	*	1.19 to 4.26	2.33	*	1.23 to 4.41
	45-54	3.12	***	1.76 to 5.54	3.22	***	1.79 to 5.79
	55-64	3.50	***	1.91 to 6.43	3.35	***	1.8 to 6.24
	65+	5.47	***	2.96 to 10.13	5.23	***	2.78 to 9.85
Gender	Male	Reference					
	Female	0.60	**	0.42 to 0.87	0.63	*	0.44 to 0.9
Region	North	Reference					
	Midlands	1.22		0.82 to 1.81	1.22		0.82 to 1.81
	South	0.80		0.56 to 1.16	0.81		0.56 to 1.16
Children in the household	None	Reference					
	≥1	1.07		0.69 to 1.66	1.07		0.7 to 1.64
Self-reported disability	No	Reference					
	Yes	2.01	***	1.37 to 2.95	2.18	***	1.49 to 3.18
Ethnicity	White	Reference					
	Mixed race	2.28		0.71 to 7.33	2.11		0.68 to 6.59
	Asian	0.64		0.13 to 3.15	0.66		0.13 to 3.34
	Black	0.15	*	0.02 to 0.98	0.17		0.02 to 1.22
	Arab/other	9.81	**	2.03 to 47.41	8.65	**	1.74 to 42.91
Time trend (monthly)		1.00		0.99 to 1.02	1.00		0.99 to 1.02
Past year smoker	No	Reference					
	Yes	1.13		0.81 to 1.58	1.22		0.88 to 1.71
Motivation to cut down drinking	None	Reference					
	Moderate	2.94	***	2.04 to 4.23	2.95	***	2.04 to 4.26
	High	5.35	***	3.36 to 8.53	5.47	***	3.42 to 8.73
AUDIT Score	8-15	Reference					
	16-19	2.78	***	1.67 to 4.64	2.76	***	1.67 to 4.55
	20+	10.91	***	7.1 to 16.78	11.20	***	7.32 to 17.13
Social grade	AB	Reference					
	C1	1.02		0.66 to 1.58			
	C2	0.88		0.53 to 1.44			
	D	1.29		0.73 to 2.26			
	E	2.03	**	1.2 to 3.42			
Education	University				Reference		
	A-level				1.16		0.72 to 1.88
	GCSE				1.17		0.76 to 1.79
	Other				1.50		0.81 to 2.81
	None				1.52		0.9 to 2.58
Constant		0.01	***	0 to 0.06	0.01	***	0 to 0.06

Key: * p<0.05, ** p<0.01, ***, p<0.001

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Table S13 - Logistic regression results for factors associated with likelihood of receiving Brief Intervention for risky alcohol use: socioeconomic-adjusted models 3 & 4

		Socioeconomic-adjusted models 3 & 4					
		OR		95% CI	OR		95% CI
Age	18-24	Reference					
	25-34	1.60		0.8 to 3.21	1.59		0.81 to 3.12
	35-44	2.49	**	1.29 to 4.82	2.69	**	1.4 to 5.15
	45-54	3.48	***	1.94 to 6.25	3.81	***	2.13 to 6.82
	55-64	3.44	***	1.88 to 6.3	4.18	***	2.19 to 7.97
	65+	4.78	***	2.6 to 8.8	6.78	***	3.54 to 13.01
Gender	Male	Reference					
	Female	0.58	**	0.4 to 0.84	0.60	**	0.42 to 0.87
Region	North	Reference					
	Midlands	1.19		0.8 to 1.78	1.23		0.82 to 1.83
	South	0.76		0.53 to 1.08	0.77		0.53 to 1.1
Children in the household	None	Reference					
	≥1	1.09		0.7 to 1.69	1.03		0.66 to 1.59
Self-reported disability	No	Reference					
	Yes	2.10	***	1.43 to 3.09	2.10	***	1.43 to 3.08
Ethnicity	White	Reference					
	Mixed race	2.18		0.73 to 6.52	2.15		0.72 to 6.41
	Asian	0.69		0.14 to 3.5	0.62		0.12 to 3.24
	Black	0.15		0.02 to 1.11	0.16		0.02 to 1.1
	Arab/other	8.36	*	1.55 to 45.13	9.37	**	1.86 to 47.14
Time trend (monthly)		1.00		0.98 to 1.02	1.00		0.98 to 1.02
Past year smoker	No	Reference					
	Yes	1.20		0.86 to 1.67	1.08		0.77 to 1.51
Motivation to cut down drinking	None	Reference					
	Moderate	2.93	***	2.04 to 4.22	2.88	***	2 to 4.14
	High	5.25	***	3.3 to 8.37	5.28	***	3.31 to 8.4
AUDIT Score	8-15	Reference					
	16-19	2.88	***	1.74 to 4.76	2.95	***	1.77 to 4.9
	20+	11.09	***	7.2 to 17.1	12.06	***	7.81 to 18.62
Employment status	Full-time	Reference					
	Other	1.53	*	1.06 to 2.21			
Housing tenure	Owned				Reference		
	Rented				1.49	*	1.05 to 2.13
Constant		0.01	***	0 to 0.06	0.01	***	0 to 0.06

Key: * p<0.05, ** p<0.01, ***, p<0.001

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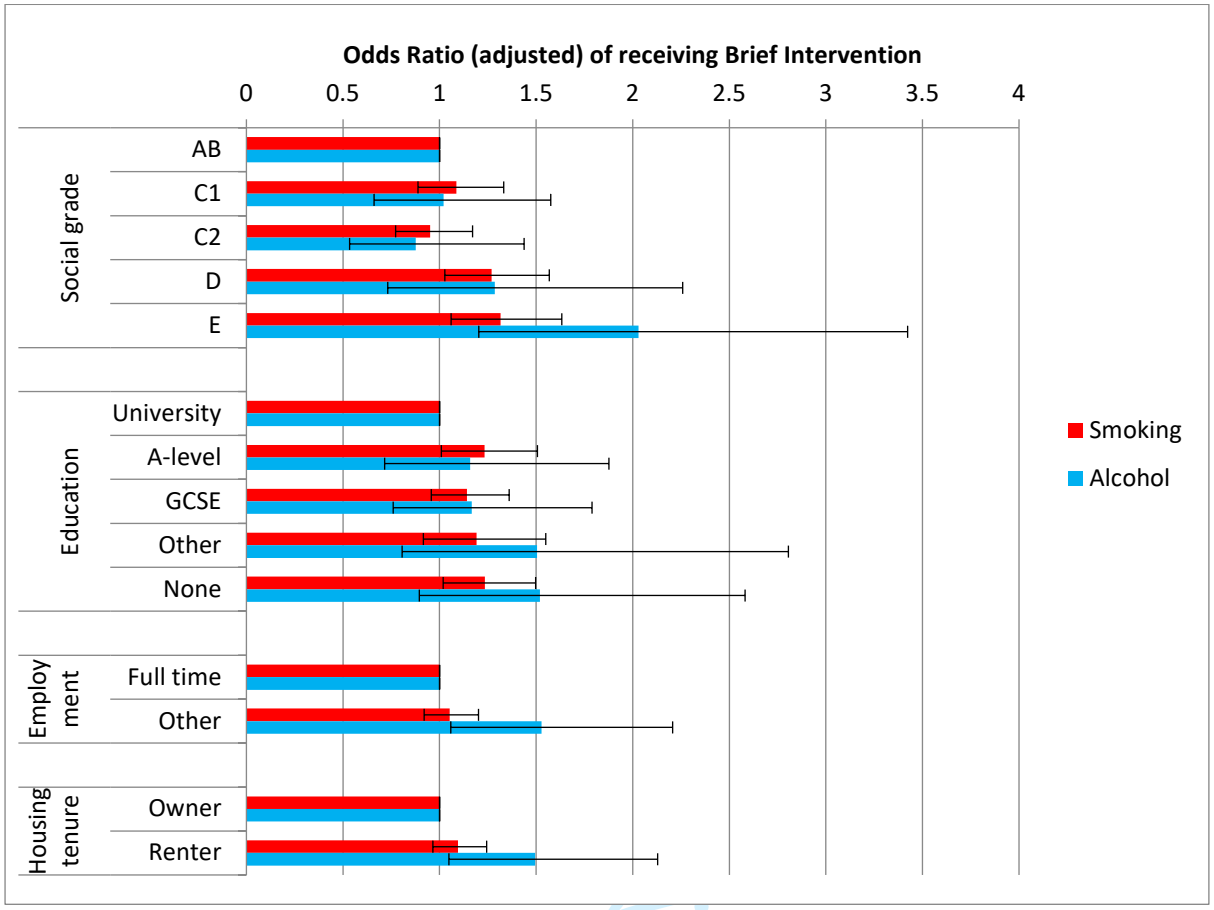
Figure S2 - Independent effects of four measures of socioeconomic status on Odds Ratio of receiving a Brief Intervention for smoking or risky drinking



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Descriptive statistics

Table S14 – Unweighted Ns underlying Table 2

		Past year smokers			Risky drinkers		
		Prevalence in population	Visited GP in past year	Received BI | visited GP	Prevalence in population	Visited GP in past year	Received BI | visited GP
Population		10067	6513	3237	6089	3975	258
Social grade	AB	1186	770	365	1437	995	73
	C1	2639	1698	824	2145	1413	90
	C2	2337	1431	667	1207	747	52
	D	2060	1314	664	715	466	38
	E	1845	1300	717	585	354	71
Education	University	1721	1063	485	1707	1142	82
	A-level	1866	1157	570	1669	980	57
	GCSE	3518	2296	1111	1711	1141	100
	Other	714	474	243	424	301	31
	None	2184	1479	799	556	393	52
Employment	Full time	3593	2051	962	3511	2414	231
	Other	6467	4459	2273	2575	1559	91
Housing tenure	Owner	6043	3889	1952	2621	1600	155
	Renter	3861	2537	1246	3377	2322	166

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Main analysis – additional model results

Behaviour-adjusted model results for smoking

Table S15 – Logistic regression results for factors associated with likelihood of receiving Brief Intervention for smoking

		Behaviour-adjusted model		
		OR		95% CI
Age	18-24			
	25-34	1.36	**	1.12 to 1.65
	35-44	1.56	***	1.28 to 1.91
	45-54	1.98	***	1.63 to 2.41
	55-64	2.23	***	1.81 to 2.75
	65+	2.14	***	1.73 to 2.65
Gender	Male			
	Female	0.97		0.86 to 1.09
Region	North			
	Midlands	0.93		0.81 to 1.07
	South	0.78	***	0.68 to 0.89
Children in the household	None			
	≥1	1.08		0.94 to 1.25
Self-reported disability	No			
	Yes	1.40	***	1.21 to 1.62
Ethnicity	White			
	Mixed race	0.87		0.56 to 1.35
	Asian	0.86		0.67 to 1.11
	Black	1.00		0.68 to 1.49
	Arab/other	0.92		0.51 to 1.66
Time trend (monthly)		1.00		1 to 1.01
Risky drinker (AUDIT 8+)	No	Reference		
	Yes	0.84	*	0.73 to 0.97
Motivation to cut down smoking	None	Reference		
	Moderate	1.42	***	1.25 to 1.63
	High	2.14	***	1.79 to 2.57
Constant		0.37	*	0.17 to 0.8

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Behaviour-adjusted model results for risky drinking

Table S16– Logistic regression results for factors associated with likelihood of receiving Brief Intervention for risky drinking

		Behaviour-adjusted model		
		OR		95% CI
Age	18-24			
	25-34	1.44		0.76 to 2.75
	35-44	2.11	*	1.12 to 3.96
	45-54	3.00	***	1.72 to 5.23
	55-64	3.30	***	1.8 to 6.03
	65+	5.00	***	2.71 to 9.23
Gender	Male			
	Female	0.64	*	0.45 to 0.91
Region	North			
	Midlands	1.18		0.8 to 1.75
	South	0.80		0.56 to 1.13
Children in the household	None			
	≥1	1.06		0.69 to 1.63
Self-reported disability	No			
	Yes	2.27	***	1.57 to 3.27
Ethnicity	White			
	Mixed race	2.19		0.7 to 6.86
	Asian	3.38		0.68 to 16.88
	Black	0.19		0.02 to 1.62
	Arab/other	8.64	**	1.81 to 41.21
Time trend (monthly)		1.00		0.98 to 1.02
Past year smoker	No	Reference		
	Yes	1.20		0.86 to 1.66
Motivation to cut down drinking	None	Reference		
	Moderate	2.85	***	2 to 4.05
	High	5.17	***	3.29 to 8.14
AUDIT Score	8-15	Reference		
	16-19	2.94	***	1.81 to 4.79
	20+	11.84	***	7.77 to 18.04
Constant		0.01	***	0 to 0.08

Reporting checklist for cross sectional study.

Based on the STROBE cross sectional guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

Upload your completed checklist as an extra file when you submit to a journal.

In your methods section, say that you used the STROBE cross sectional reporting guidelines, and cite them as:

von Elm E, Altman DG, Egger M, Pocock SJ, Gotzsche PC, Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for reporting observational studies.

		Reporting Item	Page Number
Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	1
Abstract	#1b	Provide in the abstract an informative and balanced summary of what was done and what was found	2
Background / rationale	#2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	#3	State specific objectives, including any prespecified hypotheses	3
Study design	#4	Present key elements of study design early in the paper	3
Setting	#5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	3

Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants.	3
	#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	3-4
Data sources / measurement	#8	For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give information separately for for exposed and unexposed groups if applicable.	4
Bias	#9	Describe any efforts to address potential sources of bias	4
Study size	#10	Explain how the study size was arrived at	6
Quantitative variables	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	3-4
Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	4-5
	#12b	Describe any methods used to examine subgroups and interactions	n/a
	#12c	Explain how missing data were addressed	4
	#12d	If applicable, describe analytical methods taking account of sampling strategy	4
	#12e	Describe any sensitivity analyses	4
Participants	#13a	Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give information separately for for exposed and unexposed groups if applicable.	6
	#13b	Give reasons for non-participation at each stage	n/a
	#13c	Consider use of a flow diagram	n/a

Descriptive data	#14a	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.	6
	#14b	Indicate number of participants with missing data for each variable of interest	4
Outcome data	#15	Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable.	6
Main results	#16a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	7, 9, 12
	#16b	Report category boundaries when continuous variables were categorized	5
	#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	14
Key results	#18	Summarise key results with reference to study objectives	14
Limitations	#19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	14
Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	14-15
Generalisability	#21	Discuss the generalisability (external validity) of the study results	14-15
Funding	#22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	15