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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

Colin Angus<sup>\*</sup>, MSc, Sheffield Alcohol Research Group, School of Health and Related Research, University of Sheffield, UK Jamie Brown, PhD, Health Behaviour Research Centre, Department of Epidemiology and Community health, University College London, UK Emma Beard, PhD, Department of Clinical, Educational and Health Psychology, University College London, UK Duncan Gillespie, PhD, Sheffield Alcohol Research Group, School of Health and Related Research, University of Sheffield, UK Penny Buykx, PhD, Sheffield Alcohol Research Group, School of Health and Related Research, University of Sheffield, UK Eileen Kaner, PhD, Institute of Health and Society, University of Newcastle upon Tyne, UK Susan Michie, PhD, Department of Clinical, Educational and Health Psychology, University College London, UK Petra S Meier, PhD, Sheffield Alcohol Research Group, School of Health and Related Research, University of Sheffield, UK \* Corresponding author Address: Regent Court, Regent Street, Sheffield, S1 4DA, UK Tel 0114 2220686. Email c.r.angus@sheffield.ac.uk

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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 (<u>https://osf.io/5eq4h/</u>). As the only continuous variable in the analysis, age was standardised and tested for non-linearity using the Box-

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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.

		Past year smokers (n=6450)	Risky drinkers (n=3974)
	18-24	1051 (16.2%)	877 (23.2%)
	25-34	1222 (18.8%)	539 (14.2%)
A = = = (0/)	35-44	1052 (16.2%)	572 (15.1%)
Age, n (%)	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%)
	North	2540 (39.1%)	1974 (49.7%)
Region, n (%)	Midlands	1730 (26.6%)	716 (18.0%)
	South	2234 (34.3%)	1282 (32.3%)
Children in the househ	old, n (%)	1406 (21.8%)	924 (23.3%)
Disability, n (%)		1275 (19.8%)	494 (12.4%)
	White	5812 (89.6%)	3813 (96.3%)
	Mixed race	111 (1.7%)	59 (1.5%)
Ethnicity, n (%)	Asian	353 (5.4%)	39 (1.0%)
	Black	147 (2.3%)	39 (1.0%)
	Arab/other	61 (0.9%)	10 (0.3%)
Mativation to out	None	1649 (27.3%)	
Notivation to cut	Moderate	3415 (56.5%)	
down smoking, n (%)	High	978 (16.2%)	
Risky drinker, n (%)		1446 (22.4%)	
	8-15		2372 (60.2%)
AUDIT score, n (%)	16-19		1273 (32.3%)
	20+		296 (7.5%)
Mativation to aut	None		2329 (60.2%)
iviotivation to cut	Moderate		1247 (32.2%)
down drinking, n (%)	High		292 (7.5%)
Past year smoker, n (%	)		1446 (36.4%)

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

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 AB), while the gradient in risky drinking was less 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.

## 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	Who visited GP in	Who received BI	Prevalence in	Who visited GP in	Who received BI
		population	past year	visited GP	population	past year	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)
	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)
Social grade	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)
	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)
Education	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	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)
tenure	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 Alevels 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

		Demo	graphic	-adjusted model	Behavioural and Socioeconomic-adjusted models											
		OR		95% CI	OR		95% CI	OR		95% CI	OR		95% CI	OR		95% CI
	18-24	Refere	nce													
	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
4.00	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
Age	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
Condor	Male	Refere	nce													
Gender	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
	North	Refere	nce													
Region	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	None	Refere	nce													
household	≥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	No	Refere	nce													
disability	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
	White	Refere	nce													
	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
Ethnicity	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	No															
8+)	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	None															
down smoking	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
down shloking	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
	AB				Refere	nce										
	C1				1.08		0.88 to 1.32									
Social grade	C2				0.96		0.78 to 1.17				· · · ·					
	D				1.26	*	1.02 to 1.55									
	E				1.30	*	1.05 to 1.61									
	University							Refere	nce							
	A-level							1.24	*	1.02 to 1.51						
Education	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										Refere	nce				
	Other										1.05		0.92 to 1.2			
Housing tenure	Owned													Refere	nce	

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	Rented			1						1.10	0.97 t
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 t

#### **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.

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

		Demogra n	phic-adjusted nodel			Be	havioural an	d Socio	economic-adjuste	ed model	s				
		OR	95% CI	OR		95% CI	OR		95% CI	OR		95% CI	OR		95% CI
Age	18-24 25-34 35-44 45-54	Reference 1.56 2.49 ** 2.74 ***	0.84 to 2.89 1.39 to 4.47 1.63 to 4.62	1.46 2.05 2.86	*	0.77 to 2.78 1.09 to 3.86 1.62 to 5.07	1.46 2.14 2.98	*	0.76 to 2.80 1.13 to 4.07 1.65 to 5.39	1.60 2.42 3.33	** ***	0.82 to 3.14 1.26 to 4.64 1.86 to 5.97	1.51 2.32 3.43	** ***	0.79 to 2.85 1.23 to 4.36 1.95 to 6.01
	55-64 65+	2.26 ** 2.68 **	1.30 to 3.93 1.53 to 4.71	3.23 4.94	*** ***	1.76 to 5.92 2.66 to 9.15	3.20 4.74	*** ***	1.71 to 5.99 2.50 to 9.02	3.24 4.41	*** ***	1.77 to 5.93 2.41 to 8.08	3.93 6.11	*** ***	2.11 to 7.33 3.25 to 11.5
Gender	Male Female	Reference 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 Midlands South	Reference 1.21 0.85	0.84 to 1.73 0.62 to 1.16	1.20 0.84		0.81 to 1.77 0.58 to 1.20	1.18 0.83		0.80 to 1.75 0.58 to 1.18	1.19 0.78		0.80 to 1.77 0.55 to 1.11	1.20 0.80		0.81 to 1.78 0.56 to 1.15
Children in the household	None ≥1	Reference 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 Yes	Reference 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 Mixed race Asian Black Arab/other	Reference 2.20 3.44 0.35 4.41	0.73 to 6.60 0.98 to 12.0 0.07 to 1.86 0.95 to 20.4	2.29 3.18 0.17 9.58	**	0.72 to 7.32 0.66 to 15.4 0.02 to 1.31 1.98 to 46.4	2.14 3.47 0.19 8.29	**	0.68 to 6.71 0.69 to 17.4 0.02 to 1.63 1.70 to 40.4	2.17 3.47 0.17 8.02	*	0.72 to 6.52 0.70 to 17.2 0.02 to 1.54 1.51 to 42.5	2.09 3.17 0.18 8.78	**	0.71 to 6.17 0.65 to 15.5 0.02 to 1.51 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 Yes			Referen 1.09	ice	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 High			2.94 5.26	*** ***	2.06 to 4.20 3.33 to 8.30	2.91 5.27	*** ***	2.03 to 4.17 3.34 to 8.32	2.85 5.01	*** ***	2.00 to 4.06 3.18 to 7.90	2.93 5.18	*** ***	2.06 to 4.18 3.29 to 8.14
AUDIT Score	8-15 16-19 20+			2.77 10.9	*** ***	1.68 to 4.56 7.12 to 16.6	2.81 11.7	*** ***	1.72 to 4.59 7.67 to 17.7	2.88 11.5	*** ***	1.76 to 4.73 7.54 to 17.6	2.86 11.4	*** ***	1.75 to 4.69 7.47 to 17.5
Social grade	AB C1 C2 D E			Reference 0.97 0.84 1.20 2.11	се **	0.63 to 1.49 0.51 to 1.36 0.68 to 2.10 1.27 to 3.52									
Education	University A-level GCSE Other None						Reference 1.10 1.12 1.48 1.45		0.68 to 1.79 0.73 to 1.71 0.80 to 2.72 0.86 to 2.44						
Employment status	Full-time Other									Refere	nce *	1.08 to 2.25			
Housing tenure	Owned Rented						_						Refere 1.55	nce *	1.09 to 2.20

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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, 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

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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

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

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alcohol retail monopoly. JB and EB have both received unrestricted research funding from Pfizer relating to smoking cessation studies.

#### 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 **BMJ** Open





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

211x125mm (96 x 96 DPI)

# 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'; iii) '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 asked about my drinking' or 'Yes, a doctor or other health worker within my GP surgery asked about my drinking').

#### Behaviour-adjusted model results for smoking

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

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#### Behaviour-adjusted model results for risky drinking

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

		Behaviou	r-adjı	isted model
		OR		95% CI
	18-24			
	25-34	1.44		0.76 to 2.75
A	35-44	2.11	*	1.12 to 3.96
Age	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
andar	Male			
Jender	Female	0.64	*	0.45 to 0.91
	North			
Region	Midlands	1.18		0.8 to 1.75
	South	0.80		0.56 to 1.13
Children in the bousehold	None			
	≥1	1.06		0.69 to 1.63
Self-reported disability	No			
	Yes	2.27	***	1.57 to 3.27
	White			
	Mixed race	2.19		0.7 to 6.86
thnicity	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
ime trend (monthly)		1.00		0.98 to 1.02
ast vear smoker	No	Reference		
ust year smoker	Yes	1.20		0.86 to 1.66
	None	Reference		
Motivation to cut down drinking	Moderate	2.85	***	2 to 4.05
	High	5.17	***	3.29 to 8.14
	8-15	Reference		
AUDIT Score	16-19	2.94	***	1.81 to 4.79
	20+	11.84	***	7.77 to 18.04
		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	Visited GP in past	Received BI   visited	Prevalence in	Visited GP in past	Received BI
		population	year	GP	population	year	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)
			4				
	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)
Social grade	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)
				0			
	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)
Education	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)
Frankausant	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)
Employment	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	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)
tenure	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)

		Demographic-adjusted model			Behaviour-adjusted model				
		OR		95% CI	OR		95% CI		
	18-24	Referenc	e						
	25-34	1.36	***	1.14 to 1.61	1.32	**	1.1 to 1.59		
4.55	35-44	1.59	***	1.33 to 1.9	1.60	***	1.33 to 1.93		
Age	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		
Candar	Male	Reference	ce						
Gender	Female	1.00 0.91 to 1.11			0.98		0.88 to 1.09		
	North	Referenc	e						
Region	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							
ciliaren in the nousehold	≥1	1.12 0.99 to 1.26			1.07		0.94 to 1.21		
Self-reported disability	No	Reference	e						
	Yes	1.43	***	1.25 to 1.62	1.45	***	1.26 to 1.66		
	White	Reference	e						
	Mixed race	0.83		0.56 to 1.22	0.78		0.52 to 1.17		
Ethnicity	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 (ALIDIT 8+)	No					Reference			
	Yes	_			0.89		0.78 to 1.01		
	None				Referen	ce			
Motivation to cut down smoking	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		
ey: * p<0.05, ** p<0.01, ***, p<0.	001								

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

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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
	18-24	Refer	ence				
	25-34	1.35	**	1.12 to 1.62	1.34	**	1.12 to 1.61
0	35-44	1.64	***	1.36 to 1.98	1.63	***	1.35 to 1.97
Age	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
Conder	Male	Refer	ence				
Gender	Female	0.96		0.86 to 1.08	0.98		0.88 to 1.09
	North	Refer	ence				
Region	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	Refer	ence				
Children in the household	≥1	1.05		0.92 to 1.2	1.06		0.93 to 1.21
	No	Refer	ence				
Self-reported disability	Yes	1.38	***	1.2 to 1.58	1.42	***	1.24 to 1.63
	White	Refer	ence				
	Mixed race	0.77		0.51 to 1.16	0.79		0.52 to 1.19
Ethnicity	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
Dialog drinker (AUDIT Qu)	No	Refer	ence				
Risky drinker (AUDIT 8+)	Yes	0.90		0.79 to 1.03	0.90		0.79 to 1.02
	None	Reference					
Motivation to cut down smoking	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
	AB	Refer	ence				
	C1	1.09		0.9 to 1.31			
Social grade	C2	0.92		0.76 to 1.12			
	D	1.21		0.99 to 1.47			
	E	1.29	*	1.06 to 1.58			
	University				Refer	ence	
	A-level				1.20	*	1 to 1.45
Education	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

intervention for smoking. socioeee	nonne-aujust		ucis.				
		Socioeconomic-adjusted models 3 & 4					
		OR		95% CI	OR		95% CI
	18-24	Refer	ence				
	25-34	1.34	**	1.12 to 1.61	1.32	**	1.11 to 1.59
4.50	35-44	1.62	***	1.34 to 1.96	1.63	***	1.35 to 1.97
Age	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
Candan	Male	Refer	ence				
Gender	Female	0.97		0.87 to 1.08	0.98		0.87 to 1.09
	North	Refer	ence				
Region	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
Colf reported disphility	No	Refer	ence				
Self-reported disability	Yes	1.42	***	1.24 to 1.63	1.41	***	1.22 to 1.62
	White	Reference					
	Mixed race	0.78		0.52 to 1.17	0.77		0.51 to 1.16
Ethnicity	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
Dicky dripkor (AUDIT 8)	No	Refer	ence				
RISKY UTITIKET (AUDIT 8+)	Yes	0.89		0.78 to 1.02	0.89		0.78 to 1.02
	None	Refer	ence	$\mathbf{N}_{\mathbf{A}}$			
Motivation to cut down smoking	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	Refer	ence				
	Other	1.07		0.95 to 1.22			
	Owned				Refer	ence	
	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						

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

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			Behaviou	Behaviour-adjusted mode		
		OR		95% CI	OR		95% CI	
	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	
Age	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	
	Male	Reference		102 10 1120			2100 10 010	
Gender	Female	0.72	*	0 53 to 0 96	0.67	*	0.48 to 0.93	
	North	Reference		0.33 10 0.30	0.07		0.40 10 0.55	
Region	Midlands	1 26		0 9 to 1 75	1 30		0 9 to 1 88	
	South	1.20		0.5 to 1.75	1.50		0.5 (0 1.00	
	Nono	1.01		0.75 to 1.36	0.96		0.69101.34	
Children in the household	None S1	Reference		0.5. 4.04	0.05			
	21	0.72		0.5 to 1.04	0.95		0.64 to 1.41	
Self-reported disability	NO	Reference	4.4.4.			4.4.4		
	Yes	2.91	***	2.16 to 3.91	1.91	***	1.36 to 2.68	
	white	Reference						
	Mixed race	1.45		0.5 to 4.19	1.61		0.51 to 5.09	
Ethnicity	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 vear smoker	No				Reference			
	Yes				1.20		0.88 to 1.64	
	None				Reference			
Motivation to cut down drinking	Moderate				2.64	***	1.91 to 3.65	
	High				4.54	***	2.96 to 6.96	
	8-15				Reference			
AUDIT Score	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							

		Socioeconomic-adjusted models 1 & 2					
		OR		95% CI	OR		95% CI
	18-24	Referen	nce				
	25-34	1.59		0.85 to 2.99	1.63		0.86 to 3.1
4.50	35-44	2.40	**	1.33 to 4.33	2.54	**	1.39 to 4.64
Age	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
Condor	Male	Referen	nce				
Gender	Female	0.66	*	0.47 to 0.91	0.68	*	0.49 to 0.94
	North	Referen	nce				
Region	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	Referen	nce				
children in the household	≥1	0.96		0.64 to 1.43	0.95		0.64 to 1.41
Solf reported disability	No	Reference					
Sell-reported disability	Yes	1.67	**	1.17 to 2.38	1.84	**	1.3 to 2.6
	White	Referen	nce				
	Mixed race	1.60		0.5 to 5.08	1.57		0.49 to 4.99
Ethnicity	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 smaker	No	Reference					
Past year smoker	Yes	1.08		0.78 to 1.49	1.17		0.85 to 1.6
	None	Referer	nce	2			
Motivation to cut down drinking	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
	8-15	Referen	nce				
AUDIT Score	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
	AB	Referen	nce				
	C1	1.05		0.71 to 1.55			
Social grade	C2	0.89		0.56 to 1.42			
	D	1.32		0.79 to 2.2			
	E	2.09	**	1.28 to 3.41			
	University				Referen	nce	
	A-level				1.09		0.7 to 1.69
Education	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
1011 * D CO OF ** D CO O1 *** D CO	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

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

		Socioeconomic-adjusted models 3 & 4					4
		OR		95% CI	OR		95% CI
	18-24	Refere	nce				
	25-34	1.83		0.97 to 3.45	1.70		0.91 to 3.18
A	35-44	2.91	***	1.6 to 5.27	2.83	**	1.57 to 5.12
Age	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
Candar	Male	Refere	nce				
Gender	Female	0.63	**	0.45 to 0.88	0.67	*	0.48 to 0.93
	North	Refere	nce				
Region	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	Refere	nce				
	≥1	0.96		0.64 to 1.43	0.96		0.65 to 1.44
Self-reported disability	No	Refere	nce				
	Yes	1.75	**	1.24 to 2.47	1.72	**	1.22 to 2.44
	White	Reference					
	Mixed race	1.58		0.5 to 5.03	1.53		0.49 to 4.81
Ethnicity	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
Dast year smeller	No	Refere	nce				
Past year smoker	Yes	1.17		0.85 to 1.6	1.05		0.76 to 1.45
	None	Refere	nce	$\mathbf{N}$			
Motivation to cut down drinking	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
	8-15	Refere	nce				
AUDIT Score	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	Refere	nce				
Employment status	Other	1.62	**	1.14 to 2.29			
Housing tonuro	Owned				Referen	nce	
	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	
	18-24	Referen	ce					
	25-34	1.37	**	1.14 to 1.65	1.34	**	1.1 to 1.63	
A	35-44	1.54	***	1.27 to 1.87	1.53	***	1.25 to 1.88	
Age	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	
Candar	Male	Referen	ce					
Gender	Female	1.01		0.91 to 1.13	0.97		0.86 to 1.09	
	North	Referen	ce					
Region	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 boundhold	None	Referen	ce					
Children in the nousehold	≥1	1.14		1 to 1.31	1.08		0.94 to 1.25	
Solf reported disability	No	Referen	ce					
Sell-reported disability	Yes	1.39	***	1.21 to 1.6	1.42	***	1.23 to 1.64	
	White	Referen	ce					
	Mixed race	0.93		0.61 to 1.41	0.86		0.55 to 1.34	
Ethnicity	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	
Disky drinker (AUDIT 8)	No				Reference			
KISKY UTTIKET (AUDIT 8+)	Yes				0.86	*	0.74 to 0.99	
	None			4	Referer	nce		
Motivation to cut down smoking	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				1			

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					& 2
		OR		95% CI	OR		95% CI
	18-24	Refere	ence				
	25-34	1.36	**	1.12 to 1.66	1.37	**	1.12 to 1.66
4.70	35-44	1.58	***	1.29 to 1.94	1.58	***	1.28 to 1.94
Age	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
Conder	Male	Refere	ence				
Gender	Female	0.95		0.84 to 1.07	0.96		0.86 to 1.09
	North	Refere	ence				
Region	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	Refere	ence				
	≥1	1.07		0.93 to 1.23	1.08		0.93 to 1.24
Self-reported disability	No	Refere	ence				
	Yes	1.35	***	1.16 to 1.57	1.39	***	1.2 to 1.61
	White	Refere	ence				
	Mixed race	0.84		0.54 to 1.33	0.83		0.53 to 1.3
Ethnicity	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
Picky dripkor (ALIDIT 8)	No	Refere	ence				
KISKY UTITIKET (AUDIT 8+)	Yes	0.87		0.76 to 1.01	0.87		0.75 to 1
	None	Refere	ence	$\mathbf{N}$			
Motivation to cut down smoking	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
	AB	Refere	ence				
	C1	1.09		0.89 to 1.33			
Social grade	C2	0.95		0.77 to 1.17			
	D	1.27	*	1.03 to 1.57			
	E	1.32	*	1.06 to 1.63			
	University				Refere	ence	
	A-level				1.23	*	1.01 to 1.51
Education	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
	18-24	Refere	ence				
	25-34	1.35	**	1.11 to 1.65	1.35	**	1.11 to 1.64
1.70	35-44	1.55	***	1.26 to 1.9	1.59	***	1.3 to 1.96
Age	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
Condor	Male	Refere	ence				
Gender	Female	0.96		0.85 to 1.08	0.99		0.87 to 1.11
	North	Refere	ence				
Region	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	Refere	ence				
Children in the nousenoid	≥1	1.08		0.94 to 1.25	1.07		0.92 to 1.23
Solf reported disability	No	Reference					
Sell-reported disability	Yes	1.40	***	1.2 to 1.62	1.41	***	1.21 to 1.64
	White	Reference					
	Mixed race	0.86		0.55 to 1.34	0.86		0.55 to 1.33
Ethnicity	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 (ALIDIT 8+)	No	Refere	ence				
	Yes	0.86	*	0.74 to 0.99	0.86	*	0.75 to 1
	None	Refere	ence				
Motivation to cut down smoking	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	Refere	ence				
	Other	1.05		0.92 to 1.2			
Housing tenure	Owned				Refere	ence	
	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

		Demographic-adjusted model		Behaviour-adjusted mod			
		OR		95% CI	OR		95% CI
	18-24	Reference					
	25-34	1.59		0.84 to 3.01	1.45		0.74 to 2.83
A	35-44	2.65	**	1.45 to 4.82	2.28	*	1.2 to 4.31
Age	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
_	Male	Reference					
Gender	Female	0.65	*	0.47 to 0.9	0.62	**	0.43 to 0.89
	North	Reference					
Region	Midlands	1.23		0.86 to 1.78	1.21		0.81 to 1.8
ů l	South	0.82		0.6 to 1.14	0.77		0.54 to 1.1
	None	Reference		0.0 10 1.14	0.77		0.54 to 1.1
Children in the household	>1	0.70		0 53 to 1 18	1.07		0 7 to 1 65
	No	D.75		0.55 (0 1.18	1.07		0.7 (0 1.05
Self-reported disability	Ves	3 52	***	2 57 +0 4 92	2.27	***	1 57 +0 2 29
	White	Boforonco		2.57 10 4.85	2.27		1.57 (0 5.26
	Mixed race	2 22		0.74 to 0.02	2.10		0740007
Ethnicity	Acian	1.06		0.74 to 6.63	2.19		0.7 to 6.87
Ethnicity		0.22		0.27 to 4.24	0.65		0.13 to 3.33
	DIdCK	0.52		0.08 to 1.36	0.17	-	0.02 to 1.16
Time trend (menthly)	Arab/other	4.01		1 to 21.21	9.03	**	1.87 to 43.55
	NI -	1.01	_	0.99 to 1.02	1.01		0.99 to 1.02
Past year smoker	NO Xaa				Reference		
	Yes	-			1.25		0.9 to 1.73
	None				Reference		
Motivation to cut down drinking	Moderate				2.85	***	1.99 to 4.08
	High				5.27	***	3.32 to 8.36
	8-15				Reference		
AUDIT Score	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
<b>Key:</b> * p<0.05, ** p<0.01, ***, p<0	001						

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

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
	18-24	Refere	nce				
	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
Age	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
Candar	Male	Refere	nce				
Gender	Female	0.60	**	0.42 to 0.87	0.63	*	0.44 to 0.9
	North	Refere	nce				
Region	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	Refere	nce				
	≥1	1.07		0.69 to 1.66	1.07		0.7 to 1.64
Self-reported disability	No	Refere	nce				
	Yes	2.01	***	1.37 to 2.95	2.18	***	1.49 to 3.18
	White	Refere	nce				
	Mixed race	2.28		0.71 to 7.33	2.11		0.68 to 6.59
Ethnicity	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 vear smoker	No	Refere	nce				
	Yes	1.13		0.81 to 1.58	1.22		0.88 to 1.71
	None	Refere	nce				
Motivation to cut down drinking	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
	8-15	Refere	nce				
AUDIT Score	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
	AB	Refere	nce				
	C1	1.02		0.66 to 1.58			
Social grade	C2	0.88		0.53 to 1.44			
	D	1.29		0.73 to 2.26			
	E	2.03	**	1.2 to 3.42			
	University				Referen	nce	
	A-level				1.16		0.72 to 1.88
Education	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

	iujusteu mout		-				
		Socio	econo	mic-adjusted	models	53&4	1
		OR		95% CI	OR		95% CI
	18-24	Refere	nce				
	25-34	1.60		0.8 to 3.21	1.59		0.81 to 3.12
4.50	35-44	2.49	**	1.29 to 4.82	2.69	**	1.4 to 5.15
Age	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
Candan	Male	Refere	nce				
Gender	Female	0.58	**	0.4 to 0.84	0.60	**	0.42 to 0.87
	North	Refere	nce				
Region	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	Refere	nce				
	≥1	1.09		0.7 to 1.69	1.03		0.66 to 1.59
Self-reported disability	No	Refere	nce				
	Yes	2.10	***	1.43 to 3.09	2.10	***	1.43 to 3.08
	White	Reference					
	Mixed race	2.18		0.73 to 6.52	2.15		0.72 to 6.41
Ethnicity	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	Refere	nce				
	Yes	1.20		0.86 to 1.67	1.08		0.77 to 1.51
	None	Refere	nce				
Motivation to cut down drinking	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
	8-15	Refere	nce				
AUDIT Score	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	Refere	nce				
	Other	1.53	*	1.06 to 2.21			
Housing tenure	Owned				Referen	nce	
	Rented				1.49	*	1.05 to 2.13
Constant		0.01	***	0 to 0.06	0.01	***	0 to 0.06

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

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

C2

D

Е

University

Education

Employ ment

Housing tenure

A-level

GCSE

Other

None

Full time

Other

Owner

Renter



Figure S2 - Independent effects of four measures of socioeconomic status on Odds Ratio of receiving a Brief



Smoking

Alcohol

# 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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31 32 33			Reporting Item	Page Number
34 35 36 37	Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	1
38 39 40 41	Abstract	#1b	Provide in the abstract an informative and balanced summary of what was done and what was found	2
42 43 44 45	Background / rationale	#2	Explain the scientific background and rationale for the investigation being reported	3
46 47 48 49	Objectives	#3	State specific objectives, including any prespecified hypotheses	3
50 51	Study design	#4	Present key elements of study design early in the paper	3
52 53 54 55	Setting	#5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	3
56 57 58 59 60	Eligibility criteria	<b>#6a</b> For p	Give the eligibility criteria, and the sources and methods of selection of participants. eer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml	3

1 2 3 4 5		#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	3-4
6 7 8 9 10 11 12 13	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
14 15 16	Bias	#9	Describe any efforts to address potential sources of bias	4
16 17 18	Study size	#10	Explain how the study size was arrived at	6
19 20 21 22 23	Quantitative variables	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	3-4
24 25 26 27	Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	4-5
28 29 30 31		#12b	Describe any methods used to examine subgroups and interactions	n/a
32 33		#12c	Explain how missing data were addressed	4
34 35 36 37		#12d	If applicable, describe analytical methods taking account of sampling strategy	4
38 39		#12e	Describe any sensitivity analyses	4
40 41 42 43 44 45 46 47 48	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
40 49 50		#13b	Give reasons for non-participation at each stage	n/a
51 52		#13c	Consider use of a flow diagram	n/a
53 54 55 56 57 58 59 60	Descriptive data	<b>#14a</b> For pee	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

1 2 3		#14b	Indicate number of participants with missing data for each variable of interest	4
4 5 6 7 8 9	Outcome data	#15	Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable.	6
10 11 12 13 14 15	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
16 17 18 19		#16b	Report category boundaries when continuous variables were categorized	5
20 21 22 23		#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
24 25 26 27	Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	14
28 29	Key results	#18	Summarise key results with reference to study objectives	14
30 31 32 33 34	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
35 36 37 38 39 40	Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	14-15
41 42 43 44	Generalisability	#21	Discuss the generalisability (external validity) of the study results	14-15
45 46 47 48 49	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
50 51	The STROBE chee	cklist is	distributed under the terms of the Creative Commons Attribution Lie	cense
52	CC-BY. This check	klist was	s completed on 06. April 2018 using http://www.goodreports.org/, a	tool
53 54 55 56 57 58	made by the <u>EQU</u>	ATOR N	letwork in collaboration with Penelope.ai	
59 60		For pe	er review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml	

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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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Keywords:	Alcohol, Smoking, Brief Interventions, Health Inequalities, PRIMARY CARE, PUBLIC HEALTH
	•

## SCHOLARONE<sup>™</sup> Manuscripts

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

Colin Angus<sup>\*</sup>, MSc, Sheffield Alcohol Research Group, School of Health and Related Research, University of Sheffield, UK Jamie Brown, PhD, Health Behaviour Research Centre, Department of Epidemiology and Community health, University College London, UK Emma Beard, PhD, Department of Clinical, Educational and Health Psychology, University College London, UK Duncan Gillespie, PhD, Sheffield Alcohol Research Group, School of Health and Related Research, University of Sheffield, UK Penny Buykx, PhD, Sheffield Alcohol Research Group, School of Health and Related Research, University of Sheffield, UK Eileen Kaner, PhD, Institute of Health and Society, University of Newcastle upon Tyne, UK Susan Michie, PhD, Department of Clinical, Educational and Health Psychology, University College London, UK Petra S Meier, PhD, Sheffield Alcohol Research Group, School of Health and Related Research, University of Sheffield, UK \* Corresponding author Address: Regent Court, Regent Street, Sheffield, S1 4DA, UK Tel 0114 2220686. Email c.r.angus@sheffield.ac.uk

Word count: 3519

Keywords: Alcohol, Smoking, Brief Interventions, Health Inequalities, Primary Care, Public Health

## 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

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 Page 5 of 26

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imputation and analyses were undertaken using Stata 12 [30] following a plan pre-registered with the Open Science Framework prior to any data analysis (<u>https://osf.io/5eq4h/</u>). 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.

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

		Past year	Dieles drinkere
		smokers	Risky drinkers
		(n=6513)	(11=3975)
	18-24	1051 (16.1%)	877 (22.1%)
	25-34	1222 (18.8%)	539 (13.6%)
	35-44	1052 (16.2%)	572 (14.4%)
Age, n (%)	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%)
	Male	3253 (49.9%)	2600 (65.4%)
Sex, n (%)	Female	3260 (50.1%)	1375 (34.6%)
	Missing	0 (0%)	0 (0%)
	North	2540 (39%)	1974 (49.7%)
Design (0/)	Midlands	1730 (26.6%)	716 (18%)
region, n (%)	South 🦯	2234 (34.3%)	1282 (32.3%)
	Missing	9 (0.1%)	3 (0.1%)
Children in the	Yes	4308 (66.1%)	3030 (76.2%)
	No	2205 (33.9%)	945 (23.8%)
nousenoia, ñ (%)	Missing	0 (0%)	0 (0%)
	Yes	5121 (78.6%)	3420 (86%)
Disability, n (%)	No	1275 (19.6%)	494 (12.4%)
	Missing	117 (1.8%)	61 (1.5%)
	White	5812 (89.2%)	3813 (95.9%)
	Mixed race	111 (1.7%)	59 (1.5%)
Ethnicity n (0/)	Asian	353 (5.4%) 🥖	39 (1%)
Eunificity, II (%)	Black	147 (2.3%)	39 (1%)
	Arab/other	61 (0.9%)	10 (0.3%)
	Missing	29 (0.4%)	15 (0.4%)
	None	1649 (25.3%)	4
Motivation to cut	Moderate	3415 (52.4%)	
down smoking, n (%)	High	978 (15%)	
	Missing	471 (7.2%)	
	Yes	5004 (76.8%)	
Risky drinker, n (%)	No	1446 (22.2%)	
	Missing	63 (1%)	
	8-15		3504 (88.2%)
	16-19		251 (6.3%)
AUDIT score, h (%)	20+		220 (5.5%)
	Missing		0 (0%)
	None		2372 (59.7%)
Motivation to cut	Moderate		1273 (32%)
down drinking, n (%)	High		296 (7.4%)
<u>.</u>	Missing		34 (0.9%)
	Yes		2528 (63.6%)
Past year smoker, n (%)	No		1446 (36.4%)
	Missing		1 (0%)

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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 ruτ, grade, are ilius. 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	Who visited GP in	Who received BI	Prevalence in	Who visited GP in	Who received BI
		population	past year	visited GP	population	past year	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)
	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)
Social grade	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)
	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)
Education	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)
Frankaumant	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)
Employment	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	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)
tenure	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

		Demo	graphic	-adjusted model					Behav	vioural and Socioe	conomic-	adjuste	d models			
		OR		95% CI	OR		95% CI	OR		95% CI	OR		95% CI	OR		95% CI
	18-24	Referen	nce													
	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
Age	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
Condor	Male	Referen	nce													
Genuer	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
	North	Referen	nce	-	6											
Region	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	None	Referen	nce													
household	≥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	No	Referen	nce													
disability	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
	White	Referen	nce											ļ		
	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
Ethnicity	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	No															
8+)	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	None															
down smoking	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
down shioking	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
	AB				Refere	nce										
	C1				1.08		0.88 to 1.32									
Social grade	C2				0.96		0.78 to 1.17									
	D				1.26	*	1.02 to 1.55									
	E				1.30	*	1.05 to 1.61									
	University							Refere	nce							
	A-level							1.24	*	1.02 to 1.51						
Education	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										Refere	nce				
	Other										1.05		0.92 to 1.20			
Housing tenure	Owned	1												Refere	nce	

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11          Rented       1.10         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       **	11          Rented       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       **											
Rented         1.10           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         **	Rented         1.10           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         **	Rented       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       **	11									
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         **	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         **	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     **	Rented									1.10
			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 **

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#### 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

		Demograp	ohic-adjusted			Ве	havioural a	nd Socio	peconomic-adjuste	ed model	s				
		m		0.0		05% 01	0.0			0.0			0.0		
r		UR	95% CI	UR		95% CI	UK		95% CI	OR		95% CI	OR		95% CI
	18-24	Reference	0.84 to 2.80	1.40		0.77 to 2.70	1.40		0.76 to 2.80	1.00		0.02 to 2.14	1 - 1		0 70 to 2 05
	25-34	1.50	0.84 to 2.89	1.40	*	0.77 to 2.78	1.40	*	0.76 10 2.80	1.60	**	0.82 to 3.14	1.51	**	0.79 to 2.85
Age	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	1.03 10 4.02	2.80	***	1.62 10 5.07	2.98	***	1.05 (0 5.39	3.33	***	1.80 10 5.97	3.43	***	1.95 10 6.01
	55-64	2.26 **	1.30 to 3.93	3.23	***	1.76 to 5.92	3.20	***	1./1 to 5.99	3.24	***	1.77 to 5.93	3.93	***	2.11 to 7.33
	05+	2.08	1.53 t0 4.71	4.94		2.00 10 9.15	4.74		2.50 10 9.02	4.41		2.41 to 8.08	0.11		3.25 10 11.5
Gender	Iviale	Reference	0.40 to 0.92	0.62	**	0.42 to 0.90	0.65	*	0.45 to 0.02	0.60	**	0 42 to 0 95	0.64	*	0.45 to 0.01
	Feilidie	0.00 Reference	0.49 10 0.95	0.62		0.45 10 0.89	0.05		0.45 10 0.92	0.00		0.42 10 0.85	0.04		0.45 10 0.91
Bogion	North	1 21	$0.94 \pm 0.1.72$	1 20		0 91 to 1 77	1 10		0 90 to 1 75	1 10		0 90 to 1 77	1 20		0 91 to 1 79
Region	South	1.21	0.64 to 1.75	1.20		0.61 to 1.77	1.10		0.60 to 1.75	1.19		0.80 to 1.77	1.20		0.81 t0 1.78
Childron in the	Nono	0.85 Reference	0.62 (0 1.16	0.84		0.58 to 1.20	0.83		0.58 (0 1.18	0.78		0.55 to 1.11	0.80		0.56 10 1.15
children in the	None	0 70	0 52 to 1 17	1.06		0.60 to 1.64	1.06		0.60 to 1.62	1.06		0.60 to 1.64	1.09		0 70 to 1 65
Solf reported	21	0.79 Reference	0.55 (0 1.17	1.00		0.09 10 1.04	1.00		0.09 (0 1.02	1.00		0.09 (0 1.04	1.08		0.70 to 1.05
disability	Voc	2 / 7 ***	2 54 to 4 74	1 07	**	1 34 to 2 90	2.16	***	1 49 to 3 14	2 00	***	1 42 to 3 06	2.09	***	1 /3 to 3 0/
uisability	White	Beference	2.34 (0 4.74	1.57		1.54 to 2.50	2.10		1.45 (0 5.14	2.05		1.42 10 5.00	2.05		1.45 (0 5.04
	Mixed race	2 20	0 73 to 6 60	2 20		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
Ethnicity	Acian	2.20	0.73 to 0.00	2.2.5		0.72 to 7.52	2.14		0.69 to 17 /	2.17		0.72 to 0.52	2.05		0.65 to 15 5
Ethnicity	Plack	0.25	0.07 to 1.96	0.17		0.00 to 13.4	0.10		0.03 to 17.4	0.17		0.70 to 17.2	0.19		0.03 to 15.5
	Arah/other	0.33	0.07 to 1.80	0.17	**	1.02 to 1.51	0.19 8 20	**	1 70 to 40 4	8.02	*	1.51 to 1.54	0.10 8 78	**	1 77 to 13 5
Time trend (monthly)	Alab/other	1.00	0.95 to 20.4	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
nine trend (montiny)	No	1.00	0.55 to 1.02	Referen	re	0.50 to 1.02	1.00		0.50 (0 1.02	1.00		0.50 to 1.02	1.00	-	0.50 to 1.02
Past year smoker	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
	None			1.05		0.75 to 1.52	1.17		0.04 10 1.02	1.10		0.04 to 1.02	1.07		0.77 to 1.45
Motivation to cut	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
down drinking	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
	8-15			5.20		5.55 10 0.50	5.27		5.54 (0 0.52	5.01		5.10 10 7.50	5.10		5.25 10 0.14
ALIDIT Score	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
	AB			Reference	re										
	C1			0.97		0.63 to 1.49									
Social grade	C2			0.84		0.51 to 1.36							— —		
Boolar Braac	D			1.20		0.68 to 2.10							— —		
	E			2.11	**	1.27 to 3.52									
	University						Referenc	e							
	A-level						1.10		0.68 to 1.79						
Education	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									Refere	nce				
Employment status	Other									1.56	*	1.08 to 2.25			
Housing toouro	Owned												Refere	nce	
nousing tenure	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
INSERT FIGURE 2	ABOUT HERE													

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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, 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 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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41	FIGU	RE LEGENDS
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43	Figur	e 1 - Unadjusted socioeconomic gradients in prevalence, GP attendance and BI receipt for smokers and
44	riskv	drinkers
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46	Eigur	a 2 Independent fully adjusted association of socioeconomic position with Odds Patio of resolving a
47	Figur	e 2 - Independent, fully-adjusted, association of socioeconomic position with Odds Ratio of receiving a
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Smoker

Risky drinker



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# 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.

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31				Page
32 33			Reporting Item	Number
34 35 36 37	Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	1
38 39 40 41	Abstract	#1b	Provide in the abstract an informative and balanced summary of what was done and what was found	2
42 43 44 45	Background / rationale	#2	Explain the scientific background and rationale for the investigation being reported	3
46 47 48 49	Objectives	#3	State specific objectives, including any prespecified hypotheses	3
50 51	Study design	#4	Present key elements of study design early in the paper	3
52 53 54 55 56 57 58 50	Setting	#5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	3
59 60		For pe	er review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml	

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1 2 3	Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants.	3
4 5 6 7 8 9		#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	3-4
10 11 12 13 14 15 16 17	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
18 19	Bias	#9	Describe any efforts to address potential sources of bias	4
20 21	Study size	#10	Explain how the study size was arrived at	6
22 23 24 25 26 27	Quantitative variables	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	3-4
28 29 30 31	Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	4-5
32 33 34		#12b	Describe any methods used to examine subgroups and interactions	n/a
35 36 37		#12c	Explain how missing data were addressed	4
38 39 40 41		#12d	If applicable, describe analytical methods taking account of sampling strategy	4
42 43		#12e	Describe any sensitivity analyses	4
44 45 46 47 48 49 50 51 51	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
52 53 54		#13b	Give reasons for non-participation at each stage	n/a
55 56 57 58		#13c	Consider use of a flow diagram	n/a
59 60		For pee	r review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml	

1 2 3 4 5 6	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
7 8 9 10		#14b	Indicate number of participants with missing data for each variable of interest	4
11 12 13 14 15	Outcome data	#15	Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable.	6
16 17 18 19 20 21 22	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
23 24 25 26		#16b	Report category boundaries when continuous variables were categorized	5
27 28 29 30		#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
31 32 33	Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	14
35 36	Key results	#18	Summarise key results with reference to study objectives	14
37 38 39 40 41	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
42 43 44 45 46	Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	14-15
47 48 49 50	Generalisability	#21	Discuss the generalisability (external validity) of the study results	14-15
51 52 53 54 55 56 57 58	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
59 60		For pee	er review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml	

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

Colin Angus <sup>*</sup> , MSc, Sheffield Alcohol Research Group, School of Health and Related Research,
University of Sheffield, UK
Jamie Brown, PhD, Health Behaviour Research Centre, Department of Epidemiology and Community
health, University College London, UK
Emma Beard, PhD, Department of Clinical, Educational and Health Psychology, University College
London, UK
Duncan Gillespie, PhD, Sheffield Alcohol Research Group, School of Health and Related Research,
University of Sheffield, UK
Penny Buykx, PhD, Sheffield Alcohol Research Group, School of Health and Related Research,
University of Sheffield, UK
Eileen Kaner, PhD, Institute of Health and Society, University of Newcastle upon Tyne, UK
Susan Michie, PhD, Department of Clinical, Educational and Health Psychology, University College
London, UK
Petra S Meier, PhD, Sheffield Alcohol Research Group, School of Health and Related Research,
University of Sheffield, UK
* Corresponding author
Address: Regent Court, Regent Street, Sheffield, S1 4DA, UK
Tel 0114 2220686.
Email c.r.angus@sheffield.ac.uk
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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 selfreported 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:

 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.
 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

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 imputation and analyses were undertaken using Stata 12 [30] following a plan pre-registered with the Open Science Framework prior to any data analysis (<u>https://osf.io/5eq4h/</u>). 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.

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

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

 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 , of , drinking, sipt for smos drinkers are cons ustrated in Figure 1. 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.

			Past year smokers			Risky drinkers	
		Prevalence in	Who visited GP in	Who received BI	Prevalence in	Who visited GP in	Who received BI
		population	past year	visited GP	population	past year	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)
	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)
Social grade	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)
	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)
Education	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)
	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)
Employment	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	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)
tenure	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

		Demo	graphic	-adjusted model					Behav	vioural and Socioe	conomic-	adjusted	l models			
		OR		95% CI	OR		95% CI	OR		95% CI	OR		95% CI	OR		95% CI
	18-24	Refere	nce													
	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
Age	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
Candan	Male	Refere	nce 🧹													
Gender	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
	North	Refere	nce													
Region	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	None	Refere	nce													
household	≥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	No	Refere	nce				5									
disability	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
	White	Refere	nce													
	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
Ethnicity /	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	No															
8+)	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	None															
down smoking	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
down shloking	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
	AB				Refere	nce										
	C1				1.08		0.88 to 1.32									
Social grade	C2				0.96		0.78 to 1.17									
	D				1.26	*	1.02 to 1.55									
	E				1.30	*	1.05 to 1.61									
	University							Refere	nce							
	A-level							1.24	*	1.02 to 1.51						
Education	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										Refere	nce				
	Other										1.05		0.92 to 1.20			
Housing tenure	Owned													Refere	nce	

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	Rented												1.10	
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 **	
			For peer rev	view on	ıly - hti	tp://bmjopen.	omj.con	n/site/a	about/guidel	ines.xht	ml			
			For peer rev	view on	ıly - htt	tp://bmjopen.l	omj.com	n/site/a	about/guidel	ines.xht	ml			

#### 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

		Der	mograp m	ohic-adjusted lodel			Be	havioural an	d Soci	oeconomic-adjuste	ed models	s				
		OR		95% CI	OR		95% CI	OR		95% CI	OR		95% CI	OR		95% CI
	18-24	Refere	nce													
	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
1.00	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
Age	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
Condor	Male	Refere	nce													
Gender	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
	North	Refere	nce													
Region	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	None	Refere	nce													
household	≥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	No	Refere	nce													
disability	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
	White	Refere	nce													
	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
Ethnicity	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 vear smoker	No				Referen	ce										
	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	None															
down drinking	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
	8-15															
AUDIT Score	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
	AB				Referen	ce										
	C1				0.97		0.63 to 1.49									
Social grade	C2				0.84		0.51 to 1.36									
	D				1.20		0.68 to 2.10									
	E				2.11	**	1.27 to 3.52									
	University							Reference								
	A-level							1.10		0.68 to 1.79						
Education	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 Other										Refere	nce *	1.08 to 2.25			
Housing topuro	Owned													Refere	nce	
Trousing tenure	Rented													1.55	*	1.09 to 2.20

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14 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
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# 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 53 primary care patients at older ages [41], with greater motivation to quit or cut down [42] and for risky drinkers 54 with higher AUDIT scores [43]. Numerous explanations for the relatively low rate of BI delivery for risky drinking 55 have been suggested, including a lack of training and resources and the attitudes and beliefs of both practitioners 56 57 and patients [44-46]. 58

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#### 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52

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

CA, EB and PB's salaries are funded or part-funded by the National Institute for Health Research (NIHR)'s School for Public health Research (SPHR) and all have received funding from Cancer Research UK (CRUK); EK is a senior investigator in SPHR. JB is funded by CRUK and the Society for the Study of Addiction; SM is funded by CRUK. CA has received funding related to commissioned research from Systembolaget, the Swedish government-owned alcohol retail monopoly. CA and PM have received funding related to commissioned research from Alko, the Finnish government-owned alcohol retail monopoly. JB and EB have both received unrestricted research funding from Pfizer relating to smoking cessation studies.

# 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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47	Figur	e 1 - Unadjusted socioeconomic gradients in prevalence, GP attendance and BI receipt for smokers and
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51	Figur	e 2 - Independent, fully-adjusted, association of socioeconomic position with Odds Ratio of receiving a
52	Brief	Intervention for smoking or risky drinking
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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 worker within givin 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 asked about my drinking').

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#### 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	Visited GP in past	Received BI   visited	Prevalence in	Visited GP in past	Received BI
		population	year	GP	population	year	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)
		0					
	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)
Social grade	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)
	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)
Education	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)
Employment	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	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)
tenure	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)

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

		Demographic-adjusted			Behaviour-adjusted			
			m	odel		m	odel	
		OR		95% CI	OR		95% CI	
	18-24	Referen	се					
	25-34	1.36	***	1.14 to 1.61	1.32	**	1.1 to 1.59	
4.55	35-44	1.59	***	1.33 to 1.9	1.60	***	1.33 to 1.93	
Age	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	
Candar	Male	Referen	се					
Gender	Female	1.00		0.91 to 1.11	0.98		0.88 to 1.09	
	North	Referen	се					
Region	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	Referen	се					
Children in the household	≥1	1.12		0.99 to 1.26	1.07		0.94 to 1.21	
	No	Referen	се					
Self-reported disability	Yes	1.43	***	1.25 to 1.62	1.45	***	1.26 to 1.66	
	White	Referen	ce					
	Mixed race	0.83		0.56 to 1.22	0.78		0.52 to 1.17	
Ethnicity	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	
Picky drinker (ALIDIT 8)	No			)	Refere	nce		
Risky driftker (AODIT 8+)	Yes				0.89		0.78 to 1.01	
Mativation to put down	None				Refere	nce		
smoking	Moderate				1.42	***	1.25 to 1.6	
SHICKINg	High				2.21	***	1.87 to 2.61	
Constant		0.60		0.31 to 1.19	0.46	*	0.23 to 0.95	
<ey: *="" **="" ***,="" p<0.01,="" p<0.05,="" p<0.<="" td=""><td>001</td><td></td><td></td><td>?</td><td></td><td></td><td></td></ey:>	001			?				

		Socioeconomic-adjusted models 1 & 2					
		OR		95% CI	OR		95% CI
	18-24	Refer	ence				
	25-34	1.35	**	1.12 to 1.62	1.34	**	1.12 to 1.61
A = 2	35-44	1.64	***	1.36 to 1.98	1.63	***	1.35 to 1.97
Age	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
Gondor	Male	Refer	ence				
Gender	Female	0.96		0.86 to 1.08	0.98		0.88 to 1.09
	North	Refer	ence				
Region	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	Refer	ence				
	≥1	1.05		0.92 to 1.2	1.06		0.93 to 1.21
Self-reported disability	No	Refer	ence				
	Yes	1.38	***	1.2 to 1.58	1.42	***	1.24 to 1.63
	White	Refer	ence				
	Mixed race	0.77		0.51 to 1.16	0.79		0.52 to 1.19
Ethnicity	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
Bisky drinker (ALIDIT 8+)	No	Refer	ence				
	Yes	0.90		0.79 to 1.03	0.90		0.79 to 1.02
	None	Refer	ence				
Motivation to cut down smoking	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
	AB	Refer	ence				
	C1	1.09		0.9 to 1. <mark>3</mark> 1			
Social grade	C2	0.92		0.76 to 1.12			
	D	1.21		0.99 to 1.47			
	E	1.29	*	1.06 to 1.58			
	University				Refer	ence	
	A-level				1.20	*	1 to 1.45
Education	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

 Table S3 - Unweighted logistic regression results for factors associated with likelihood of receiving Brief

 Intervention for smoking: socioeconomic adjusted models 1 & 2

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

		Socioeconomic-adjusted models 3 & 4					
		OR		95% CI	OR		95% CI
	18-24	Refer	ence				
	25-34	1.34	**	1.12 to 1.61	1.32	**	1.11 to 1.59
4.50	35-44	1.62	***	1.34 to 1.96	1.63	***	1.35 to 1.97
Age	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
Gondor	Male	Refer	ence				
	Female	0.97		0.87 to 1.08	0.98		0.87 to 1.09
	North	Refer	ence				
Region	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					
Cillidren in the nodsenoid	≥1	1.06		0.93 to 1.21	1.06		0.93 to 1.21
Solf reported disability	No	Reference					
Sell-reported disability	Yes	1.42	***	1.24 to 1.63	1.41	***	1.22 to 1.62
	White	Reference					
	Mixed race	0.78		0.52 to 1.17	0.77		0.51 to 1.16
Ethnicity	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
Picky dripker (ALIDIT 8+)	No	Refer	ence				
	Yes	0.89		0.78 to 1.02	0.89		0.78 to 1.02
	None	Refer	ence				
Motivation to cut down smoking	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	Refer	ence				
	Other	1.07		0.95 to 1.22			
Housing tenure	Owned				Refer	ence	
	Rented				1.14	*	1.01 to 1.27
Constant		0.45	*	0.22 to 0.92	0.43	*	0.21 to 0.88

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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 mode		
		OR		95% CI	OR		95% CI
	18-24	Reference					
	25-34	1.77		1 to 3.15	1.62		0.87 to 3.03
A	35-44	2.92	***	1.7 to 5	2.52	**	1.41 to 4.53
Age	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
Conden	Male	Reference					
Gender	Female	0.72	*	0.53 to 0.96	0.67	*	0.48 to 0.93
	North	Reference					
Region	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					
Children in the household	≥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
	White	Reference					
	Mixed race	1.45		0.5 to 4.19	1.61		0.51 to 5.09
Ethnicity	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		
Fast year smoker	Yes				1.20		0.88 to 1.64
Mativation to cut down	None				Reference		
drinking	Moderate				2.64	***	1.91 to 3.65
urinking	High				4.54	***	2.96 to 6.96
	8-15				Reference		
AUDIT Score	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
ey: * p<0.05, ** p<0.01, ***, p<0.0	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
	18-24	Refere	nce				
	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
Age	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
	Male	Refere	nce				
Gender	Female	0.66	*	0.47 to 0.91	0.68	*	0.49 to 0.94
	North	Refere	nce				
Region	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
	None	Refere	nce				
Children in the nousehold	≥1	0.96		0.64 to 1.43	0.95		0.64 to 1.41
	No	Refere	nce				
Self-reported disability	Yes	1.67	**	1.17 to 2.38	1.84	**	1.3 to 2.6
	White	Refere	nce				
	Mixed race	1.60		0.5 to 5.08	1.57		0.49 to 4.99
Ethnicity	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
Dest user smaller	No	Refere	nce	•			
Past year smoker	Yes	1.08		0.78 to 1.49	1.17		0.85 to 1.6
	None	Refere	nce				
Motivation to cut down drinking	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
	8-15	Refere	nce				
AUDIT Score	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
	AB	Refere	nce				
	C1	1.05		0.71 to 1.55			
Social grade	C2	0.89		0.56 to 1.42			
	D	1.32		0.79 to 2.2			
	E	2.09	**	1.28 to 3.41			
	University				Refere	nce	
	A-level				1.09		0.7 to 1.69
Education	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

		Socioeconomic-adjusted models 3 & 4					
		OR		95% CI	OR		95% CI
	18-24	Referer	ice				
	25-34	1.83		0.97 to 3.45	1.70		0.91 to 3.18
4.50	35-44	2.91	***	1.6 to 5.27	2.83	**	1.57 to 5.12
Age	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
Conden	Male	Referer	nce				
Gender	Female	0.63	**	0.45 to 0.88	0.67	*	0.48 to 0.93
	North	Referer	nce				
Region	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 bousehold	None	Referer	ice				
children in the nousehold	≥1	0.96		0.64 to 1.43	0.96		0.65 to 1.44
Solf reported disability	No	Referer	nce				
	Yes	1.75	**	1.24 to 2.47	1.72	**	1.22 to 2.44
	White	Reference					
	Mixed race	1.58		0.5 to 5.03	1.53		0.49 to 4.81
Ethnicity	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	Referer	ice				
	Yes	1.17		0.85 to 1.6	1.05		0.76 to 1.45
	None	Referer	nce				
Motivation to cut down drinking	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
	8-15	Referer	ice				
AUDIT Score	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	Referer	ice				
	Other	1.62	**	1.14 to 2.29			
Housing tenure	Owned				Referer	nce	
	Rented				1.65	**	1.18 to 2.3
Constant		0.01	***	0 to 0.05	0.01	***	0 to 0.04

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



Figure S1 – Unweighted independent effects of four measures of socioeconomic status on Odds Ratio of



#### 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		Behaviour-adjusted			
		model			mode	I	
		OR		95% CI	OR		95% CI
	18-24	Reference	ce				
	25-34	1.37	**	1.14 to 1.65	1.34	**	1.1 to 1.63
4.50	35-44	1.54	***	1.27 to 1.87	1.53	***	1.25 to 1.88
Age	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
Gondor	Male	Reference					
Gender	Female	1.01		0.91 to 1.13	0.97		0.86 to 1.09
	North	Reference	ce				
Region	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	ce				
Children in the household	≥1	1.14	1.14 1 to 1.31				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
	White	Reference	ce				
	Mixed race	0.93		0.61 to 1.41	0.86		0.55 to 1.34
Ethnicity	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
Bisky drinker (ALIDIT 8+)	No				Referer	nce	
	Yes				0.86	*	0.74 to 0.99
Motivation to cut down	None				Referer	nce	
smoking	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
ey: * p<0.05, ** p<0.01, ***, p<0.0	001						

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
	18-24	Refere	ence				
	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
Age	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
Condon	Male	Refere	ence				
Gender	Female	0.95		0.84 to 1.07	0.96		0.86 to 1.09
	North	Refere	ence				
Region	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	Refere	ence				
	≥1	1.07		0.93 to 1.23	1.08		0.93 to 1.24
Self-reported disability	No	Refere	ence				
	Yes	1.35	***	1.16 to 1.57	1.39	***	1.2 to 1.61
	White	Reference					
	Mixed race	0.84		0.54 to 1.33	0.83		0.53 to 1.3
Ethnicity	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
Bisky dripkor (ALIDIT 8+)	No	Refer	ence				
Risky driffker (AODIT 8+)	Yes	0.87		0.76 to 1.01	0.87		0.75 to 1
	None	Refere	ence				
Motivation to cut down smoking	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
	AB	Refere	ence				
	C1	1.09		0.89 to 1.33			
Social grade	C2	0.95		0.77 to 1.17			
	D	1.27	*	1.03 to 1.57			
	E	1.32	*	1.06 to 1.63			
	University				Refere	ence	
	A-level				1.23	*	1.01 to 1.51
Education	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

#### Socioeconomic-adjusted models 3 & 4 95% CI 95% CI OR OR 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 Age 45-54 \*\*\* \*\*\* 1.63 to 2.43 2.03 1.66 to 2.49 1.99 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 Male Reference Gender Female 0.96 0.85 to 1.08 0.99 0.87 to 1.11 North Reference Midlands Region 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 None Reference Children in the household ≥1 1.08 1.07 0.94 to 1.25 0.92 to 1.23 No Reference Self-reported disability Yes \*\*\* \*\*\* 1.40 1.2 to 1.62 1.41 1.21 to 1.64 White Reference Mixed race 0.86 0.55 to 1.34 0.86 0.55 to 1.33 Ethnicity 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 No Reference Risky drinker (AUDIT 8+) Yes 0.86 \* 0.74 to 0.99 0.86 \* 0.75 to 1 None Reference Motivation to cut down smoking 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 Full-time Reference **Employment status** Other 1.05 0.92 to 1.2 Owned Reference Housing tenure Rented 1.10 0.97 to 1.24 Constant 0.33 \*\* 0.31 \*\* 0.15 to 0.72 0.14 to 0.69

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

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
	Male	Reference					
Gender	Female	0.65	*	0.47 to 0.9	0.62	**	0.43 to 0.89
	North	Reference					
Region	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

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

		Socioeconomic-adjusted models 1 & 2					
		OR		95% CI	OR		95% CI
	18-24	Refere	nce				
	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
Age	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
Candan	Male	Refere	nce				
Gender	Female	0.60	**	0.42 to 0.87	0.63	*	0.44 to 0.9
	North	Refere	nce				
Region	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	Refere	nce				
Children in the household	≥1	1.07		0.69 to 1.66	1.07		0.7 to 1.64
Solf reported disability	No	Refere	nce				
Self-reported disability	Yes	2.01	***	1.37 to 2.95	2.18	***	1.49 to 3.18
	White	Refere	nce				
	Mixed race	2.28		0.71 to 7.33	2.11		0.68 to 6.59
Ethnicity	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	Refere	nce				
	Yes	1.13		0.81 to 1.58	1.22		0.88 to 1.71
	None	Refere	nce				
Motivation to cut down drinking	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
	8-15	Refere	nce				
AUDIT Score	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	Refere	nce				
	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				Referen	nce	
	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
## 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
	18-24	Refere	nce				
	25-34	1.60		0.8 to 3.21	1.59		0.81 to 3.12
4.70	35-44	2.49	**	1.29 to 4.82	2.69	**	1.4 to 5.15
Age	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
Cander	Male	Refere	nce				
Gender	Female	0.58	**	0.4 to 0.84	0.60	**	0.42 to 0.87
	North	Refere	nce				
Region	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	Refere	nce				
	≥1	1.09		0.7 to 1.69	1.03		0.66 to 1.59
Solf reported disability	No	Refere	nce				
	Yes	2.10	***	1.43 to 3.09	2.10	***	1.43 to 3.08
	White	Refere	nce				
	Mixed race	2.18		0.73 to 6.52	2.15		0.72 to 6.41
Ethnicity	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	Refere	nce	•			
	Yes	1.20		0.86 to 1.67	1.08		0.77 to 1.51
	None	Refere	nce				
Motivation to cut down drinking	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
	8-15	Refere	nce				
AUDIT Score	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	Refere	nce				
	Other	1.53	*	1.06 to 2.21			
Housing tenure	Owned				Referer	nce	
	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



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

#### 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
	18-24			
	25-34	1.36	**	1.12 to 1.65
4.50	35-44	1.56	***	1.28 to 1.91
Age	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			
Gender	Female	0.97		0.86 to 1.09
	North			
Region	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
	White			
	Mixed race	0.87		0.56 to 1.35
Ethnicity	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 (ALIDIT 8+)	No	Referen	nce	
	Yes	0.84	*	0.73 to 0.97
	None	Referen	nce	
Motivation to cut down smoking	Moderate	1.42	***	1.25 to 1.63
	High	2.14	***	1.79 to 2.57
Constant		0.37	*	0.17 to 0.8

#### Behaviour-adjusted model results for risky drinking

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

		Behaviou	r-adjı	usted model
		OR		95% CI
	18-24			
	25-34	1.44		0.76 to 2.75
4.50	35-44	2.11	*	1.12 to 3.96
Age	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
Condor	Male			
Gender	Female	0.64	*	0.45 to 0.91
	North			
Region	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
Solf reported disability	No			
Sell-Lepol ted disability	Yes	2.27	***	1.57 to 3.27
	White			
	Mixed race	2.19		0.7 to 6.86
Ethnicity	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
	None	Reference		
Motivation to cut down drinking	Moderate	2.85	***	2 to 4.05
	High	5.17	***	3.29 to 8.14
	8-15	Reference		
AUDIT Score	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.

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

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		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
	For pe	er review only - http://bmiopen.hmi.com/site/about/quidelines.yhtml	

1 2 3	Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants.	3
4 5 6 7 8 9		#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	3-4
10 11 12 13 14 15 16 17	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
18 19	Bias	#9	Describe any efforts to address potential sources of bias	4
20 21 22	Study size	#10	Explain how the study size was arrived at	6
22 23 24 25 26 27	Quantitative variables	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	3-4
28 29 30 31	Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	4-5
32 33 34		#12b	Describe any methods used to examine subgroups and interactions	n/a
35 36 37		#12c	Explain how missing data were addressed	4
38 39 40 41		#12d	If applicable, describe analytical methods taking account of sampling strategy	4
42 43		#12e	Describe any sensitivity analyses	4
44 45 46 47 48 49 50 51 52	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
53 54		#13b	Give reasons for non-participation at each stage	n/a
55 56 57 58		#13c	Consider use of a flow diagram	n/a
59 60		For pee	er review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml	

1 2 3 4 5 6	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
7 8 9 10		#14b	Indicate number of participants with missing data for each variable of interest	4
11 12 13 14 15	Outcome data	#15	Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable.	6
17 18 19 20 21 22	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
23 24 25 26		#16b	Report category boundaries when continuous variables were categorized	5
27 28 29 30		#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
31 32 33 34	Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	14
35 36	Key results	#18	Summarise key results with reference to study objectives	14
37 38 39 40 41	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
42 43 44 45 46 47	Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	14-15
48 49 50	Generalisability	#21	Discuss the generalisability (external validity) of the study results	14-15
52 53 54 55 56 57 58 59	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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