Title

Impact of minimum unit pricing on alcohol-related emergency department attendances in Scotland: a natural experiment study

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Abstract

Background

Minimum Unit Pricing (MUP) was introduced in Scotland at 50p per unit (8g) of alcohol on 1st May 2018 to reduce alcohol consumption and associated harms. We assessed its impact on alcohol-related emergency department (ED) attendances, drinking patterns, and having an alcohol-related diagnosis amongst ED attendees.

Methods

We used a natural experiment approach to compare outcomes between Scotland (intervention group) and England (comparison group). Two EDs in Scotland and two in Northern England were recruited for one baseline and two post-intervention waves during selected weekday and weekend hours. Research nurses considered all attendees for interview, and recorded reasons for not interviewing attendees. The primary outcome was alcohol-related attendances among all recorded attendees. Secondary outcomes included alcohol-related diagnosis, binge drinking and high-risk drinking, and tested for differential effects across socioeconomic groups. Difference-in-difference regression models adjusted for age, sex and baseline covariates.

Findings

12,207 participants were recruited in Scotland and 11,248 in Northern England. The odds ratio for an alcohol-related attendance was 1.14 (95% CI 0.90-1.44) after the introduction of MUP in Scotland relative to Northern England, after controlling for covariates. It is estimated that an additional 1.0% (95% CI -0.7% to 2.7%) of the ED attendances were alcohol-related than would have been the case in the absence of MUP. Meanwhile, the odds for an attendee having at least one alcohol-related diagnosis increased after MUP (OR=1.25, 95%CI 1.00-1.57). There was no evidence of substantive differences in the majority of other secondary outcomes after the introduction of MUP in Scotland, or of differential effects across socioeconomic groups.

Interpretation

We found no evidence that MUP impacted on alcohol-related ED attendances, suggesting that the underlying price may not have been high enough.

Word limits: 293/250

Research in context

Evidence before this study

Excessive alcohol consumption is a major cause of disease and death across the world. In the European context, Scotland, where the real price of alcohol has reduced over recent years, is particularly badly affected. There is a dose-response relationship between the alcohol price and the amount consumed. We carried out an initial narrative literature review in 2012 when Minimum Unit Pricing was first considered in Scotland, and updated our review in 2020. We searched Medline, Psychinfo and Google Scholar for papers on alcohol and minimum unit price. Although similar interventions have been implemented elsewhere (e.g. Canada, Russia) the evidence for MUP's impacts on health specifically, as opposed to minimum pricing policies in general (which have often set differing minimum prices based on beverage type), came only from modelling studies, and these showed MUP was the most effective pricing policy for public health. The only empirical study to date has shown a fall in consumption following MUP in Scotland. The level for MUP at 50p per unit of alcohol was set in 2012 based on the modelling, and retained without adjustment for inflation after consultation in 2017.

Added value of this study

This is the first evaluation of the national implementation of MUP based on pure alcohol content to evaluate its impacts on alcohol-related emergency department (ED) attendances, drinking patterns, and alcohol-related diagnosis amongst ED attendees.

We found no clear evidence in the ED setting that MUP at a level of 50p per unit of alcohol reduced alcohol-related attendances. Similarly, there was no evidence for a consistent effect on different age, sex and socioeconomic population subgroups.

Implications of all the available evidence

We found no evidence in the ED context that a 50p MUP provides health benefits or harm in Scotland after a one year period. Despite that, if other forthcoming evidence shows MUP improves health in other settings, in combination with recent evidence of reductions in alcohol sales following MUP in Scotland, it would suggest MUP may be worth retaining. We consider our findings to likely reflect the nature of harms within the ED setting and during the relatively short time period studied. Therefore, there may indeed be no effect on ED attendances for MUP at the 50p per unit level. The implication is that the price per unit for MUP should be raised and then further evaluated. Modelling certainly suggested greater effect at an increased price level, so it would be logical to test whether that holds in the real world. Finally, there may be further lessons here for the design of policy and associated evaluations to maximise their chances of finding the clearest results and answers.

Introduction

Alcohol accounts for 2.8 million deaths every year, approximately 10% of all deaths worldwide 2016.[1] Alcohol misuse not only affects public health, but also contributes to socioeconomic inequalities in health. The lowest socioeconomic groups are considered more likely to report extreme heavy drinking, and to experience greater alcohol harm for similar levels of alcohol consumption in comparison to higher socioeconomic groups.[2 3] The Scottish Government has been implementing a range of strategies to reduce alcohol consumption, alcohol-related harms, and health inequalities.[4] Minimum Unit Pricing (MUP) of alcohol was an innovative and high-profile component of a comprehensive alcohol strategy.

There is considerable evidence of an inverse alcohol price-consumption relationship.[5-7] These studies show that pricing policies are one of the most effective strategies to reduce alcohol consumption and the associated health harms.[5-9] Data modelling suggested that MUP would be an effective policy for reducing alcohol consumption and associated health harms.[5 6 10] Recent findings also show that the introduction of MUP has significantly reduced alcohol-related harms in the Northern Territory, Australia.[11] The Sheffield Alcohol Policy Model[10], in particular, indicated that MUP would be effective in targeting heavier drinkers with lower incomes. Therefore, health inequalities are likely to be reduced by the introduction of MUP.

The Alcohol (Minimum Pricing) (Scotland) Bill was first introduced to the Scottish Parliament on 31 October 2011 and passed in May 2012. After a series of legal challenges from the alcohol industry, the UK Supreme Court confirmed that the MUP legislation was lawful and proportionate in November 2017. On 1 May 2018, Scotland became the first country to carry out a national implementation of a MUP for alcohol. Under the new legislation, the minimum price is set to be 50p per UK unit of pure alcohol (1 unit is 8g/10mL ethanol). Unlike the MUP policies in some Canadian provinces that introduced a minimum price for selling specific beverages or the policies in the Northern Territories in Australia that introduced a minimum price for per standard drink, the minimum price in Scotland is based purely on alcohol content without reference to beverage type. In 2016, the Sheffield Alcohol Policy Model estimated a 50p minimum unit price would be effective in reducing alcohol consumption in Scotland by 3.5% per year, particularly among harmful (7.0%) and hazardous drinkers (2.5%) who are at greatest risk of alcohol harms.[10] Recent evidence suggests MUP has reduced population alcohol consumption in Scotland,[12] but the impact on particular groups and on alcohol-related harm is less conclusive.[13 14]

Emergency Department (ED) attendances are likely to be sensitive to changes in alcohol-related harms as they reflect both acute and chronic health problems. There is only limited evidence regarding alcohol use disorder on ED, or the sensitivity of ED to detect policy changes. Therefore, we assessed the impact of MUP on alcohol-related ED attendances and drinking patterns amongst the ED attendees, and whether this varied by age, sex, and socioeconomic group.

Methods

Study design

Since alcohol-related attendances to EDs that do not result in admission are not routinely, we collected primary data in EDs to examine changes in alcohol-related attendance and in patterns of alcohol consumption among attendees that occur as a result of MUP. We employed a repeated cross-sectional design to compare outcome measures between Scotland and Northern England as a natural experiment. Northern England was chosen as a comparison group as alcohol consumption levels, and culture are more similar to Scotland.[15 16] The natural experiment was

the introduction of MUP in Scotland and we used Northern England as a control using regression analysis to compare changes since baseline.

Setting

We recruited one large hospital with an ED in each of four cities of comparable population size, two exposed to MUP in Scotland (Glasgow and Edinburgh), and two unexposed in Northern England (Liverpool and Sheffield).

Data collection took place over three, three-week waves. Following the decision to implement MUP, there was time for a single baseline, taken as quickly as possible (February 2018) to minimise behaviour changes in anticipation of implementation. There were two post-implementation follow-ups, in September to October 2018 and February 2019. In each wave, data collection took place from 20:00 until 03:30 the following day from Thursday to Sunday, and from 09:00 to 16:30 on Monday to Wednesday.

We also requested anonymised information (sex, age group, and diagnoses) collected routinely on all attendees over the three-week collection periods for each wave.

Participants

Trained research nurses considered all attendees for approach. Attendees who were clearly clinically inappropriate or unavailable were not approached, and therefore ineligible for the study. Research nurses used iPad to record the reasons for not approaching, sex and age group for those who were not approached.

Attendees who were approached by research nurses were then given written information about the study and had up to 40 minutes to decide whether to take part. Face-to-face structured interviews were carried out by research nurses using iPad. There was a formal screening where the approached attendees were asked eligibility questions before consent was taken. The eligibility criteria were: age ≥ 16 years, able to speak English or interpreter available, a new ED presentation during that shift, conscious, well enough (physically and mentally), sober enough (alcohol or drugs), still in the department for interview (i.e. had not left or been admitted), and safe for staff to approach. Eligible respondents were then asked to sign their consent on an iPad, and whether they further consented to linkage of their hospital notes to the interview data. For respondents who consented to the data linkage, we requested date of birth, full postcode, and diagnoses. More detail about reasons for not being approached, interviews being terminated, and failing the inclusion criteria can be found in Appendix 1.

Variables

Exposures and outcomes

Exposure to MUP was defined as living in Scotland after the introduction of MUP. We, therefore, considered attendees in Scottish EDs were exposed to MUP from Wave 2 onwards and not in Wave 1. On the other hand, attendees in Northern England were not exposed to MUP at any wave.

The primary outcome of interest was alcohol-related attendances among attendees who were recorded by research nurses through either observation or interview. An attendance was alcohol-related if the attendee was not eligible for interview owing to alcohol intoxication (for those who were not approached by research nurses or those who terminated the interview), or if the respondents reported binge-drinking (≥ 6/8 units for women/men) in the last 24 hours, or self-reported the attendance was alcohol-related due to their own or another's drinking.

We analysed alcohol-related diagnosis as a secondary outcome. The anonymised data requested from hospitals allowed us to examine all attendees during the three study periods. A diagnosis was alcohol-related if attributable to alcohol consumption according to the definition used by NHS Health Scotland.[17] Appendix 2 lists the alcohol-related conditions which are based on International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10) codes. [18]

We further examined secondary outcomes among respondents who completed the interviews. Three dichotomous outcomes were assessed: current alcohol use, binge-drinking in the past week, and binge-drinking in the past 24 hours. Then, we examined three other secondary outcomes among respondents who were current drinkers. These outcomes were FAST [19] [20] (FAST Alcohol Screening Test) score as a continuous measure, alcohol misuse (FAST score 3+), and increased alcohol use in the past year as two dichotomous outcomes.

Covariates

Our primary outcome focuses on attendees who were recorded by research nurses through either observation or interview. Research nurses recorded sex and age group for attendees based on their observation. This information allowed us to adjust for sex and age group in the analysis of the primary outcome.

The anonymised data from the hospitals contained information about sex and age group of all attendees. Therefore, we adjusted for sex and age group in the analysis of alcohol-related diagnosis.

The questionnaire covered sociodemographic data, including sex, age, ethnicity, employment status, marital status and housing ownership. Area-based deprivation scores were assigned to each interviewee based on their postcode of residence. We used 2011 Carstairs area deprivation scores[21] calculated for wards in England and postcode sectors in Scotland.[22] This gave geographies with similarly sized populations and so a measure of deprivation comparable across all four EDs and the two countries. In Scotland, postcode sectors were sometimes split between two Carstairs deciles where a postcode covered two councils. We used a population weighting method to assign a Carstairs score to the whole postcode dependent on the population split between the councils. These variables were used as covariates when we analysed secondary outcomes.

Statistical analysis

We evaluated the impact of the implementation of MUP by fitting fixed-effect multivariate regression models. For our primary analysis, we fitted the following models:

Model 1: $\quad y = \beta_0 + \beta_1 MUP + \beta_2 country + \beta_3 time + \varepsilon$

Model 2: $\quad y = \beta_0 + \beta_1 MUP + \beta_2 hospital + \beta_3 wave + \varepsilon$

Model 3: $\quad y = \beta_0 + \beta_1 MUP + \beta_2 hospital + \beta_3 wave + \beta_4 covariates + \varepsilon$

where y is the outcome variable, ε is the residual, and MUP is a dichotomous indicator with the value 1 for attendees who attended Scotland EDs after the implementation of MUP, and 0 otherwise. Our coefficient of interest is β_1, the difference-in-difference (DID) estimate, which is defined as the differences in outcome between Scotland and England before and after the introduction of MUP. We used logistic regression for binary outcomes, and linear regression for continuous outcome.

Model 1 is the unadjusted model with only the DID estimate, and fixed-effects for country (0 = England and 1 = Scotland) and time (0 = before the introduction of MUP and 1 = after the introduction of MUP). The country fixed-effects control for all unobserved country-specific factors that are time-invariant, while the time fixed-effects account for seasonal effects over time. In Model 2, we further adjusted for hospital (0 = Edinburgh ED, 1 = Glasgow ED, 2 = Liverpool ED and 3 = Sheffield ED) and wave (0 = Wave 1, 1 = Wave 2 and 3 = Wave 3) fixed-effects. Since the country and time fixed-effects in the unadjusted model were confounded with the newly included hospital and wave, we omitted them from Model 2. In Model 3, the final model, we further included a set of covariates: sex, age group, ethnicity, employment status, marital status, housing ownership, and Carstairs.

Appendices 3 and 4 give the percentage of missing data for each demographic and outcome variable by country and wave. We imputed all variables in the dataset (except the anonymised dataset requested from hospitals) using multiple imputation. A total of 20 imputed datasets were created and analysed in R using the MICE package.[23] The parameters of interest were estimated in each imputed dataset separately, and combined using Rubin's rules.

We included non-response weights in the imputation process and regression models. Using the anonymised information for all attendees from the hospitals, we calculated inverse probability weights to account for the differences in distribution of sex and age group between interviewees and attendees.

We undertook various sensitivity analyses to investigate whether our results were sensitive to the model specification. To examine whether our findings were sensitive to the FAST cut-off score, we also analysed the effect of MUP against FAST cut-offs of 2+ (hazardous drinker), 4+ (harmful drinker) and 6+ (dependent drinker). These cut-offs were validated using data from the Adult Psychiatric Morbidity Survey 2007.[24] We replicated the analyses on alcohol-related attendance (primary outcome), and alcohol-related diagnosis (secondary outcome) using the sample based on all interviewees by including ethnicity, employment status, marital status, housing ownership, and Carstairs as covariates. Finally, we also performed the weighted and unweighted analysis on the complete cases.

Role of the funding source
The funders of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report. VS and ADM had full access to all the data in the study. All authors had final responsibility for the decision to submit for publication.

Results
Descriptive of sample
A total of 26,969 attendees aged at least 16 years visited the EDs during the three study periods, and 23,455 (87.0%) of them were recorded by research nurses. Among those who were recorded, 14,047 (59.9%) of them were approached and 12,249 were identified to be eligible to participate in the study, of whom 8,746 (71.4%) completed the interview. Figure 1 illustrates the flowchart which summarises the study participants in all four EDs and three waves.

We calculated two response rates: the realistic response rate uses a denominator of all eligible attendees, and the absolute response rate uses all recorded attendees as the denominator. Table 1 presents both response rates by wave and hospital. The response rates in Scotland were generally higher than those in England. The overall realistic response rates decreased over the three waves from 78.0% in Wave 1 to 71.6% in Wave 2, and 66.5% in Wave 3. Across three

waves, Liverpool had the lowest realistic response rate (60.8%) among four hospitals. Meanwhile, Sheffield had the lowest absolute response rate (27.9%).

Table 1 Summary of response rates by wave and hospital

		Wave 1	Wave 2	Wave 3	Overall
Edinburgh	Realistic response rate	81.1%	72.9%	73.9%	75.6%
	Absolute response rate	44.2%	44.2%	45.5%	44.6%
Glasgow	Realistic response rate	81.3%	77.5%	77.7%	78.7%
	Absolute response rate	40.3%	38.1%	36.1%	38.0%
Liverpool	Realistic response rate	72.3%	63.2%	53.0%	60.8%
	Absolute response rate	36.7%	42.6%	39.5%	39.9%
Sheffield	Realistic response rate	74.4%	73.6%	61.0%	69.1%
	Absolute response rate	27.8%	30.2%	25.9%	27.9%
Overall	Realistic response rate	78.0%	71.6%	66.5%	71.4%
	Absolute response rate	37.0%	38.4%	36.4%	37.3%

We performed Pearson's chi-square test to compare the sex and age differences between respondents (those who completed the interview) and all attendees (see Table 2). The differences between waves were small for sex but there were greater differences for age groups. Despite these differences, inverse probability weights were applied in all analysis models.

Table 2 Summary of Pearson's chi-square test between survey respondents and sampling frame

		Wave 1		Wave 2		Wave 3		Overall	
		χ^2	p-value	χ^2	p-value	χ^2	p-value	χ^2	p-value
Edinburgh	Sex	4.8	0.028	6.6	0.010	1.0	0.315	11.0	0.001
	Age	13.1	0.005	27.9	0.000	7.6	0.054	43.7	0.000
Glasgow	Sex	1.2	0.267	0.0	0.992	0.7	0.419	1.3	0.251
	Age	69.1	0.000	43.5	0.000	29.3	0.000	132.5	0.000
Liverpool	Sex	1.1	0.295	1.1	0.298	0.0	0.945	1.2	0.267
	Age	3.7	0.295	23.1	0.000	10.2	0.017	29.8	0.000
Sheffield	Sex	0.7	0.390	1.2	0.277	1.9	0.168	0.1	0.724
	Age	7.7	0.052	15.7	0.001	21.8	0.000	37.2	0.000
Overall	Sex	3.5	0.060	2.1	0.143	0.0	0.847	4.2	0.041
	Age	53.9	0.000	82.9	0.000	55.6	0.000	189.1	0.000

Descriptive statistics

The demographic characteristics of all attendees, attendees who were recorded by nurse interviewers, and those who completed the interview are shown in Table 3. The analysis for the primary outcome focused on the sample of recorded attendees (n=23,455). Meanwhile, the analytic sample for alcohol-related diagnosis was based on all attendees.

A total of 8,746 attendees completed the interview. We excluded those who lived outside Scotland and England (n=20) and non-UK residents (n=39). As a result, 8,687 respondents were included in the analytic sample for the following secondary outcomes: current alcohol use, binge-drinking in the past week, and binge-drinking in the past 24 hours. The remaining three secondary outcomes (FAST score, alcohol misuse, binge-drinking at least weekly, and increased alcohol use in the past year) were based on respondents who were current drinkers (N=6,991). Although there are some slight differences in the demographic distribution between the Scottish and English samples, we accounted for these in our difference-in-difference analysis.

Table 3 Demographic characteristics of samples

	All attendees		Attendees recorded by research nurses		Respondents	
	Scotland (N=14,051)	England (N=12,918)	Scotland (N=12,207)	England (N=11,248)	Scotland (N=5,059)	England (N=3,628)
Sex						
Female	7,212 (51.3%)	6,552 (50.7%)	6,131 (50.2%)	5,634 (50.1%)	2,483 (49.1%)	1,854 (51.1%)
Male	6,837 (48.7%)	6,366 (49.3%)	6,015 (49.3%)	5,499 (48.9%)	2,574 (50.9%)	1,774 (48.9%)
Non-binary	2 (0.0%)	0 (0.0%)	2 (0.0%)	0 (0.0%)	2 (0.0%)	0 (0.0%)
Missing	0 (0.0%)	0 (0.0%)	59 (0.5%)	115 (1.0%)	0 (0.0%)	0 (0.0%)
Age						
16-25	2,509 (17.9%)	2,725 (21.1%)	2,450 (20.1%)	2,210 (19.6%)	1,137 (22.5%)	861 (23.7%)
26-45	4,211 (30.0%)	3,830 (29.6%)	3,769 (30.9%)	3,119 (27.7%)	1,613 (31.9%)	1,146 (31.6%)
46-65	3,832 (27.3%)	3,081 (23.9%)	3,155 (25.8%)	2,571 (22.9%)	1,352 (26.7%)	901 (24.8%)
66+	3,499 (24.9%)	3,251 (25.2%)	2,762 (22.6%)	2,846 (25.3%)	957 (18.9%)	720 (19.8%)
Missing	0 (0.0%)	31 (0.2%)	71 (0.6%)	502 (4.5%)	0 (0.0%)	0 (0.0%)
Ethnicity						
White					4,717 (93.2%)	3,172 (87.4%)
Non-white					325 (6.4%)	438 (12.1%)
Missing					17 (0.3%)	18 (0.5%)
Employ status						
Employed					2,590 (51.2%)	1,690 (46.6%)
Economically inactive					1,938 (38.3%)	1,479 (40.8%)
Unemployed					498 (9.8%)	431 (11.9%)
Missing					33 (0.7%)	28 (0.8%)
Marital status						
Married/Co-habiting					2,116 (41.8%)	1,453 (40.0%)
Separated/Divorced/Widowed					770 (15.2%)	547 (15.1%)
Single					2,097 (41.5%)	1,588 (43.8%)
Missing					76 (1.5%)	40 (1.1%)
Housing ownership						
Owner Occupied					1,917 (37.9%)	1,285 (35.4%)
Rented					1,306 (25.8%)	1,207 (33.3%)
Housing Association/Council					888 (17.6%)	446 (12.3%)

	All attendees		Attendees recorded by research nurses		Respondents	
	Scotland (N=14,051)	England (N=12,918)	Scotland (N=12,207)	England (N=11,248)	Scotland (N=5,059)	England (N=3,628)
Other					881 (17.4%)	627 (17.3%)
Missing					67 (1.3%)	63 (1.7%)
Carstairs						
Mean (SD)					7.06 (2.60)	7.37 (2.54)
Median [Min, Max]					8.00 [1.00, 10.0]	8.00 [1.00, 10.0]
Missing					54 (1.1%)	166 (4.6%)

Figure 1   Flowchart of study participants


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┌─────────────────────────┐
│   23455 attendees       │
└───────────┬─────────────┘
            │      ┌──────────────────────────────┐
            ├─────▶│ 9408 were not approached by  │
            │      │         interviewers         │
            ▼      └──────────────────────────────┘
┌─────────────────────────┐
│  14047 were approached  │
└───────────┬─────────────┘
            │      ┌──────────────────────────────┐
            ├─────▶│ 4798 terminated the interview│
            ▼      └──────────────────────────────┘
┌─────────────────────────┐
│ 9249 continued with the │
│        interview        │
└───────────┬─────────────┘
            │      ┌──────────────────────────────┐
            ├─────▶│ 210 did not fulfil the       │
            │      │     inclusion criteria       │
            ▼      └──────────────────────────────┘
┌─────────────────────────────┐
│ 8907 fulfiled inclusion     │
│         criteria            │
└───────────┬─────────────────┘
            │      ┌──────────────────────────────┐
            ├─────▶│ 132 terminated the interview │
            │      │ 97 did not consent for       │
            │      │        interview             │
            ▼      └──────────────────────────────┘
┌─────────────────────────────┐
│ 8810 consented for interview│
└───────────┬─────────────────┘
            │      ┌──────────────────────────────┐
            ├─────▶│ 33 terminated the interview  │
            ▼      └──────────────────────────────┘
┌─────────────────────────┐
│  8777 were interviewed  │
└───────────┬─────────────┘
            │      ┌──────────────────────────────┐
            ├─────▶│ 31 did not complete the whole│
            │      │          interview           │
            ▼      └──────────────────────────────┘
┌─────────────────────────┐
│ 8746 completed the whole│
│        interview        │
└───────────┬─────────────┘
            │      ┌──────────────────────────────┐
            ├─────▶│ 20 non-Scotland/ non-England │
            │      │       UK residents           │
            │      │ 39 non-UK residents          │
            ▼      └──────────────────────────────┘
┌─────────────────────────────┐
│ 8687 included in final      │
│        analysis             │
└─────────────────────────────┘
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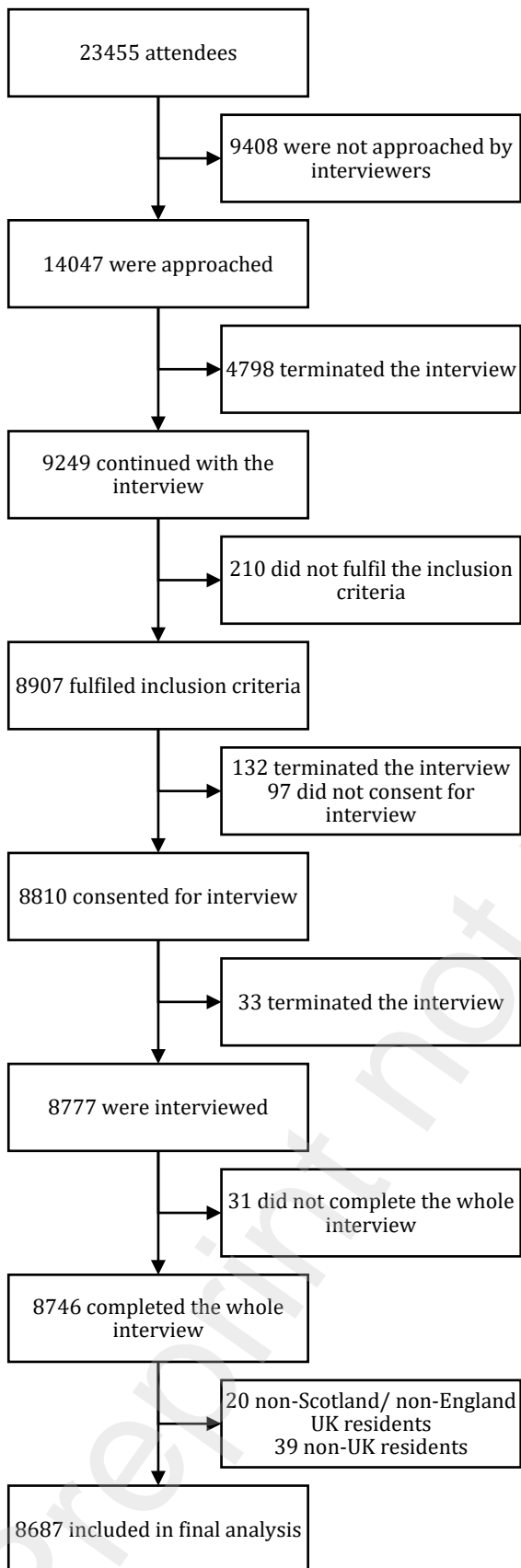
Figure 2A shows the changes in the proportion of attendees with alcohol-related attendance in Scotland and England before and after the introduction of the MUP. On average, Scotland had a higher proportion of attendances that were alcohol-related than England. Scotland had a stable trend, while there was a decreasing trend in England. In contrast, England had a higher prevalence of alcohol-related diagnosis than Scotland (Figure 2B). The proportion of attendees with at least one alcohol-related condition rose slightly in Scotland but fell in England.

Across waves, there was a slightly increasing trend in being a current alcohol drinker in both countries (Figure 2C). Binge-drinking in the past week among all respondents increased slightly in Scotland but decreased in England (Figure 2D). However, both countries showed a slight increase in binge-drinking in the past 24 hours across waves (Figure 2E). The mean FAST score among drinkers increased in both Scotland and England (Figure 2F). The proportion of alcohol misuse (FAST score 3+) increased in England, while Scotland had a relatively stable trend (Figure 2G). Meanwhile, the proportion of drinkers who reported an increase in alcohol use in the past 12 months also had a stable trend in both countries (Figure 2H).

Figure 3 shows the DID estimates from the final regression models for our primary outcome and seven secondary outcomes (see Appendix 5 for the full regression models). There was no evidence of substantive differences in most outcomes after the introduction of MUP in Scotland. The odds ratio of an alcohol-related attendance was 1.14 (95% CI 0.90 to 1.44, p=0.272), indicating that there was little difference between Scotland and England before and after MUP was implemented in Scotland. Based on marginal analysis, it is estimated that an additional 1.0% (95% CI -0.7% to 2.7%) of the ED attendances were alcohol-related than would have been the case in the absence of MUP. We estimated that approximately 258 attendances at ED were alcohol-related as a result of the introduction of MUP (95% CI -191 to 707).

However, the DID estimates show that among all attendees, the odds for an attendee having at least one alcohol-related diagnosis increased by 25% relative to change observed in England after MUP (OR=1.25, 95%CI 1.00 to 1.57, p=0.046). Nevertheless, there was no effect on other secondary outcomes, suggesting that the introduction of MUP in Scotland did not substantially alter these outcomes in the population studied.

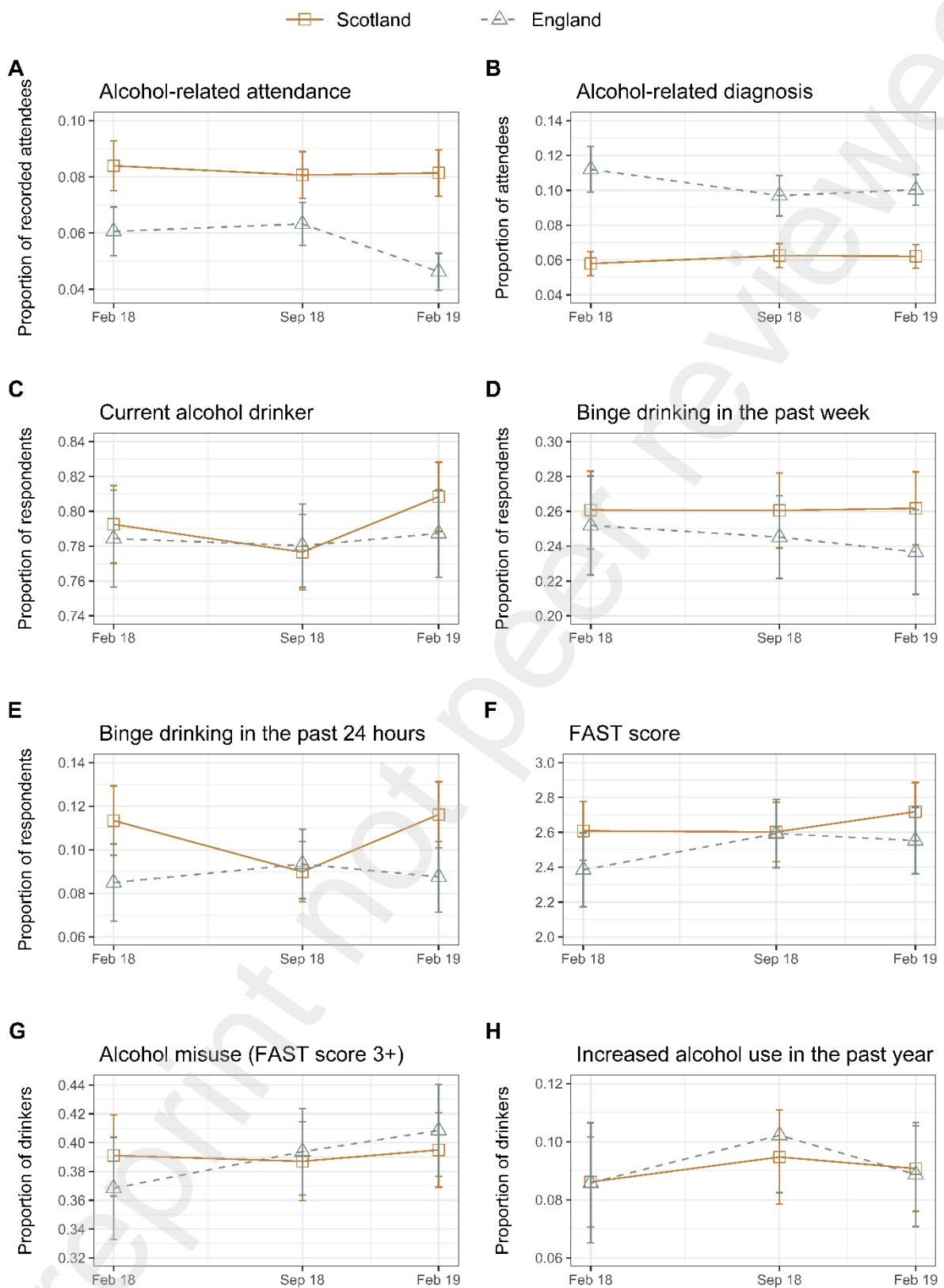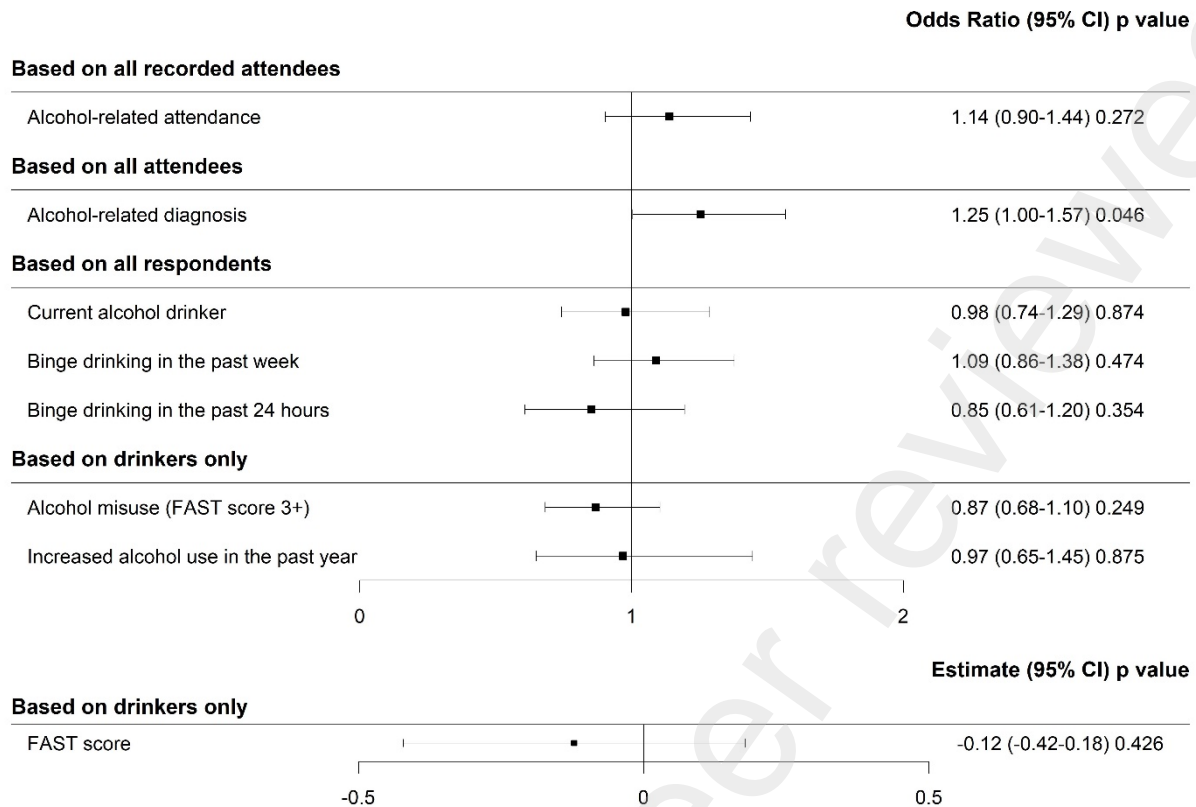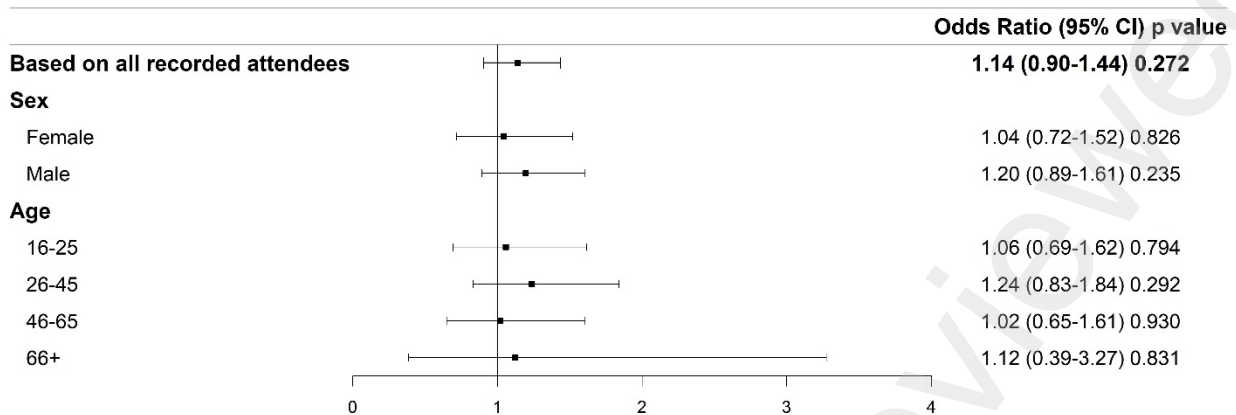Figure 2   Changes in primary and secondary outcomes across waves

Figure 3   Difference-in-difference estimates of the overall effects of MUP

Odds Ratio (95% CI) p value

Based on all recorded attendees

Alcohol-related attendance — 1.14 (0.90-1.44) 0.272

Based on all attendees

Alcohol-related diagnosis — 1.25 (1.00-1.57) 0.046

Based on all respondents

Current alcohol drinker — 0.98 (0.74-1.29) 0.874

Binge drinking in the past week — 1.09 (0.86-1.38) 0.474

Binge drinking in the past 24 hours — 0.85 (0.61-1.20) 0.354

Based on drinkers only

Alcohol misuse (FAST score 3+) — 0.87 (0.68-1.10) 0.249

Increased alcohol use in the past year — 0.97 (0.65-1.45) 0.875

0   1   2

Estimate (95% CI) p value

Based on drinkers only

FAST score — -0.12 (-0.42-0.18) 0.426

-0.5   0   0.5

We further investigated the outcomes by sex, age group, ethnicity, employment status, marital status, and housing ownership. A Bonferroni correction was used to adjust the p-values for multiple comparison. Figure 4 shows the stratified results for the primary outcome. There was no evidence to show MUP had any differential effect across sex and age group. Full results for other secondary outcomes are given in Appendix 6. The stratified analysis shows the introduction of MUP in Scotland was associated with increased odds of alcohol-related diagnosis among men who attended the EDs (OR=1.56, 95% CI 1.16 to 2.11, p=0.004, Bonferroni-corrected p=0.021, Figure 5). Meanwhile, the stratified analyses on the remaining secondary outcomes did not show any differential effect across sociodemographic groups, after Bonferroni correction.
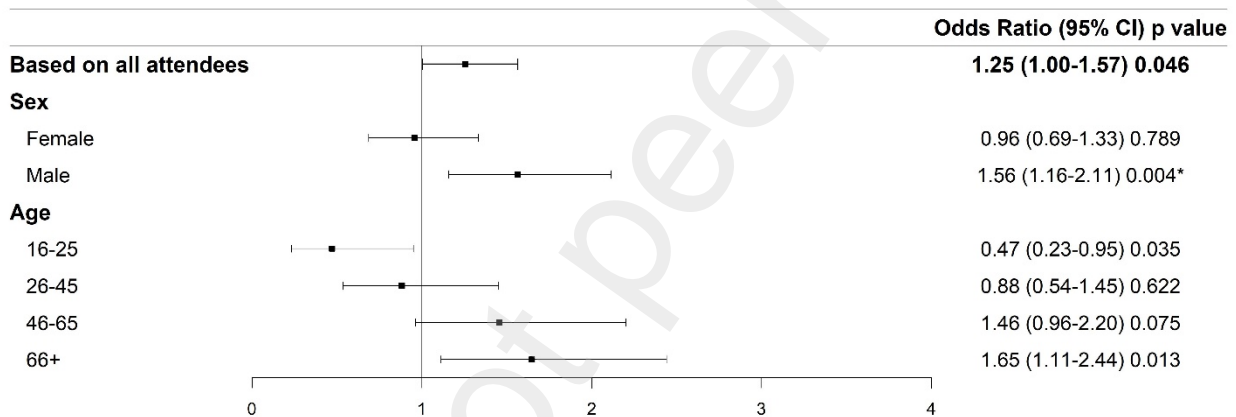
Figure 4   Stratified analysis for primary outcome: Alcohol-related attendance

	Odds Ratio (95% CI) p value
Based on all recorded attendees	**1.14 (0.90-1.44) 0.272**
Sex	
Female	1.04 (0.72-1.52) 0.826
Male	1.20 (0.89-1.61) 0.235
Age	
16-25	1.06 (0.69-1.62) 0.794
26-45	1.24 (0.83-1.84) 0.292
46-65	1.02 (0.65-1.61) 0.930
66+	1.12 (0.39-3.27) 0.831

Note1: p value in the forest plot was uncorrected.
Note2: the asterisk (*) denotes the corrected p-value remains significant after Bonferroni correction for multiple comparison.

Figure 5   Stratified analysis for secondary outcome: Alcohol-related diagnosis

	Odds Ratio (95% CI) p value
Based on all attendees	**1.25 (1.00-1.57) 0.046**
Sex	
Female	0.96 (0.69-1.33) 0.789
Male	1.56 (1.16-2.11) 0.004*
Age	
16-25	0.47 (0.23-0.95) 0.035
26-45	0.88 (0.54-1.45) 0.622
46-65	1.46 (0.96-2.20) 0.075
66+	1.65 (1.11-2.44) 0.013

Note1: p value in the forest plot was uncorrected.
Note2: the asterisk (*) denotes the corrected p-value remains significant after Bonferroni correction for multiple comparison.

Testing the robustness of our analysis, we analysed the effect of MUP against FAST cut-offs of 2+, 4+, and 6+, repeated the analysis on primary outcome using the sample based on survey respondents, and replicated the analysis using unweighted and weighted complete cases. All these analyses produced similar results (see Appendix 6). We also performed sensitivity analysis on alcohol-related diagnosis based on survey respondents who consented to data linkage. Results from the sensitivity analysis showed that the DID estimate was not significant at 5% level, whereas the main analysis showed a significant difference. Since the main analysis was based on all attendees while sensitivity analysis was based on respondents who consented to data linkage, we were confident that the main analysis was not subjected to any selection bias, and therefore, our results were also robust.

Discussion

Key results

We examined the impact of MUP on alcohol-related ED visits and alcohol-related diagnosis among attendees. We also studied patterns of alcohol use among those who participated in the interview. Our results showed that MUP was only marginally associated with alcohol-related diagnosis and

there was no evidence that MUP had any effect on primary and other secondary outcomes. We similarly found no evidence of MUP having differential effects across socioeconomic groups, except for alcohol-related diagnosis. After correcting for multiple comparisons, we found that MUP was associated with increased odds of alcohol-related diagnosis only among male attendees.

There is limited research on the association between hospital admissions and the introduction of MUP. Existing studies have suggested MUP led to a reduction in alcohol-attributable hospital admissions and alcohol-related deaths,[25-27] but there was no immediate effect on ED attendances for alcohol-related injury in Canada.[28] These studies focus on alcohol-related admissions and attendances based on patients' diagnosed diseases and injuries. Our study, on the other hand, examined alcohol-related attendances based on the nurse interviewers' observations and attendees' self-reported behaviours. Given that the definitions of alcohol-related attendance were not comparable between our study and the Canadian studies, it may explain why our results were different from theirs. Our study also examined alcohol-attributable diagnosis among all ED attendees. We combined all chronic and acute alcohol-related conditions as a whole rather than acute injuries covered elsewhere.[28] Our data show that less than 1% of all attendees in both Scotland and England were diagnosed with partially acute injuries; as such, it was not possible to analyse acute partially alcohol-related diagnosis separately. However, our research provides further evidence that there was no immediate association between MUP and changes in the prevalence of alcohol-related diagnosis among ED attendees.

Our analyses have several important strengths. This is the first study to examine the association between MUP and alcohol-related attendances and alcohol-related diagnosis within the ED setting in Scotland. Diagnostic data on alcohol-related attendances that do not result in admissions are not routinely captured in administrative health data in both Scotland and England. In contrast to research which relies on hospitalisations data, our study is more sensitive in detecting alcohol-related harms which result in ED attendance, including injury-related harms that are common among young people. Although we found a weak significant immediate association between MUP and alcohol-related diagnosis, the result echoes another study which examined alcohol-related injury ED visits in Canada.[28] It provides more evidence that MUP may be less likely to impact on harms that most commonly present to EDs, including those related to acute consumption among young people. However, the consequences on the broader range of alcohol-related harms remain unknown and it is therefore important to monitor how alcohol-related diagnosis would change in the longer run.

This study has some limitations. First, the definition of alcohol-related attendances for unapproached or ineligible attendees was based on nurse interviewers' observations only. Attendances were considered as alcohol-related only if the nurses recorded them as alcohol intoxicated, on the basis of the interview or for non-participants, interviewers' observation. As a result, we may have misclassified some survey non-participants who attended the ED because of another's drinking or underlying alcohol-related conditions that were not observable to interviewers. Our analysis is therefore likely to underestimate the association between alcohol-related attendances and the introduction of MUP. Second, we were unable to test the parallel trend assumption when difference-in-difference analysis was used. The Scottish Government announced on 21 November 2017 that MUP would be implemented on 1 May 2018. It gave us limited time for data collection, therefore only one pre-MUP data time point was possible. However, other data suggest the prior trends in alcohol-specific deaths[29], and alcohol-related hospital admission[15 16] in Scotland and Northern England since 2012 were broadly similar (see Appendix 7). These data provide some proxy information on alcohol-related ED attendances and alcohol drinking patterns in both countries to validate the parallel trend assumption. Third, we excluded one hospital from England when we analysed alcohol-related diagnosis among respondents who consented for data

linkage. The data provided from this hospital did not allow us to convert to the ICD-10 diagnostic coding system on which the alcohol-attributable diagnosis was based. Therefore, we lost 1,368 cases (around 17.5% of total sample size) when we performed this analysis. That may have affected the statistical power.

The study protocol identified a number of potential risks arising from MUP:[30] 1) displacement effects where reductions in alcohol-related harms may be accompanied by increases in other drug related harms; 2) increased alcohol-related harm through substitution or changed drinking patterns; 3) consumers may switch to alternative sources of alcohol not subject to MUP such that the price paid does not increase; and 4) MUP could unfairly penalise poorer drinkers who may be less able to absorb the additional costs and may also forgo other essentials such as food. Our results show that there was no evidence that alcohol-related harms increased within the ED setting as a result of the implementation of MUP which echoes the results from a previous Canadian study.[28] There was a six-year delay before the legislation was passed after the Alcohol (Minimum Pricing) (Scotland) Bill was first introduced. The gap between legislation being first introduced and its implementation has meant the magnitude of price changes has been relatively small. It might also explain why we were unable to detect any significant effects of MUP on alcohol-related harms and drinking patterns as it may not have been implemented at an adequate level. The underlying inflation rates may also devalue the 50p potentially and hence limiting the intended impact. MUP might have also increased public awareness of health harms relating to alcohol, and much of that could have happened around the time of legislation and during the legal challenges from the alcohol industry. Our study would not pick up such an effect due to the research design.

In summary, we did not find evidence for the introduction of MUP in Scotland impacting on alcohol-related harms within the ED setting. However, the broader evidence base is more consistent with an effect of MUP on both alcohol consumption and harms. This study is part of a wider evaluation programme coordinated by Public Health Scotland to inform the decision by the Scottish Parliament as to whether they will vote for MUP to continue following the sixth year of implementation. Therefore, we should interpret the results with caution and should not draw conclusions regarding the wider societal impact of MUP on alcohol harm purely based on this study.

(word counts: 3784/3500)

Footnotes

Data Statement
The data are limited in their potential for reuse, and so it will be sufficient to make these data available to other researchers via open access publication

Contributors
SVK and LB conceived the study. SVK, LG, AL, GM, LB, PD, CD, DE, SH, TP, MS, AF and AHL all contributed to the overall study design and grant application. LB provided initial strategic leadership for the study, followed by AHL. AHL, OM and VS provided statistical expertise and VS carried out statistical analysis. ADM and RF led the study day to day, contributed to parts of the methodology used, helped acquire and analyse the data. VS led the drafting and wrote the first draft. SP, LO and CY provided information about the local context for the studies. All authors made substantial contributions to study development, critically revised the paper and approved the final manuscript.

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Appendix

Appendix 1 Reasons for ineligiblity

<u>Reasons for not approached by nurse interviewers</u>

	Scotland (N=4609)	England (N=1559)
Too unwell	574 (12.5%)	787 (16.4%)
Distressed	182 (3.9%)	195 (4.1%)
Gross intoxication (alcohol)	199 (4.3%)	125 (2.6%)
Gross intoxication (drugs)	111 (2.4%)	70 (1.5%)
Cognitive impairment	243 (5.3%)	297 (6.2%)
Police in attendance	159 (3.4%)	36 (0.8%)
Language issue	65 (1.4%)	65 (1.4%)
Already participated	26 (0.6%)	8 (0.2%)
Routine follow up	17 (0.4%)	53 (1.1%)
Left emergency department	766 (16.6%)	674 (14.0%)
Admitted	73 (1.6%)	19 (0.4%)
Staff safety issue	46 (1.0%)	61 (1.3%)
End of shift	1084 (23.5%)	847 (17.6%)
Dead on arrival	1 (0.0%)	1 (0.0%)
End of shift severe weather	0 (0.0%)	0 (0.0%)
Other – mental health	20 (0.4%)	18 (0.4%)
Other – barrier nursed/ infectious	1 (0.0%)	25 (0.5%)
Other – other study	9 (0.2%)	5 (0.1%)
Other – sight/reading problem	6 (0.1%)	6 (0.1%)
Other – tests in progress	0 (0.0%)	0 (0.0%)
Other – not clinically appropriate	14 (0.3%)	8 (0.2%)
Other – not triaged	0 (0.0%)	0 (0.0%)
Other – asleep	2 (0.0%)	13 (0.3%)
Other – confused	5 (0.1%)	10 (0.2%)
Other – pain	3 (0.1%)	9 (0.2%)
Other – unlocatable	1 (0.0%)	6 (0.1%)
Other – unspecified	93 (2.0%)	91 (1.9%)

Reasons for termination

	Scotland (N=2247)	England (N=2716)
Initial disinterest	784 (34.9%)	492 (18.1%)
Patient left without completing	96 (4.3%)	73 (2.7%)
Routine follow up	3 (0.1%)	3 (0.1%)
Withdrew consent	36 (1.6%)	21 (0.8%)
Patient admitted	8 (0.4%)	10 (0.4%)
Already participated/ refused	23 (1.0%)	17 (0.6%)
Barrier nursed/ infectious	3 (0.1%)	1 (0.0%)
Cognitive problem/ confused/ learning disability/ Alzheimer	88 (3.9%)	72 (2.7%)
End of shift	22 (1.0%)	12 (0.4%)
Sight/reading problems	63 (2.8%)	87 (3.2%)
Hearing problems	5 (0.2%)	11 (0.4%)
Refused	35 (1.6%)	57 (2.1%)
Language problem	64 (2.8%)	94 (3.5%)
Too unwell	255 (11.3%)	343 (12.6%)
Too intoxicated (alcohol)	41 (1.8%)	38 (1.4%)
Too intoxicated (drugs)	24 (1.1%)	15 (0.6%)
Incapable of consent requirement	16 (0.7%)	17 (0.6%)
Too much pain	26 (1.2%)	30 (1.1%)
Too distressed	80 (3.6%)	31 (1.1%)
Other – unspecified	59 (2.6%)	48 (1.8%)

Reasons for failing inclusion criteria

	Scotland (N=184)	England (N=26)
Below aged 16	0 (0.0%)	0 (0.0%)
Clinically inappropriate	43 (23.4%)	1 (3.8%)
Did not speak English/ without translators	19 (10.3%)	5 (19.2%)
Old ED presentation	1 (0.5%)	1 (3.8%)
Unconscious	5 (2.7%)	0 (0.0%)
Not well enough (physically)	77 (41.8%)	11 (42.3%)
Not well enough (mentally)	49 (26.6%)	9 (34.6%)
Not sober enough (alcohol)	33 (17.9%)	5 (19.2%)
Not sober enough (drug)	12 (6.5%)	0 (0.0%)
Left emergency department	14 (7.6%)	1 (3.8%)
Threatening	5 (2.7%)	0 (0.0%)

Appendix 2 Conditions wholly and partially attributable to alcohol consumption

Description of condition	ICD-10 code	
Alcohol-induced pseudo-Cushing's syndrome	E24.4	Wholly chronic
Degeneration of nervous system due to use of alcohol	G31.2	Wholly chronic
Alcoholic polyneuropathy	G62.1	Wholly chronic
Alcoholic myopathy	G72.1	Wholly chronic
Alcoholic cardiomyopathy	I42.6	Wholly chronic
Alcoholic gastritis	K29.2	Wholly chronic
Alcoholic liver disease	K70	Wholly chronic
Alcohol-induced acute pancreatitis	K85.2	Wholly chronic
Alcohol-induced chronic pancreatitis	K86.0	Wholly chronic
Fetal alcohol syndrome (dysmorphic)	Q86.0	Wholly chronic
Mental and behavioural disorders due to use of alcohol	F10	Wholly acute
Excess alcohol blood levels	R78.0	Wholly acute
Ethanol poisoning	T51.0	Wholly acute
Methanol poisoning	T51.1	Wholly acute
Toxic effect of alcohol, unspecified	T51.9	Wholly acute
Accidental poisoning by and exposure to alcohol	X45	Wholly acute
Intentional self-poisoning by and exposure to alcohol	X65	Wholly acute
Poisoning by and exposure to alcohol, undetermined intent	Y15	Wholly acute
Evidence of alcohol involvement determined by blood alcohol level	Y90	Wholly acute
Evidence of alcohol involvement determined by level of intoxication	Y91	Wholly acute
Tuberculosis	A15-A19	Partially chronic
Lip, oral cavity and pharynx	C00-C14	Partially chronic
Oesophagus	C15	Partially chronic
Colorectal	C18-C20	Partially chronic
Liver and intrahepatic bile ducts	C22	Partially chronic
Larynx	C32	Partially chronic
Breast	C50	Partially chronic
Diabetes mellitus (type II)	E11	Partially chronic
Epilepsy and status epilepticus	G40-G41	Partially chronic
Hypertensive diseases	I10-I15	Partially chronic
Ischaemic heart disease	I20-I25	Partially chronic
Cardiac arrhythmias	I47-I48	Partially chronic
Haemorrhagic stroke	I60-I62	Partially chronic
Ischaemic stroke	I63-I66, I69.3-I69.4	Partially chronic
Pneumonia	J10.0-J11.0, J12-J15, J18	Partially chronic
Unspecified liver disease	K73, K74	Partially chronic
Cholelithiasis (gall stones)	K80	Partially chronic
Acute and chronic pancreatitis	K85, K86.1	Partially chronic
Oesophageal varices	I85	Partially chronic
Spontaneous abortion	O03	Partially chronic
Road/pedestrian traffic accidents	†	Partially acute
Poisoning	X40-X49 (excl. X45)	Partially acute
Fall injuries	W00-W19	Partially acute
Fire injuries	X00-X09	Partially acute
Drowning	W65-W74	Partially acute
Other unintentional injuries	††	Partially acute
Event of undetermined intent	Y10-Y34, Y78.2 (excl. Y15)	Partially acute
Intentional self-harm	X60-X84, Y87.0	Partially acute
Assault	X85-Y09, Y87.1	Partially acute

†   V021-V029, V031-V039, V041-V049, V092, V093, V123-V129, V133-V139, V143-V149, V194-V196, V203-V209, V213-V219, V223-V229, V233-V239, V243-V249, V253-V259, V263-V269, V273-V279, V283-V289, V294-V299, V304-V309, V314-V319, V324-V329, V334-V339, V344-V349, V354-V359, V364-V369, V374-V379, V384-V389, V394-V399, V404-V409, V414-V419, V424-V429, V434-V439, V444-V449, V454-

V459, V464-V469, V474-V479, V484-V489, V494-V499, V504-V509, V514-V519, V524-V529, V534-V539, V544-V549, V554-V559, V564-V569, V574-V579, V584-V589, V594-V599, V604-V609, V614-V619, V624-V629, V634-V639, V644-V649, V654-V659, V664-V669, V674-V679, V684-V689, V694-V699, V704-V709, V714-V719, V724-V729, V734-V739, V744-V749, V754-V759, V764-V769, V774-V779, V784-V789, V794-V799, V803-V805, V811, V821, V830-V833, V840-V843, V850-V853, V860-V863, V870-V878, V892

††   V01, V090, V091, V099, V100-V109, V110-V119, V120-122, V130-132, V140-V142, V150-V159, V160-V169, V170-V179, V180-V189, V191-V193, V20-V28: 0.1-0.2;V290-V293, V30-V38: 0.1-0.2; V390-V393, V40-V48: 0.1-0.2; V490-V493, V50-V58: 0.1-0.2; V590-V593, V60-V68: 0.1-0.2; V690-V693, V70-V78: 0.1-0.2; V790-V793, V800, V801, V806-V809, V810, V812-V819, V820, V822-V829, V834-V839, V844-V849, V854-V859, V864-V869, V879, V88, V890, V891, V893-V899, V90-V94,V95-V97, V98-V99, W20-W52, W75-W84, W85-W99, X10-X19, X20-X29, X30-X33, X50-X57, X58, X59, Y40-Y84 Y85, Y86, Y88, Y89

Appendix 3   Demographics of recorded attendees and survey respondents

Demographics of recorded attendees across three waves in Scotland and England

	Scotland			England		
	Wave 1 **(N=3675)**	**Wave 2** **(N=4144)**	**Wave 3** **(N=4388)**	**Wave 1** **(N=3252)**	**Wave 2** **(N=3969)**	**Wave 3** **(N=4027)**
Sex						
Female	1849 (50.3%)	2053 (49.5%)	2229 (50.8%)	1647 (50.6%)	1982 (49.9%)	2005 (49.8%)
Male	1814 (49.4%)	2073 (50.0%)	2128 (48.5%)	1571 (48.3%)	1943 (49.0%)	1985 (49.3%)
Non-binary	0 (0%)	1 (0.0%)	1 (0.0%)	0 (0%)	0 (0%)	0 (0%)
Missing	12 (0.3%)	17 (0.4%)	30 (0.7%)	34 (1.0%)	44 (1.1%)	37 (0.9%)
Age						
16-25	733 (19.9%)	847 (20.4%)	870 (19.8%)	555 (17.1%)	839 (21.1%)	816 (20.3%)
26-45	1110 (30.2%)	1271 (30.7%)	1388 (31.6%)	858 (26.4%)	1138 (28.7%)	1123 (27.9%)
46-65	969 (26.4%)	1051 (25.4%)	1135 (25.9%)	715 (22.0%)	907 (22.9%)	949 (23.6%)
66+	850 (23.1%)	949 (22.9%)	963 (21.9%)	933 (28.7%)	923 (23.3%)	990 (24.6%)
Missing	13 (0.4%)	26 (0.6%)	32 (0.7%)	191 (5.9%)	162 (4.1%)	149 (3.7%)

Demographics of all attendees across three waves in Scotland and England

	Scotland			England		
	Wave 1 **(N=4346)**	**Wave 2** **(N=4732)**	**Wave 3** **(N=4973)**	**Wave 1** **(N=3957)**	**Wave 2** **(N=4488)**	**Wave 3** **(N=4473)**
Sex						
Female	2233 (51.4%)	2384 (50.4%)	2595 (52.2%)	2008 (50.7%)	2262 (50.4%)	2282 (51.0%)
Male	2113 (48.6%)	2347 (49.6%)	2377 (47.8%)	1949 (49.3%)	2226 (49.6%)	2191 (49.0%)
Non-binary	0 (0%)	1 (0.0%)	1 (0.0%)	0 (0%)	0 (0%)	0 (0%)
Age						
16-25	744 (17.1%)	869 (18.4%)	896 (18.0%)	807 (20.4%)	982 (21.9%)	936 (20.9%)
26-45	1286 (29.6%)	1414 (29.9%)	1511 (30.4%)	1172 (29.6%)	1363 (30.4%)	1295 (29.0%)
46-65	1194 (27.5%)	1265 (26.7%)	1373 (27.6%)	917 (23.2%)	1072 (23.9%)	1092 (24.4%)
66+	1122 (25.8%)	1184 (25.0%)	1193 (24.0%)	1053 (26.6%)	1058 (23.6%)	1140 (25.5%)
Missing	0 (0%)	0 (0%)	0 (0%)	8 (0.2%)	13 (0.3%)	10 (0.2%)

Demographics of survey respondents across three waves in Scotland and England

	Scotland			**England**		
	Wave 1 **(N=1551)**	**Wave 2** **(N=1706)**	**Wave 3** **(N=1802)**	**Wave 1** **(N=998)**	**Wave 2** **(N=1385)**	**Wave 3** **(N=1245)**
Sex						
Female	747 (48.2%)	820 (48.1%)	916 (50.8%)	507 (50.8%)	696 (50.3%)	651 (52.3%)
Male	804 (51.8%)	885 (51.9%)	885 (49.1%)	491 (49.2%)	689 (49.7%)	594 (47.7%)
Non-binary	0 (0%)	1 (0.1%)	1 (0.1%)	0 (0%)	0 (0%)	0 (0%)
Age						
16-25	364 (23.5%)	385 (22.6%)	388 (21.5%)	202 (20.2%)	345 (24.9%)	314 (25.2%)
26-45	468 (30.2%)	570 (33.4%)	575 (31.9%)	319 (32.0%)	434 (31.3%)	393 (31.6%)
46-65	424 (27.3%)	451 (26.4%)	477 (26.5%)	252 (25.3%)	354 (25.6%)	295 (23.7%)
66+	295 (19.0%)	300 (17.6%)	362 (20.1%)	225 (22.5%)	252 (18.2%)	243 (19.5%)
Ethnicity						
White	1456 (93.9%)	1577 (92.4%)	1684 (93.5%)	886 (88.8%)	1199 (86.6%)	1087 (87.3%)
Non-white	94 (6.1%)	120 (7.0%)	111 (6.2%)	107 (10.7%)	181 (13.1%)	150 (12.0%)
Missing	1 (0.1%)	9 (0.5%)	7 (0.4%)	5 (0.5%)	5 (0.4%)	8 (0.6%)
Employ status						
Employed	785 (50.6%)	898 (52.6%)	907 (50.3%)	458 (45.9%)	671 (48.4%)	561 (45.1%)
Economically inactive	593 (38.2%)	630 (36.9%)	715 (39.7%)	409 (41.0%)	564 (40.7%)	506 (40.6%)
Unemployed	164 (10.6%)	166 (9.7%)	168 (9.3%)	126 (12.6%)	141 (10.2%)	164 (13.2%)
Missing	9 (0.6%)	12 (0.7%)	12 (0.7%)	5 (0.5%)	9 (0.6%)	14 (1.1%)
Marital status						
Married/Co-habiting	638 (41.1%)	724 (42.4%)	754 (41.8%)	439 (44.0%)	546 (39.4%)	468 (37.6%)
Separated/Divorced/Widowed	249 (16.1%)	245 (14.4%)	276 (15.3%)	163 (16.3%)	188 (13.6%)	196 (15.7%)
Single	651 (42.0%)	705 (41.3%)	741 (41.1%)	387 (38.8%)	633 (45.7%)	568 (45.6%)
Missing	13 (0.8%)	32 (1.9%)	31 (1.7%)	9 (0.9%)	18 (1.3%)	13 (1.0%)
Housing ownership						
Owner Occupied	574 (37.0%)	642 (37.6%)	701 (38.9%)	376 (37.7%)	479 (34.6%)	430 (34.5%)
Rented	418 (27.0%)	441 (25.8%)	447 (24.8%)	317 (31.8%)	496 (35.8%)	394 (31.6%)
Housing Association/Council	268 (17.3%)	302 (17.7%)	318 (17.6%)	125 (12.5%)	160 (11.6%)	161 (12.9%)
Other	277 (17.9%)	295 (17.3%)	309 (17.1%)	166 (16.6%)	233 (16.8%)	228 (18.3%)
Missing	14 (0.9%)	26 (1.5%)	27 (1.5%)	14 (1.4%)	17 (1.2%)	32 (2.6%)
Carstairs						
Mean (SD)	7.06 (2.65)	6.97 (2.64)	7.15 (2.53)	7.15 (2.61)	7.46 (2.50)	7.46 (2.53)

	Scotland			England		
	Wave 1 (N=1551)	**Wave 2 (N=1706)**	**Wave 3 (N=1802)**	**Wave 1 (N=998)**	**Wave 2 (N=1385)**	**Wave 3 (N=1245)**
Median [Min, Max]	8.00 [1.00, 10.0]	7.00 [1.00, 10.0]	8.00 [1.00, 10.0]	8.00 [1.00, 10.0]	8.00 [1.00, 10.0]	8.00 [1.00, 10.0]
Missing	11 (0.7%)	20 (1.2%)	23 (1.3%)	51 (5.1%)	75 (5.4%)	40 (3.2%)

Appendix 4 Missing data for outcome variables

	Scotland			England		
	Wave 1	**Wave 2**	**Wave 3**	**Wave 1**	**Wave 2**	**Wave 3**
Based on all recorded attendees	**N=3,675**	**N=4,144**	**N=4,388**	**N=3,252**	**N=3,969**	**N=4,027**
Alcohol-related attendance						
Alcohol-related	321 (8.7%)	335 (8.1%)	353 (8.0%)	179 (5.5%)	245 (6.2%)	180 (4.5%)
Non-alcohol related	3,319 (90.3%)	3,755 (90.6%)	3,973 (90.5%)	3,038 (93.4%)	3,668 (92.4%)	3,782 (93.9%)
Missing	35 (1.0%)	54 (1.3%)	62 (1.4%)	35 (1.1%)	56 (1.4%)	65 (1.6%)
Based on all attendees	**N=4,346**	**N=4,732**	**N=4,973**	**N=2,213**	**N=2,465**	**N=2,517**
Alcohol-related diagnosis*						
Alcohol-related	252 (5.8%)	296 (6.3%)	309 (6.2%)	248 (11.2%)	239 (9.7%)	255 (10.1%)
Non-alcohol related	4,094 (94.2%)	4,436 (93.7%)	4,664 (93.8%)	1,965 (88.8%)	2,226 (90.3%)	2,262 (89.9%)
Based on respondents who consented for data linkage	**N=1,481**	**N=1,607**	**N=1,730**	**N=504**	**N=602**	**N=542**
Alcohol-related diagnosis*						
Alcohol-related diagnosis	67 (4.5%)	80 (5.0%)	94 (5.4%)	51 (10.1%)	55 (9.1%)	43 (7.9%)
Non-alcohol related diagnosis	1,414 (95.5%)	1,527 (95.0%)	1,636 (94.6%)	453 (89.9%)	547 (90.9%)	499 (92.1%)
Based on all respondents	**N=1,551**	**N=1,706**	**N=1,802**	**N=998**	**N=1,385**	**N=1,245**
Alcohol-related attendance						
Alcohol-related	228 (14.7%)	225 (13.2%)	279 (15.5%)	104 (10.4%)	174 (12.6%)	149 (12.0%)
Non-alcohol related	1,290 (83.2%)	1,428 (83.7%)	1,461 (81.1%)	859 (86.1%)	1,155 (83.4%)	1,031 (82.8%)
Missing	33 (2.1%)	53 (3.1%)	62 (3.4%)	35 (3.5%)	56 (4.0%)	65 (5.2%)
Current alcohol drinker						
Drinker	1,263 (81.4%)	1,358 (79.6%)	1,481 (82.2%)	796 (79.8%)	1,099 (79.4%)	994 (79.8%)
Non-drinker	288 (18.6%)	347 (20.3%)	319 (17.7%)	202 (20.2%)	284 (20.5%)	244 (19.6%)
Missing	0 (0%)	1 (0.1%)	2 (0.1%)	0 (0%)	2 (0.1%)	7 (0.6%)
Binge drinking in the past week						
Binger	436 (28.1%)	458 (26.8%)	472 (26.2%)	244 (24.4%)	328 (23.7%)	290 (23.3%)
Non-binger	1,080 (69.6%)	1,193 (69.9%)	1270 (70.5%)	716 (71.7%)	997 (72.0%)	888 (71.3%)
Missing	35 (2.3%)	55 (3.2%)	60 (3.3%)	38 (3.8%)	60 (4.3%)	67 (5.4%)
Binge drinking in the past 24 hours						
Binger	187 (12.1%)	157 (9.2%)	210 (11.7%)	84 (8.4%)	126 (9.1%)	107 (8.6%)
Non-binger	1,334 (86.0%)	1,499 (87.9%)	1,539 (85.4%)	881 (88.3%)	1,214 (87.7%)	1,082 (86.9%)
Missing	30 (1.9%)	50 (2.9%)	53 (2.9%)	33 (3.3%)	45 (3.2%)	56 (4.5%)

	Scotland			England		
	Wave 1	**Wave 2**	**Wave 3**	**Wave 1**	**Wave 2**	**Wave 3**
Based on drinkers only	**N=1,263**	**N=1,358**	**N=1,481**	**N=796**	**N=1,099**	**N=994**
FAST score						
Mean (SD)	2.79 (2.95)	2.70 (3.00)	2.79 (3.16)	2.36 (2.77)	2.61 (2.93)	2.64 (2.87)
Median [Min, Max]	2.00 [0, 16.0]	2.00 [0, 16.0]	2.00 [0, 16.0]	2.00 [0, 16.0]	2.00 [0, 16.0]	2.00 [0, 16.0]
Missing	43 (3.4%)	58 (4.3%)	59 (4.0%)	31 (3.9%)	38 (3.5%)	42 (4.2%)
Alcohol misuse (FAST score 3+)						
Hazardous drinker (3+)	514 (40.7%)	518 (38.1%)	581 (39.2%)	277 (34.8%)	431 (39.2%)	403 (40.5%)
Non-hazardous drinker (<3)	706 (55.9%)	782 (57.6%)	841 (56.8%)	488 (61.3%)	630 (57.3%)	549 (55.2%)
Missing	43 (3.4%)	58 (4.3%)	59 (4.0%)	31 (3.9%)	38 (3.5%)	42 (4.2%)
Change in alcohol use in the past year						
Increased	118 (9.3%)	134 (9.9%)	139 (9.4%)	65 (8.2%)	109 (9.9%)	91 (9.2%)
Decreased/ Unchanged	1,116 (88.4%)	1,184 (87.2%)	1,294 (87.4%)	703 (88.3%)	960 (87.4%)	863 (86.8%)
Missing	29 (2.3%)	40 (2.9%)	48 (3.2%)	28 (3.5%)	30 (2.7%)	40 (4.0%)
At least hazardous drinking level						
At least hazardous (2+)	701 (55.5%)	731 (53.8%)	781 (52.7%)	388 (48.7%)	596 (54.2%)	550 (55.3%)
Not hazardous (<2)	519 (41.1%)	569 (41.9%)	641 (43.3%)	377 (47.4%)	465 (42.3%)	402 (40.4%)
Missing	43 (3.4%)	58 (4.3%)	59 (4.0%)	31 (3.9%)	38 (3.5%)	42 (4.2%)
At least harmful drinking level						
At least harmful (4+)	329 (26.0%)	309 (22.8%)	365 (24.6%)	176 (22.1%)	255 (23.2%)	229 (23.0%)
Not harmful (<4)	891 (70.5%)	991 (73.0%)	1057 (71.4%)	589 (74.0%)	806 (73.3%)	723 (72.7%)
Missing	43 (3.4%)	58 (4.3%)	59 (4.0%)	31 (3.9%)	38 (3.5%)	42 (4.2%)
At least dependent drinking level						
At least dependent (6+)	182 (14.4%)	172 (12.7%)	204 (13.8%)	79 (9.9%)	127 (11.6%)	110 (11.1%)
Not dependent (<6)	1,038 (82.2%)	1,128 (83.1%)	1,218 (82.2%)	686 (86.2%)	934 (85.0%)	842 (84.7%)
Missing	43 (3.4%)	58 (4.3%)	59 (4.0%)	31 (3.9%)	38 (3.5%)	42 (4.2%)

* One hospital from England was omitted from analysis as the hospital data provided by that hospital did not allow us to convert to the ICD-10 diagnostic coding system which the alcohol-related diagnoses are based on.

Appendix 5   Difference-in-difference estimates of the effects of MUP – stratified analysis

Based on all recorded attendees – Alcohol-related attendance

	Scotland			England			Model 1		Model 2		Model 3	
	Wave 1	Wave 2	Wave 3	Wave 1	Wave 2	Wave 3	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p
Based on all recorded attendees	8.4%	8.1%	8.1%	6.1%	6.3%	4.6%	1.07 (0.85 to 1.35)	0.547	1.12 (0.89 to 1.41)	0.328	1.14 (0.90 to 1.44)	0.272
Sex												
Female	5.8%	5.3%	5.2%	4.7%	5.1%	3.5%	0.99 (0.69 to 1.44)	0.976	1.05 (0.72 to 1.52)	0.816	1.04 (0.72 to 1.52)	0.826
Male	11.1%	10.9%	11.4%	7.4%	7.6%	5.8%	1.13 (0.84 to 1.51)	0.427	1.17 (0.87 to 1.57)	0.288	1.20 (0.89 to 1.61)	0.235
Age												
16-25	14.5%	11.0%	12.4%	10.4%	9.7%	7.1%	0.99 (0.65 to 1.51)	0.971	1.04 (0.68 to 1.59)	0.854	1.06 (0.69 to 1.62)	0.794
26-45	9.7%	9.3%	9.1%	7.7%	7.1%	5.6%	1.16 (0.79 to 1.72)	0.452	1.24 (0.84 to 1.84)	0.283	1.24 (0.83 to 1.84)	0.292
46-65	8.8%	9.2%	8.0%	6.4%	7.3%	5.4%	0.98 (0.62 to 1.53)	0.920	1.01 (0.64 to 1.58)	0.975	1.02 (0.65 to 1.61)	0.930
66+	2.4%	3.2%	3.9%	0.8%	1.3%	0.8%	1.10 (0.38 to 3.18)	0.859	1.13 (0.39 to 3.28)	0.826	1.12 (0.39 to 3.27)	0.831

Based on all attendees – Alcohol-related diagnosis

	Scotland			England			Model 1		Model 2		Model 3	
	Wave 1	Wave 2	Wave 3	Wave 1	Wave 2	Wave 3	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p
Based on all attendees	5.8%	6.3%	6.2%	11.2%	9.7%	10.0%	1.24 (0.99 to 1.55)	0.058	1.24 (0.99 to 1.55)	0.055	1.25 (1.00 to 1.57)	5.8%
Sex												
Female	5.0%	4.7%	4.8%	9.8%	9.7%	9.7%	0.96 (0.69 to 1.33)	0.791	0.95 (0.68 to 1.33)	0.773	0.96 (0.69 to 1.33)	5.0%
Male	6.7%	7.9%	7.7%	12.7%	9.7%	10.4%	1.53 (1.14 to 2.07)	0.005	1.55 (1.14 to 2.09)	0.004	1.56 (1.16 to 2.11)	6.7%
Age												
16-25	6.3%	5.3%	4.9%	3.3%	5.9%	5.6%	0.48 (0.24 to 0.97)	0.041	0.47 (0.23 to 0.95)	0.035	0.47 (0.23 to 0.95)	6.3%
26-45	5.5%	5.7%	6.0%	5.2%	5.0%	7.3%	0.90 (0.55 to 1.48)	0.674	0.90 (0.54 to 1.47)	0.663	0.88 (0.54 to 1.45)	5.5%
46-65	6.0%	8.0%	6.8%	14.3%	12.9%	12.6%	1.44 (0.96 to 2.18)	0.080	1.44 (0.95 to 2.18)	0.083	1.46 (0.96 to 2.20)	6.0%
66+	5.5%	5.8%	6.9%	20.2%	14.9%	14.4%	1.67 (1.13 to 2.46)	0.010	1.65 (1.12 to 2.44)	0.012	1.65 (1.11 to 2.44)	5.5%

Based on all respondents – Current alcohol drinker

	Scotland			England			Model 1		Model 2		Model 3	
	Wave 1	Wave 2	Wave 3	Wave 1	Wave 2	Wave 3	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p
Based on all respondents	79.3%	77.7%	80.8%	78.4%	78.0%	78.7%	1.01 (0.78 to 1.30)	0.957	1.00 (0.78 to 1.29)	0.990	0.98 (0.74 to 1.29)	0.874
Sex												
Female	76.0%	73.6%	75.8%	76.1%	74.5%	75.4%	1.00 (0.71 to 1.41)	0.993	0.99 (0.71 to 1.40)	0.972	0.97 (0.67 to 1.40)	0.861
Male	82.7%	81.7%	86.4%	80.8%	81.6%	82.2%	1.03 (0.71 to 1.49)	0.885	1.03 (0.70 to 1.50)	0.893	0.99 (0.66 to 1.48)	0.952
Age												
16-25	92.8%	90.0%	89.4%	87.4%	84.1%	87.8%	0.77 (0.39 to 1.51)	0.447	0.81 (0.41 to 1.59)	0.533	0.94 (0.44 to 2.02)	0.872
26-45	84.3%	81.8%	83.7%	83.5%	82.3%	82.2%	0.98 (0.62 to 1.55)	0.932	0.99 (0.62 to 1.59)	0.983	0.92 (0.55 to 1.54)	0.758
46-65	75.4%	77.0%	83.8%	82.7%	78.5%	77.1%	1.84 (1.14 to 2.98)	0.013	1.79 (1.10 to 2.90)	0.018	1.69 (1.01 to 2.81)	0.044
66+	68.2%	64.0%	67.4%	61.8%	65.8%	68.6%	0.71 (0.43 to 1.14)	0.158	0.68 (0.42 to 1.11)	0.121	0.67 (0.40 to 1.13)	0.131
Ethnicity												
White	80.8%	79.9%	82.6%	81.4%	82.8%	82.5%	0.94 (0.71 to 1.26)	0.696	0.93 (0.70 to 1.23)	0.603	0.90 (0.67 to 1.22)	0.493
Non-white	52.8%	45.7%	51.1%	53.6%	44.9%	49.5%			(Too few cases for analysis)			
Employ status												
Employed	89.3%	87.1%	88.3%	86.9%	85.7%	88.4%	0.85 (0.55 to 1.30)	0.452	0.85 (0.56 to 1.31)	0.473	0.76 (0.48 to 1.21)	0.252
Economically inactive	69.5%	67.9%	72.5%	70.2%	71.2%	71.6%	0.98 (0.68 to 1.40)	0.906	0.97 (0.67 to 1.39)	0.857	0.98 (0.66 to 1.45)	0.922
Unemployed	73.2%	72.8%	80.8%	76.7%	72.1%	71.1%	1.60 (0.82 to 3.12)	0.171	1.65 (0.84 to 3.25)	0.145	1.83 (0.90 to 3.72)	0.094
Marital status												
Married/Co-habiting	80.4%	77.8%	81.5%	78.2%	80.0%	76.8%	0.94 (0.64 to 1.38)	0.752	0.94 (0.64 to 1.39)	0.760	0.84 (0.54 to 1.29)	0.422
Separated/Divorced/Widowed	69.3%	66.9%	68.8%	65.3%	61.1%	67.5%	0.97 (0.56 to 1.69)	0.915	0.95 (0.54 to 1.65)	0.844	1.00 (0.55 to 1.82)	0.996
Single	83.3%	82.9%	85.9%	84.8%	82.2%	85.7%	1.17 (0.77 to 1.78)	0.467	1.15 (0.75 to 1.76)	0.521	1.08 (0.69 to 1.69)	0.746
Housing ownership												
Owner Occupied	81.3%	80.2%	82.3%	79.4%	79.5%	79.1%	1.00 (0.65 to 1.54)	0.983	0.97 (0.63 to 1.50)	0.908	0.87 (0.55 to 1.38)	0.553
Rented	80.4%	78.9%	81.3%	79.2%	81.7%	81.5%	0.84 (0.52 to 1.35)	0.466	0.84 (0.52 to 1.36)	0.486	0.81 (0.49 to 1.35)	0.423
Housing Association/Council	66.4%	70.5%	72.6%	72.5%	68.8%	68.5%	1.54 (0.86 to 2.76)	0.148	1.52 (0.85 to 2.72)	0.160	1.53 (0.84 to 2.80)	0.169
Other	87.6%	77.2%	85.7%	79.3%	73.3%	81.0%	0.72 (0.37 to 1.38)	0.316	0.72 (0.37 to 1.40)	0.334	0.91 (0.42 to 1.97)	0.819

Based on all respondents – Binge drinking in the past week

	Scotland			England			Model 1		Model 2		Model 3	
	Wave 1	Wave 2	Wave 3	Wave 1	Wave 2	Wave 3	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p
Based on all respondents	26.1%	26.1%	26.2%	25.2%	24.5%	23.7%	1.06 (0.85 to 1.33)	0.609	1.07 (0.86 to 1.34)	0.550	1.09 (0.86 to 1.38)	0.474
Sex												
Female	20.6%	19.1%	18.8%	19.6%	20.2%	18.1%	0.93 (0.66 to 1.30)	0.661	0.95 (0.67 to 1.34)	0.753	0.94 (0.66 to 1.33)	0.719
Male	31.9%	33.1%	34.3%	31.0%	28.9%	29.6%	1.18 (0.87 to 1.60)	0.281	1.18 (0.87 to 1.60)	0.282	1.22 (0.89 to 1.67)	0.212
Age												
16-25	42.4%	37.1%	38.5%	35.6%	33.9%	31.5%	0.94 (0.61 to 1.44)	0.767	0.95 (0.62 to 1.45)	0.801	1.01 (0.65 to 1.58)	0.951
26-45	30.1%	30.6%	28.0%	29.4%	28.3%	31.9%	0.94 (0.64 to 1.37)	0.741	0.93 (0.64 to 1.36)	0.720	0.89 (0.60 to 1.31)	0.548
46-65	25.7%	28.0%	28.6%	33.1%	28.1%	24.6%	1.57 (1.03 to 2.41)	0.036	1.59 (1.04 to 2.43)	0.032	1.66 (1.07 to 2.57)	0.023
66+	10.6%	10.1%	11.7%	5.0%	6.7%	6.7%	0.75 (0.31 to 1.86)	0.542	0.75 (0.30 to 1.86)	0.539	0.74 (0.29 to 1.89)	0.532
Ethnicity												
White	27.0%	26.8%	26.9%	26.3%	26.7%	25.2%	1.01 (0.80 to 1.28)	0.927	1.02 (0.81 to 1.29)	0.864	1.04 (0.82 to 1.32)	0.751
Non-white	10.4%	14.6%	14.3%	15.5%	9.3%	12.1%			(Too few cases for analysis)			
Employ status												
Employed	31.9%	31.6%	29.7%	32.4%	29.7%	30.3%	1.05 (0.78 to 1.42)	0.736	1.05 (0.78 to 1.43)	0.736	1.06 (0.78 to 1.45)	0.701
Economically inactive	17.9%	18.8%	20.0%	16.6%	18.0%	15.5%	1.09 (0.73 to 1.64)	0.679	1.12 (0.74 to 1.68)	0.590	1.17 (0.76 to 1.79)	0.477
Unemployed	33.9%	30.3%	36.7%	29.1%	29.3%	29.7%	0.96 (0.51 to 1.81)	0.911	1.02 (0.54 to 1.92)	0.950	1.13 (0.57 to 2.21)	0.728
Marital status												
Married/Co-habiting	20.7%	22.0%	21.9%	22.7%	21.6%	19.8%	1.20 (0.84 to 1.73)	0.316	1.21 (0.84 to 1.74)	0.310	1.17 (0.80 to 1.70)	0.416
Separated/Divorced/Widowed	15.9%	16.2%	15.1%	16.2%	12.3%	11.9%	1.37 (0.69 to 2.71)	0.374	1.38 (0.69 to 2.73)	0.361	1.64 (0.80 to 3.37)	0.179
Single	37.7%	35.6%	36.4%	32.2%	31.5%	32.7%	0.94 (0.68 to 1.30)	0.700	0.94 (0.68 to 1.29)	0.693	0.92 (0.66 to 1.28)	0.627
Housing ownership												
Owner Occupied	20.3%	22.8%	19.4%	21.4%	21.3%	19.5%	1.11 (0.75 to 1.63)	0.611	1.11 (0.75 to 1.64)	0.605	1.07 (0.72 to 1.61)	0.731
Rented	30.4%	29.3%	30.7%	30.6%	29.6%	27.7%	1.07 (0.72 to 1.57)	0.738	1.08 (0.73 to 1.59)	0.711	1.16 (0.77 to 1.75)	0.466
Housing Association/Council	24.9%	22.8%	26.4%	22.1%	18.4%	23.5%	1.05 (0.56 to 1.96)	0.889	1.06 (0.56 to 1.98)	0.861	1.03 (0.54 to 1.98)	0.924
Other	36.2%	32.8%	37.0%	26.0%	25.3%	26.1%	0.96 (0.57 to 1.63)	0.882	0.96 (0.57 to 1.63)	0.886	1.07 (0.62 to 1.86)	0.807

Based on all respondents – Binge drinking in the past 24 hours

	Scotland			England			Model 1		Model 2		Model 3	
	Wave 1	Wave 2	Wave 3	Wave 1	Wave 2	Wave 3	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p
Based on all respondents	11.3%	9.0%	11.6%	8.5%	9.3%	8.8%	0.84 (0.60 to 1.17)	0.296	0.85 (0.61 to 1.18)	0.328	0.85 (0.61 to 1.20)	0.354
Sex												
Female	8.7%	5.9%	7.5%	7.3%	6.6%	5.7%	0.91 (0.54 to 1.53)	0.716	0.94 (0.55 to 1.58)	0.803	0.94 (0.55 to 1.59)	0.818
Male	14.1%	12.1%	16.2%	9.7%	12.1%	11.9%	0.79 (0.51 to 1.21)	0.273	0.79 (0.51 to 1.20)	0.270	0.79 (0.51 to 1.23)	0.295
Age												
16-25	17.2%	11.8%	17.9%	10.9%	10.9%	9.4%	0.90 (0.48 to 1.70)	0.755	0.89 (0.48 to 1.67)	0.718	0.90 (0.47 to 1.71)	0.741
26-45	12.6%	10.9%	11.8%	10.3%	12.1%	12.0%	0.75 (0.43 to 1.29)	0.296	0.77 (0.44 to 1.32)	0.338	0.76 (0.43 to 1.34)	0.343
46-65	12.8%	10.1%	12.5%	11.7%	11.1%	10.7%	0.95 (0.52 to 1.73)	0.859	0.97 (0.53 to 1.77)	0.914	1.04 (0.55 to 1.94)	0.913
66+	4.3%	3.4%	5.6%	1.6%	2.3%	2.6%	0.67 (0.14 to 3.08)	0.602	0.65 (0.14 to 3.02)	0.582	0.67 (0.14 to 3.12)	0.606
Ethnicity												
White	11.9%	9.3%	11.9%	8.8%	10.5%	9.2%	0.77 (0.55 to 1.08)	0.135	0.79 (0.56 to 1.10)	0.162	0.79 (0.56 to 1.12)	0.192
Non-white	1.2%	4.8%	6.1%	6.1%	1.4%	5.2%			(Too few cases for analysis)			
Employ status												
Employed	11.8%	9.2%	10.8%	9.5%	9.9%	10.2%	0.78 (0.49 to 1.25)	0.306	0.79 (0.49 to 1.25)	0.314	0.79 (0.49 to 1.27)	0.331
Economically inactive	9.0%	7.2%	9.9%	6.0%	7.3%	5.2%	0.91 (0.50 to 1.64)	0.746	0.92 (0.51 to 1.65)	0.773	0.93 (0.51 to 1.71)	0.814
Unemployed	19.2%	16.2%	24.5%	13.5%	16.4%	16.5%	0.85 (0.39 to 1.87)	0.693	0.93 (0.42 to 2.04)	0.849	1.02 (0.45 to 2.31)	0.970
Marital status												
Married/Co-habiting	8.8%	6.3%	8.4%	6.7%	7.3%	5.5%	0.87 (0.48 to 1.55)	0.624	0.86 (0.48 to 1.55)	0.624	0.81 (0.45 to 1.45)	0.470
Separated/Divorced/Widowed	8.3%	5.3%	7.0%	6.3%	6.5%	6.1%	0.72 (0.28 to 1.88)	0.507	0.74 (0.28 to 1.91)	0.531	0.84 (0.31 to 2.27)	0.731
Single	15.9%	13.9%	17.5%	11.5%	12.2%	13.0%	0.90 (0.57 to 1.41)	0.638	0.90 (0.57 to 1.40)	0.630	0.87 (0.55 to 1.39)	0.567
Housing ownership												
Owner Occupied	8.1%	6.7%	6.8%	6.4%	7.7%	7.0%	0.72 (0.39 to 1.32)	0.287	0.72 (0.39 to 1.32)	0.287	0.67 (0.36 to 1.26)	0.218
Rented	13.6%	8.7%	13.3%	11.8%	10.7%	7.9%	1.01 (0.58 to 1.75)	0.972	1.01 (0.58 to 1.75)	0.972	1.11 (0.64 to 1.95)	0.708
Housing Association/Council	12.5%	10.7%	13.4%	6.4%	8.5%	10.1%	0.63 (0.24 to 1.70)	0.362	0.64 (0.24 to 1.73)	0.379	0.63 (0.23 to 1.75)	0.375
Other	15.1%	13.1%	19.8%	8.4%	10.8%	13.0%	0.75 (0.36 to 1.59)	0.459	0.76 (0.36 to 1.60)	0.472	0.82 (0.38 to 1.75)	0.602

Based on drinkers only – Alcohol misuse (FAST score 3+)

	Scotland			England			Model 1		Model 2		Model 3	
	Wave 1	Wave 2	Wave 3	Wave 1	Wave 2	Wave 3	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p
Based on drinkers only	39.1%	38.7%	39.5%	36.8%	39.4%	40.8%	0.87 (0.70 to 1.10)	0.239	0.89 (0.71 to 1.12)	0.323	0.87 (0.68 to 1.10)	0.249
Sex												
Female	31.2%	29.1%	31.5%	27.9%	33.4%	33.6%	0.74 (0.52 to 1.04)	0.083	0.75 (0.53 to 1.06)	0.102	0.70 (0.49 to 1.00)	0.049
Male	46.7%	47.6%	47.2%	45.6%	44.9%	47.8%	1.00 (0.73 to 1.36)	0.985	1.02 (0.75 to 1.39)	0.916	1.04 (0.75 to 1.44)	0.826
Age												
16-25	59.0%	52.4%	57.0%	47.4%	51.7%	52.5%	0.69 (0.45 to 1.08)	0.103	0.70 (0.45 to 1.10)	0.120	0.75 (0.48 to 1.18)	0.216
26-45	38.9%	39.2%	39.3%	42.7%	44.9%	46.5%	0.90 (0.61 to 1.32)	0.599	0.94 (0.64 to 1.39)	0.761	0.90 (0.60 to 1.35)	0.626
46-65	41.4%	36.9%	39.8%	37.9%	41.7%	43.8%	0.73 (0.47 to 1.13)	0.157	0.72 (0.46 to 1.12)	0.147	0.72 (0.46 to 1.14)	0.164
66+	18.0%	25.8%	21.7%	14.9%	12.2%	17.2%	1.42 (0.66 to 3.07)	0.369	1.45 (0.67 to 3.17)	0.346	1.61 (0.72 to 3.58)	0.245
Ethnicity												
White	39.3%	38.9%	39.6%	36.8%	40.9%	41.0%	0.84 (0.66 to 1.06)	0.136	0.86 (0.68 to 1.08)	0.195	0.84 (0.66 to 1.08)	0.171
Non-white	33.1%	33.6%	37.5%	37.3%	19.7%	38.8%	(Too few cases for analysis)					
Employ status												
Employed	41.0%	37.4%	39.4%	41.0%	44.0%	42.8%	0.81 (0.60 to 1.10)	0.180	0.82 (0.61 to 1.11)	0.198	0.83 (0.60 to 1.13)	0.236
Economically inactive	32.6%	37.1%	35.5%	28.5%	31.1%	32.9%	1.00 (0.66 to 1.51)	0.999	1.04 (0.69 to 1.58)	0.838	1.03 (0.65 to 1.62)	0.910
Unemployed	55.4%	54.2%	57.4%	46.6%	50.6%	60.7%	0.69 (0.35 to 1.36)	0.288	0.77 (0.39 to 1.52)	0.444	0.88 (0.43 to 1.80)	0.724
Marital status												
Married/Co-habiting	29.3%	31.7%	31.0%	30.6%	31.9%	34.1%	0.99 (0.68 to 1.43)	0.954	0.99 (0.68 to 1.44)	0.966	0.92 (0.63 to 1.35)	0.664
Separated/Divorced/Widowed	26.0%	31.1%	28.3%	25.9%	28.5%	27.0%	1.09 (0.55 to 2.16)	0.796	1.10 (0.56 to 2.16)	0.789	1.13 (0.55 to 2.33)	0.741
Single	55.8%	49.4%	52.9%	47.3%	48.8%	51.4%	0.75 (0.54 to 1.04)	0.083	0.77 (0.55 to 1.07)	0.115	0.74 (0.53 to 1.05)	0.089
Housing ownership												
Owner Occupied	24.2%	29.7%	26.8%	29.4%	28.6%	33.1%	1.15 (0.77 to 1.71)	0.509	1.15 (0.77 to 1.72)	0.507	1.09 (0.72 to 1.66)	0.670
Rented	47.0%	43.6%	49.7%	45.3%	49.3%	46.8%	0.88 (0.59 to 1.31)	0.539	0.89 (0.60 to 1.33)	0.566	0.94 (0.61 to 1.43)	0.763
Housing Association/Council	47.5%	44.9%	43.2%	40.0%	35.6%	45.7%	0.84 (0.44 to 1.58)	0.587	0.83 (0.44 to 1.57)	0.568	0.65 (0.32 to 1.30)	0.223
Other	57.8%	48.3%	53.8%	35.8%	44.6%	43.8%	0.54 (0.31 to 0.92)	0.024	0.57 (0.33 to 0.98)	0.042	0.60 (0.35 to 1.04)	0.069

Based on drinkers only – FAST score

	Scotland			England			Model 1		Model 2		Model 3	
	Wave 1	Wave 2	Wave 3	Wave 1	Wave 2	Wave 3	Est (95% CI)	p	Est (95% CI)	p	Est (95% CI)	p
Based on drinkers only	2.61	2.60	2.72	2.38	2.59	2.55	-0.13 (-0.46 to 0.20)	0.425	-0.08 (-0.40 to 0.25)	0.650	-0.12 (-0.42 to 0.18)	0.426
Sex												
Female	2.14	1.98	2.11	2.00	2.09	2.07	-0.18 (-0.60 to 0.25)	0.417	-0.15 (-0.57 to 0.28)	0.504	-0.20 (-0.59 to 0.20)	0.330
Male	3.06	3.17	3.31	2.76	3.06	3.01	-0.09 (-0.57 to 0.39)	0.705	-0.01 (-0.49 to 0.47)	0.959	-0.05 (-0.49 to 0.40)	0.837
Age												
16-25	3.56	3.33	3.51	2.99	3.08	3.03	-0.20 (-0.78 to 0.38)	0.490	-0.18 (-0.76 to 0.39)	0.536	-0.18 (-0.75 to 0.40)	0.548
26-45	2.82	2.79	2.89	2.95	3.18	3.22	-0.23 (-0.83 to 0.36)	0.446	-0.14 (-0.74 to 0.45)	0.637	-0.16 (-0.72 to 0.40)	0.568
46-65	2.82	2.61	2.88	2.36	2.84	2.74	-0.48 (-1.15 to 0.18)	0.153	-0.48 (-1.14 to 0.18)	0.156	-0.44 (-1.06 to 0.17)	0.160
66+	1.16	1.53	1.42	0.87	0.70	0.91	0.37 (-0.22 to 0.97)	0.221	0.40 (-0.20 to 1.00)	0.191	0.45 (-0.13 to 1.04)	0.132
Ethnicity												
White	2.63	2.60	2.71	2.38	2.64	2.52	-0.17 (-0.51 to 0.17)	0.334	-0.11 (-0.45 to 0.23)	0.525	-0.13 (-0.44 to 0.18)	0.400
Non-white	2.13	2.66	2.90	2.41	1.98	2.98			(Too few cases for analysis)			
Employ status												
Employed	2.56	2.38	2.48	2.41	2.64	2.46	-0.28 (-0.62 to 0.06)	0.108	-0.26 (-0.59 to 0.08)	0.136	-0.23 (-0.56 to 0.09)	0.159
Economically inactive	2.19	2.45	2.42	1.86	2.12	2.00	0.04 (-0.52 to 0.60)	0.887	0.12 (-0.44 to 0.67)	0.680	0.07 (-0.44 to 0.58)	0.799
Unemployed	4.65	4.67	5.40	3.99	4.48	4.86	-0.28 (-1.80 to 1.24)	0.715	0.02 (-1.49 to 1.52)	0.982	0.36 (-1.06 to 1.78)	0.620
Marital status												
Married/Co-habiting	2.00	2.01	2.08	1.90	1.86	1.93	0.06 (-0.34 to 0.47)	0.752	0.07 (-0.33 to 0.47)	0.721	-0.03 (-0.40 to 0.35)	0.890
Separated/Divorced/Widowed	2.00	2.07	2.24	1.67	1.92	1.70	0.02 (-0.90 to 0.95)	0.960	0.04 (-0.88 to 0.97)	0.928	-0.06 (-0.90 to 0.77)	0.884
Single	3.56	3.46	3.59	3.15	3.42	3.38	-0.28 (-0.82 to 0.26)	0.316	-0.19 (-0.73 to 0.35)	0.491	-0.25 (-0.77 to 0.26)	0.334
Housing ownership												
Owner Occupied	1.69	1.84	1.70	1.76	1.73	1.76	0.10 (-0.32 to 0.51)	0.642	0.12 (-0.29 to 0.53)	0.574	0.06 (-0.32 to 0.44)	0.762
Rented	2.95	2.78	3.28	2.61	3.12	2.99	-0.37 (-0.93 to 0.19)	0.193	-0.35 (-0.90 to 0.21)	0.219	-0.26 (-0.79 to 0.26)	0.321
Housing Association/Council	3.67	3.49	3.56	2.99	2.74	3.06	-0.06 (-1.26 to 1.14)	0.925	-0.09 (-1.29 to 1.11)	0.882	-0.58 (-1.73 to 0.58)	0.328
Other	3.47	3.39	3.71	2.96	3.33	3.17	-0.20 (-1.09 to 0.70)	0.668	-0.06 (-0.95 to 0.83)	0.897	0.05 (-0.78 to 0.89)	0.904

Based on drinkers only – Increased alcohol use in the past year

	Scotland			England			Model 1		Model 2		Model 3	
	Wave 1	Wave 2	Wave 3	Wave 1	Wave 2	Wave 3	Est (95% CI)	p	Est (95% CI)	p	Est (95% CI)	p
Based on drinkers only	8.6%	9.5%	9.1%	8.6%	10.2%	8.9%	0.96 (0.65 to 1.41)	0.834	0.98 (0.67 to 1.44)	0.925	0.97 (0.65 to 1.45)	0.875
Sex												
Female	8.5%	7.5%	7.6%	8.1%	8.3%	9.3%	0.80 (0.45 to 1.41)	0.442	0.82 (0.46 to 1.44)	0.486	0.79 (0.44 to 1.41)	0.422
Male	8.7%	11.3%	10.5%	9.0%	12.0%	8.4%	1.11 (0.66 to 1.87)	0.704	1.13 (0.67 to 1.91)	0.652	1.14 (0.66 to 1.98)	0.636
Age												
16-25	18.4%	20.7%	19.4%	18.9%	20.1%	18.1%	1.10 (0.62 to 1.93)	0.751	1.07 (0.61 to 1.89)	0.816	1.07 (0.60 to 1.91)	0.820
26-45	7.3%	8.1%	7.8%	6.7%	8.6%	8.5%	0.84 (0.41 to 1.73)	0.634	0.88 (0.43 to 1.82)	0.736	0.86 (0.40 to 1.81)	0.683
46-65	8.2%	7.3%	7.4%	6.3%	7.7%	6.6%	0.78 (0.33 to 1.82)	0.564	0.79 (0.34 to 1.84)	0.581	0.79 (0.33 to 1.88)	0.590
66+	1.9%	2.6%	3.1%	2.8%	3.8%	1.9%	1.52 (0.22 to 10.40)	0.670	1.50 (0.22 to 10.46)	0.682	1.56 (0.23 to 10.42)	0.645
Ethnicity												
White	8.8%	9.2%	8.9%	8.5%	10.2%	8.7%	0.92 (0.62 to 1.37)	0.679	0.94 (0.63 to 1.40)	0.763	0.95 (0.63 to 1.44)	0.816
Non-white	4.8%	16.3%	15.0%	9.3%	10.8%	10.7%	(Too few cases for analysis)					
Employ status												
Employed	8.6%	7.1%	6.0%	7.0%	7.8%	7.0%	0.70 (0.40 to 1.23)	0.216	0.70 (0.40 to 1.23)	0.211	0.71 (0.40 to 1.26)	0.245
Economically inactive	7.3%	9.9%	10.1%	10.5%	11.9%	9.4%	1.38 (0.75 to 2.55)	0.307	1.42 (0.77 to 2.64)	0.263	1.43 (0.74 to 2.74)	0.284
Unemployed	14.4%	22.8%	22.8%	9.0%	16.9%	14.7%	0.93 (0.33 to 2.60)	0.892	1.05 (0.37 to 2.96)	0.928	1.10 (0.38 to 3.20)	0.858
Marital status												
Married/Co-habiting	5.0%	4.3%	5.2%	4.1%	3.6%	3.7%	1.07 (0.47 to 2.41)	0.871	1.09 (0.48 to 2.46)	0.832	1.03 (0.45 to 2.34)	0.948
Separated/Divorced/Widowed	6.4%	6.9%	4.8%	6.8%	10.4%	6.0%	0.76 (0.21 to 2.68)	0.664	0.73 (0.20 to 2.61)	0.628	0.70 (0.19 to 2.51)	0.580
Single	13.7%	16.1%	14.9%	14.0%	16.0%	14.2%	1.06 (0.66 to 1.70)	0.811	1.06 (0.66 to 1.71)	0.801	1.01 (0.62 to 1.65)	0.953
Housing ownership												
Owner Occupied	4.5%	3.7%	3.5%	4.0%	6.1%	4.5%	0.59 (0.24 to 1.46)	0.256	0.61 (0.25 to 1.51)	0.286	0.61 (0.24 to 1.52)	0.285
Rented	11.3%	12.4%	12.1%	11.6%	11.8%	7.9%	1.27 (0.68 to 2.36)	0.446	1.32 (0.71 to 2.45)	0.384	1.43 (0.75 to 2.72)	0.275
Housing Association/Council	10.8%	10.9%	10.7%	9.9%	9.4%	10.2%	1.01 (0.37 to 2.77)	0.988	1.00 (0.36 to 2.74)	0.993	0.80 (0.27 to 2.30)	0.674
Other	13.1%	18.4%	17.4%	12.4%	16.8%	19.2%	0.93 (0.44 to 1.98)	0.849	0.89 (0.42 to 1.91)	0.774	0.97 (0.44 to 2.11)	0.933

Appendix 6   Sensitivity analysis
Based on drinkers only – At least hazardous drinking level (FAST score 2+)

	Scotland			England			Model 1		Model 2		Model 3	
	Wave 1	Wave 2	Wave 3	Wave 1	Wave 2	Wave 3	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p
Based on drinkers only	53.6%	53.8%	53.3%	50.6%	53.8%	55.4%	0.85 (0.68 to 1.07)	0.165	0.87 (0.69 to 1.09)	0.217	0.83 (0.65 to 1.05)	0.127
Sex												
Female	45.3%	43.1%	46.9%	43.2%	51.0%	49.9%	0.74 (0.54 to 1.02)	0.070	0.75 (0.54 to 1.04)	0.084	0.69 (0.49 to 0.96)	0.030
Male	61.6%	63.6%	59.4%	57.9%	56.3%	60.6%	0.97 (0.71 to 1.34)	0.867	0.99 (0.72 to 1.36)	0.939	1.00 (0.71 to 1.41)	0.982
Age												
16-25	76.2%	72.5%	73.3%	66.0%	73.7%	72.1%	0.60 (0.37 to 0.97)	0.039	0.62 (0.38 to 1.01)	0.053	0.66 (0.40 to 1.08)	0.097
26-45	59.6%	59.4%	56.8%	59.8%	62.0%	67.2%	0.77 (0.53 to 1.14)	0.195	0.78 (0.53 to 1.15)	0.214	0.74 (0.50 to 1.11)	0.147
46-65	54.2%	50.2%	52.7%	51.5%	54.3%	55.1%	0.79 (0.51 to 1.22)	0.284	0.78 (0.51 to 1.21)	0.269	0.77 (0.50 to 1.20)	0.256
66+	22.9%	30.0%	28.7%	18.4%	15.0%	21.3%	1.41 (0.70 to 2.83)	0.331	1.46 (0.72 to 2.94)	0.294	1.62 (0.79 to 3.33)	0.191
Ethnicity												
White	54.0%	53.9%	53.2%	50.4%	54.9%	55.0%	0.82 (0.65 to 1.03)	0.091	0.83 (0.66 to 1.05)	0.127	0.80 (0.63 to 1.03)	0.085
Non-white	41.7%	52.9%	54.1%	52.9%	39.9%	60.4%			(Too few cases for analysis)			
Employ status												
Employed	60.1%	57.9%	56.6%	59.6%	60.8%	61.9%	0.83 (0.61 to 1.12)	0.225	0.83 (0.61 to 1.13)	0.234	0.82 (0.60 to 1.13)	0.221
Economically inactive	40.8%	45.7%	45.2%	36.5%	43.4%	43.2%	0.91 (0.62 to 1.34)	0.630	0.94 (0.64 to 1.39)	0.759	0.90 (0.58 to 1.39)	0.628
Unemployed	68.2%	62.9%	68.4%	59.0%	61.1%	70.6%	0.66 (0.33 to 1.33)	0.245	0.72 (0.35 to 1.46)	0.358	0.77 (0.37 to 1.60)	0.483
Marital status												
Married/Co-habiting	45.5%	46.9%	45.3%	45.8%	44.4%	47.4%	1.02 (0.73 to 1.44)	0.907	1.02 (0.72 to 1.43)	0.926	0.96 (0.67 to 1.38)	0.837
Separated/Divorced/Widowed	34.8%	42.1%	36.0%	33.4%	35.2%	36.0%	1.08 (0.57 to 2.05)	0.802	1.08 (0.57 to 2.05)	0.805	1.06 (0.54 to 2.12)	0.858
Single	71.0%	66.1%	68.5%	61.9%	66.9%	68.9%	0.65 (0.46 to 0.93)	0.017	0.66 (0.46 to 0.94)	0.023	0.62 (0.43 to 0.89)	0.010
Housing ownership												
Owner Occupied	39.0%	44.6%	40.5%	42.5%	40.8%	42.0%	1.21 (0.84 to 1.74)	0.316	1.21 (0.84 to 1.74)	0.309	1.16 (0.79 to 1.70)	0.455
Rented	60.3%	61.6%	62.3%	58.2%	65.3%	66.7%	0.77 (0.51 to 1.16)	0.213	0.77 (0.51 to 1.17)	0.228	0.79 (0.51 to 1.23)	0.298
Housing Association/Council	60.0%	52.5%	57.1%	50.6%	48.0%	60.6%	0.69 (0.37 to 1.31)	0.261	0.69 (0.37 to 1.31)	0.262	0.55 (0.28 to 1.09)	0.087
Other	74.9%	66.8%	69.4%	54.8%	61.9%	60.6%	0.55 (0.31 to 0.96)	0.037	0.57 (0.32 to 1.01)	0.052	0.65 (0.37 to 1.13)	0.129

Based on drinkers only – At least harmful drinking level (FAST score 4+)

	Scotland			England			Model 1		Model 2		Model 3	
	Wave 1	Wave 2	Wave 3	Wave 1	Wave 2	Wave 3	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p
Based on drinkers only	24.8%	23.0%	24.7%	23.3%	23.8%	23.1%	0.94 (0.73 to 1.22)	0.656	0.97 (0.75 to 1.26)	0.816	0.96 (0.73 to 1.27)	0.797
Sex												
Female	18.2%	15.0%	15.9%	17.8%	18.2%	16.9%	0.83 (0.55 to 1.26)	0.394	0.85 (0.56 to 1.29)	0.455	0.81 (0.53 to 1.25)	0.346
Male	31.2%	30.4%	33.2%	28.7%	29.0%	29.0%	1.01 (0.73 to 1.41)	0.942	1.04 (0.75 to 1.46)	0.799	1.08 (0.75 to 1.54)	0.685
Age												
16-25	39.7%	34.0%	38.7%	35.0%	33.7%	32.1%	0.95 (0.60 to 1.50)	0.828	0.96 (0.60 to 1.51)	0.847	1.01 (0.63 to 1.62)	0.955
26-45	24.8%	22.9%	25.3%	26.8%	28.3%	27.5%	0.91 (0.59 to 1.41)	0.675	0.95 (0.62 to 1.48)	0.829	0.91 (0.57 to 1.45)	0.678
46-65	23.7%	19.2%	22.9%	23.3%	22.8%	23.9%	0.86 (0.52 to 1.44)	0.571	0.86 (0.51 to 1.43)	0.557	0.91 (0.52 to 1.60)	0.743
66+	12.2%	16.4%	12.3%	5.1%	5.3%	6.4%	1.01 (0.32 to 3.25)	0.984	1.02 (0.32 to 3.29)	0.975	1.08 (0.32 to 3.60)	0.902
Ethnicity												
White	25.1%	23.0%	24.6%	23.0%	24.6%	22.7%	0.90 (0.69 to 1.17)	0.422	0.92 (0.71 to 1.21)	0.563	0.93 (0.70 to 1.24)	0.642
Non-white	16.8%	23.4%	27.7%	27.5%	13.9%	27.7%			(Too few cases for analysis)			
Employ status												
Employed	22.8%	19.0%	21.7%	22.9%	24.2%	20.8%	0.88 (0.62 to 1.26)	0.488	0.90 (0.63 to 1.28)	0.552	0.92 (0.63 to 1.34)	0.674
Economically inactive	22.6%	24.3%	23.2%	19.6%	19.8%	19.0%	1.08 (0.68 to 1.69)	0.752	1.13 (0.71 to 1.77)	0.608	1.11 (0.68 to 1.80)	0.683
Unemployed	46.2%	42.7%	48.5%	37.1%	39.8%	46.7%	0.75 (0.38 to 1.50)	0.419	0.82 (0.41 to 1.65)	0.581	0.96 (0.46 to 2.03)	0.923
Marital status												
Married/Co-habiting	15.5%	14.4%	15.4%	16.1%	13.0%	14.9%	1.14 (0.72 to 1.82)	0.575	1.15 (0.72 to 1.84)	0.557	1.06 (0.66 to 1.72)	0.803
Separated/Divorced/Widowed	19.3%	19.3%	18.8%	15.0%	18.5%	12.8%	0.96 (0.42 to 2.18)	0.918	0.95 (0.42 to 2.17)	0.903	1.01 (0.42 to 2.42)	0.986
Single	37.6%	33.8%	36.9%	33.9%	34.7%	33.5%	0.90 (0.64 to 1.27)	0.551	0.92 (0.65 to 1.31)	0.660	0.90 (0.63 to 1.30)	0.582
Housing ownership												
Owner Occupied	12.3%	14.0%	12.5%	15.5%	13.0%	14.1%	1.28 (0.77 to 2.14)	0.345	1.30 (0.78 to 2.17)	0.315	1.27 (0.75 to 2.15)	0.379
Rented	32.0%	26.9%	33.2%	27.7%	32.5%	29.5%	0.78 (0.50 to 1.20)	0.250	0.77 (0.50 to 1.18)	0.229	0.82 (0.52 to 1.29)	0.384
Housing Association/Council	36.1%	30.6%	29.7%	30.4%	21.9%	29.6%	0.95 (0.48 to 1.89)	0.893	0.94 (0.47 to 1.86)	0.854	0.73 (0.34 to 1.60)	0.434
Other	35.7%	32.5%	39.0%	27.9%	30.6%	26.9%	0.97 (0.55 to 1.71)	0.908	1.02 (0.57 to 1.81)	0.949	1.08 (0.60 to 1.95)	0.799

Based on drinkers only – At least dependent drinking level (FAST score 6+)

	Scotland			England			Model 1		Model 2		Model 3	
	Wave 1	Wave 2	Wave 3	Wave 1	Wave 2	Wave 3	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p
Based on drinkers only	13.8%	12.6%	13.9%	10.6%	12.3%	11.3%	0.84 (0.60 to 1.19)	0.333	0.88 (0.62 to 1.25)	0.476	0.85 (0.59 to 1.23)	0.385
Sex												
Female	9.5%	7.0%	7.6%	8.6%	7.1%	7.3%	0.91 (0.52 to 1.61)	0.754	0.94 (0.53 to 1.67)	0.844	0.87 (0.49 to 1.57)	0.650
Male	18.0%	17.7%	20.0%	12.5%	17.1%	15.2%	0.79 (0.51 to 1.21)	0.274	0.83 (0.54 to 1.28)	0.391	0.80 (0.51 to 1.27)	0.351
Age												
16-25	19.3%	17.1%	19.2%	15.5%	13.7%	12.6%	1.12 (0.62 to 2.03)	0.715	1.15 (0.63 to 2.09)	0.647	1.14 (0.62 to 2.11)	0.672
26-45	13.3%	12.4%	14.3%	12.9%	16.3%	16.4%	0.76 (0.44 to 1.34)	0.347	0.82 (0.47 to 1.44)	0.496	0.77 (0.42 to 1.41)	0.399
46-65	16.1%	13.0%	14.5%	9.8%	13.3%	11.5%	0.64 (0.33 to 1.25)	0.188	0.64 (0.33 to 1.25)	0.194	0.64 (0.30 to 1.35)	0.241
66+	6.5%	7.6%	7.1%	2.5%	2.6%	2.8%	0.95 (0.17 to 5.43)	0.954	0.96 (0.17 to 5.54)	0.968	0.97 (0.16 to 5.83)	0.969
Ethnicity												
White	13.8%	12.5%	13.8%	10.5%	12.7%	11.0%	0.82 (0.57 to 1.18)	0.285	0.86 (0.60 to 1.23)	0.404	0.84 (0.57 to 1.24)	0.389
Non-white	12.8%	15.9%	17.7%	11.3%	7.3%	15.6%			(Too few cases for analysis)			
Employ status												
Employed	10.2%	8.6%	9.8%	7.5%	11.2%	8.1%	0.67 (0.39 to 1.13)	0.133	0.69 (0.41 to 1.17)	0.169	0.72 (0.42 to 1.23)	0.227
Economically inactive	14.0%	13.8%	13.6%	9.2%	9.8%	8.9%	0.96 (0.52 to 1.75)	0.887	1.01 (0.55 to 1.84)	0.978	0.93 (0.49 to 1.77)	0.832
Unemployed	34.1%	33.0%	39.8%	27.5%	30.3%	33.1%	0.91 (0.44 to 1.89)	0.798	1.00 (0.48 to 2.09)	0.995	1.18 (0.53 to 2.61)	0.691
Marital status												
Married/Co-habiting	7.7%	7.5%	7.9%	6.1%	6.5%	5.2%	1.03 (0.52 to 2.04)	0.932	1.06 (0.53 to 2.09)	0.873	0.89 (0.44 to 1.81)	0.745
Separated/Divorced/Widowed	13.7%	10.6%	13.0%	6.6%	8.8%	7.4%	0.67 (0.21 to 2.12)	0.499	0.68 (0.22 to 2.14)	0.509	0.67 (0.19 to 2.35)	0.527
Single	20.6%	18.9%	20.8%	16.7%	18.3%	17.8%	0.87 (0.57 to 1.34)	0.540	0.92 (0.60 to 1.42)	0.707	0.88 (0.55 to 1.38)	0.570
Housing ownership												
Owner Occupied	5.9%	6.0%	5.6%	5.0%	5.1%	5.1%	0.96 (0.43 to 2.14)	0.912	0.98 (0.44 to 2.20)	0.963	0.96 (0.42 to 2.18)	0.913
Rented	16.2%	13.5%	18.6%	11.0%	15.8%	13.0%	0.72 (0.40 to 1.29)	0.269	0.74 (0.41 to 1.32)	0.307	0.80 (0.43 to 1.48)	0.469
Housing Association/Council	26.3%	23.1%	22.4%	19.6%	16.4%	18.7%	0.93 (0.42 to 2.08)	0.863	0.92 (0.41 to 2.06)	0.831	0.70 (0.28 to 1.78)	0.458
Other	18.9%	17.9%	20.5%	16.3%	18.7%	17.0%	0.92 (0.46 to 1.83)	0.811	0.99 (0.50 to 1.99)	0.986	1.02 (0.49 to 2.11)	0.957

Based on all respondents – Alcohol-related attendance

	Scotland			England			Model 1		Model 2		Model 3	
	Wave 1	Wave 2	Wave 3	Wave 1	Wave 2	Wave 3	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p
Based on all respondents	13.7%	12.7%	15.3%	10.5%	12.6%	12.2%	0.85 (0.63 to 1.14)	0.280	0.86 (0.64 to 1.16)	0.335	0.87 (0.64 to 1.18)	0.377
Sex												
Female	10.6%	8.7%	9.7%	8.1%	9.2%	8.4%	0.78 (0.49 to 1.26)	0.316	0.81 (0.50 to 1.31)	0.401	0.82 (0.50 to 1.33)	0.422
Male	17.0%	16.7%	21.4%	13.1%	16.2%	16.2%	0.89 (0.61 to 1.31)	0.563	0.90 (0.61 to 1.31)	0.575	0.91 (0.62 to 1.35)	0.655
Age												
16-25	22.6%	16.2%	23.7%	14.2%	17.1%	14.8%	0.74 (0.43 to 1.29)	0.288	0.74 (0.43 to 1.28)	0.283	0.74 (0.42 to 1.31)	0.303
26-45	15.5%	15.3%	17.2%	13.7%	15.3%	15.5%	0.92 (0.57 to 1.51)	0.748	0.94 (0.57 to 1.54)	0.803	0.93 (0.56 to 1.54)	0.776
46-65	14.4%	14.0%	15.4%	13.2%	14.6%	15.5%	0.88 (0.50 to 1.55)	0.661	0.90 (0.51 to 1.59)	0.727	0.97 (0.54 to 1.74)	0.916
66+	4.7%	5.4%	6.3%	1.6%	2.8%	3.0%	0.67 (0.15 to 2.99)	0.604	0.66 (0.15 to 2.96)	0.588	0.68 (0.15 to 3.07)	0.616
Ethnicity												
White	14.4%	12.9%	15.6%	10.8%	13.9%	12.9%	0.77 (0.57 to 1.05)	0.101	0.79 (0.58 to 1.07)	0.131	0.80 (0.58 to 1.10)	0.162
Non-white	2.3%	9.9%	10.0%	8.4%	4.3%	6.6%	(Too few cases for analysis)					
Employ status												
Employed	14.0%	12.3%	15.2%	11.5%	13.5%	13.4%	0.82 (0.54 to 1.25)	0.355	0.82 (0.54 to 1.25)	0.350	0.82 (0.54 to 1.27)	0.379
Economically inactive	10.7%	10.9%	12.4%	7.4%	10.3%	7.2%	0.90 (0.53 to 1.53)	0.701	0.93 (0.54 to 1.57)	0.776	0.95 (0.55 to 1.65)	0.862
Unemployed	25.3%	23.2%	29.4%	18.1%	19.6%	25.5%	0.79 (0.39 to 1.61)	0.516	0.87 (0.42 to 1.77)	0.695	0.96 (0.45 to 2.02)	0.911
Marital status												
Married/Co-habiting	10.2%	8.7%	11.0%	7.5%	9.4%	8.3%	0.80 (0.47 to 1.38)	0.425	0.80 (0.47 to 1.37)	0.419	0.74 (0.43 to 1.28)	0.281
Separated/Divorced/Widowed	8.7%	7.4%	8.6%	6.4%	8.2%	8.1%	0.70 (0.28 to 1.78)	0.459	0.71 (0.28 to 1.80)	0.475	0.82 (0.31 to 2.14)	0.682
Single	20.5%	19.8%	23.3%	15.9%	17.2%	17.7%	0.96 (0.65 to 1.43)	0.855	0.98 (0.66 to 1.46)	0.910	0.96 (0.64 to 1.44)	0.835
Housing ownership												
Owner Occupied	9.4%	8.5%	8.2%	7.2%	10.1%	9.8%	0.61 (0.35 to 1.09)	0.095	0.61 (0.35 to 1.09)	0.094	0.58 (0.32 to 1.04)	0.065
Rented	16.1%	14.8%	20.2%	13.7%	15.4%	11.5%	1.11 (0.67 to 1.83)	0.693	1.12 (0.68 to 1.86)	0.649	1.24 (0.74 to 2.07)	0.411
Housing Association/Council	16.5%	16.0%	16.5%	9.2%	10.7%	14.7%	0.68 (0.30 to 1.56)	0.366	0.69 (0.30 to 1.58)	0.383	0.66 (0.28 to 1.55)	0.346
Other	18.2%	16.1%	25.1%	13.1%	14.0%	16.6%	0.98 (0.51 to 1.86)	0.946	0.99 (0.52 to 1.89)	0.976	1.08 (0.56 to 2.11)	0.810

Based on all respondents who consented for data linkage– Alcohol-related diagnosis

	Scotland			England			Model 1		Model 2		Model 3	
	Wave 1	Wave 2	Wave 3	Wave 1	Wave 2	Wave 3	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p
Based on all respondents who consented for data linkage	4.5%	5.4%	5.7%	10.9%	9.3%	8.3%	1.56 (0.96 to 2.53)	0.075	1.56 (0.96 to 2.54)	0.072	1.57 (0.96 to 2.58)	0.072
Sex												
Female	4.1%	4.8%	5.0%	9.4%	8.9%	7.8%	1.36 (0.63 to 2.94)	0.434	1.36 (0.63 to 2.94)	0.433	1.45 (0.66 to 3.17)	0.351
Male	4.9%	5.9%	6.4%	12.5%	9.7%	8.9%	1.75 (0.94 to 3.26)	0.076	1.77 (0.95 to 3.29)	0.073	1.70 (0.90 to 3.19)	0.100
Age												
16-25	2.2%	2.8%	3.7%	2.8%	1.8%	3.6%	1.57 (0.31 to 8.00)	0.585	1.53 (0.30 to 7.82)	0.607	1.38 (0.27 to 7.13)	0.701
26-45	4.3%	1.7%	3.5%	5.2%	3.7%	5.7%	0.69 (0.23 to 2.00)	0.489	0.66 (0.23 to 1.92)	0.445	0.64 (0.22 to 1.91)	0.427
46-65	4.2%	7.9%	5.6%	13.0%	13.1%	11.6%	1.73 (0.74 to 4.07)	0.209	1.76 (0.75 to 4.15)	0.196	1.69 (0.71 to 4.04)	0.235
66+	6.8%	9.2%	9.8%	20.5%	17.6%	11.0%	2.25 (0.99 to 5.08)	0.052	2.20 (0.97 to 4.98)	0.058	2.30 (1.01 to 5.21)	0.047
Ethnicity												
White	4.8%	5.7%	5.8%	11.0%	9.6%	8.2%	1.53 (0.92 to 2.55)	0.098	1.55 (0.93 to 2.57)	0.092	1.56 (0.93 to 2.60)	0.090
Non-white	0.6%	0.8%	3.8%	10.2%	7.2%	9.2%	(Too few cases for analysis)					
Employ status												
Employed	3.3%	3.6%	4.1%	4.6%	5.4%	5.5%	1.00 (0.42 to 2.34)	0.991	1.00 (0.42 to 2.35)	0.999	1.09 (0.46 to 2.58)	0.844
Economically inactive	5.6%	7.1%	7.3%	16.5%	12.5%	9.2%	2.11 (1.07 to 4.19)	0.032	2.12 (1.07 to 4.19)	0.031	2.12 (1.06 to 4.23)	0.034
Unemployed	6.1%	6.4%	6.2%	14.8%	15.3%	17.5%	0.90 (0.26 to 3.13)	0.870	0.86 (0.25 to 3.01)	0.818	0.81 (0.23 to 2.90)	0.749
Marital status												
Married/Co-habiting	4.8%	5.7%	5.5%	13.3%	12.3%	9.0%	1.52 (0.78 to 2.99)	0.221	1.60 (0.82 to 3.15)	0.170	1.51 (0.76 to 3.01)	0.238
Separated/Divorced/Widowed	5.2%	6.6%	7.5%	13.7%	12.1%	9.2%	1.85 (0.62 to 5.55)	0.272	1.81 (0.60 to 5.44)	0.289	1.76 (0.58 to 5.34)	0.321
Single	3.9%	4.4%	4.9%	6.1%	4.5%	6.9%	1.32 (0.52 to 3.34)	0.561	1.30 (0.51 to 3.29)	0.584	1.49 (0.58 to 3.81)	0.406
Housing ownership												
Owner Occupied	5.8%	7.2%	7.4%	14.7%	10.9%	10.2%	1.85 (0.93 to 3.68)	0.077	1.86 (0.94 to 3.69)	0.076	1.93 (0.96 to 3.85)	0.064
Rented	2.6%	3.5%	3.8%	5.3%	8.5%	3.8%	1.14 (0.36 to 3.56)	0.828	1.18 (0.38 to 3.69)	0.771	1.28 (0.40 to 4.07)	0.681
Housing Association/Council	5.6%	5.5%	4.6%	14.7%	8.9%	8.1%	1.68 (0.55 to 5.11)	0.361	1.65 (0.54 to 5.02)	0.382	1.63 (0.51 to 5.20)	0.411
Other	2.9%	3.5%	4.9%	6.5%	6.7%	9.5%	1.17 (0.29 to 4.75)	0.824	1.18 (0.29 to 4.79)	0.819	0.97 (0.23 to 4.00)	0.962

Complete-case, weighted analysis

	Scotland			England			Model 1		Model 2		Model 3	
	Wave 1	Wave 2	Wave 3	Wave 1	Wave 2	Wave 3	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p
Based on all recorded attendees												
Alcohol-related attendance	8.4%	8.0%	8.1%	6.0%	6.2%	4.5%	1.08 (0.86 to 1.36)	0.506	1.13 (0.90 to 1.42)	0.301	1.17 (0.92 to 1.48)	0.194
Based on all respondents												
Current alcohol drinker	79.3%	77.7%	80.8%	78.4%	78.0%	78.7%	1.01 (0.78 to 1.30)	0.958	1.00 (0.78 to 1.29)	0.992	0.99 (0.74 to 1.31)	0.928
Binge drinking in the past 24 hours	11.3%	8.7%	11.5%	8.5%	9.2%	8.3%	0.85 (0.61 to 1.19)	0.344	0.86 (0.62 to 1.20)	0.375	0.89 (0.63 to 1.27)	0.525
Binge drinking in the past week	25.9%	25.6%	25.9%	24.8%	23.6%	22.9%	1.08 (0.86 to 1.35)	0.519	1.09 (0.87 to 1.36)	0.470	1.12 (0.88 to 1.42)	0.367
Based on drinkers only												
Alcohol misuse (FAST score 3+)	39.3%	38.4%	39.4%	36.7%	39.0%	40.5%	0.87 (0.69 to 1.09)	0.215	0.88 (0.70 to 1.11)	0.288	0.88 (0.69 to 1.13)	0.312
Increased alcohol use in the past year	8.6%	9.4%	9.1%	8.5%	10.2%	8.7%	0.96 (0.66 to 1.41)	0.849	0.99 (0.67 to 1.45)	0.946	1.00 (0.66 to 1.51)	1.000
Based on respondents who consented for data linkage												
Alcohol-related diagnosis	4.5%	5.4%	5.7%	10.9%	9.3%	8.3%	1.56 (0.96 to 2.53)	0.075	1.56 (0.96 to 2.54)	0.072	1.48 (0.90 to 2.45)	0.125
							Est (95% CI)	p	Est (95% CI)	p	Est (95% CI)	p
Based on drinkers only												
FAST score	2.62	2.58	2.71	2.36	2.54	2.52	-0.13 (-0.45 to 0.19)	0.411	-0.08 (-0.40 to 0.24)	0.626	-0.12 (-0.42 to 0.17)	0.406

Difference-in-difference estimates of the effects of MUP – Complete-case, weighted analysis

	Scotland			England			Model 1		Model 2		Model 3	
	Wave 1	Wave 2	Wave 3	Wave 1	Wave 2	Wave 3	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p
Based on all recorded attendees												
Alcohol-related attendance	8.4%	8.0%	8.1%	6.0%	6.2%	4.5%	1.08 (0.86 to 1.36)	0.506	1.13 (0.90 to 1.42)	0.301	1.17 (0.92 to 1.48)	0.194
Based on all respondents												
Current alcohol drinker	79.3%	77.7%	80.8%	78.4%	78.0%	78.7%	1.01 (0.78 to 1.30)	0.958	1.00 (0.78 to 1.29)	0.992	0.99 (0.74 to 1.31)	0.928
Binge drinking in the past week	25.9%	25.6%	25.9%	24.8%	23.6%	22.9%	1.08 (0.86 to 1.35)	0.519	1.09 (0.87 to 1.36)	0.470	1.12 (0.88 to 1.42)	0.367
Binge drinking in the past 24 hours	11.3%	8.7%	11.5%	8.5%	9.2%	8.3%	0.85 (0.61 to 1.19)	0.344	0.86 (0.62 to 1.20)	0.375	0.89 (0.63 to 1.27)	0.525
Based on drinkers only												
Alcohol misuse (FAST score 3+)	39.3%	38.4%	39.4%	36.7%	39.0%	40.5%	0.87 (0.69 to 1.09)	0.215	0.88 (0.70 to 1.11)	0.288	0.88 (0.69 to 1.13)	0.312
Increased alcohol use in the past year	8.6%	9.4%	9.1%	8.5%	10.2%	8.7%	0.96 (0.66 to 1.41)	0.849	0.99 (0.67 to 1.45)	0.946	1.00 (0.66 to 1.51)	1.000
							Est (95% CI)	p	Est (95% CI)	p	Est (95% CI)	p
Based on drinkers only												
FAST score	2.62	2.58	2.71	2.36	2.54	2.52	-0.13 (-0.45 to 0.19)	0.411	-0.08 (-0.40 to 0.24)	0.626	-0.12 (-0.42 to 0.17)	0.406

Difference-in-difference estimates of the effects of MUP – Complete-case, unweighted analysis

	Scotland			England			Model 1		Model 2		Model 3	
	Wave 1	Wave 2	Wave 3	Wave 1	Wave 2	Wave 3	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p
Based on all recorded attendees												
Alcohol-related attendance	8.8%	8.2%	8.2%	5.6%	6.3%	4.5%	0.95 (0.76 to 1.19)	0.663	0.99 (0.79 to 1.24)	0.915	1.09 (0.87 to 1.38)	0.454
Based on all respondents												
Current alcohol drinker	81.4%	79.6%	82.3%	79.8%	79.5%	80.3%	0.97 (0.76 to 1.23)	0.777	0.96 (0.76 to 1.22)	0.755	1.00 (0.77 to 1.31)	0.988
Binge drinking in the past week	28.8%	27.7%	27.1%	25.4%	24.8%	24.6%	0.97 (0.78 to 1.21)	0.800	0.98 (0.79 to 1.22)	0.869	1.06 (0.84 to 1.35)	0.612
Binge drinking in the past 24 hours	12.3%	9.5%	12.0%	8.7%	9.4%	9.0%	0.81 (0.59 to 1.12)	0.198	0.82 (0.59 to 1.13)	0.224	0.89 (0.63 to 1.25)	0.503
Based on drinkers only												
Alcohol misuse (FAST score 3+)	42.1%	39.8%	40.9%	36.2%	40.6%	42.3%	0.75 (0.60 to 0.93)	0.009	0.76 (0.61 to 0.95)	0.016	0.80 (0.63 to 1.02)	0.070
Increased alcohol use in the past year	9.6%	10.2%	9.7%	8.5%	10.2%	9.5%	0.96 (0.66 to 1.41)	0.849	0.99 (0.67 to 1.45)	0.946	1.00 (0.66 to 1.51)	1.000
							Est (95% CI)	p	Est (95% CI)	p	Est (95% CI)	p
Based on drinkers only												
FAST score	2.79	2.70	2.79	2.36	2.61	2.64	-0.31 (-0.61 to 0.00)	0.052	-0.25 (-0.56 to 0.06)	0.113	-0.21 (-0.49 to 0.08)	0.165

Appendix 7

Trends in alcohol-specific deaths, and alcohol-related hospital admission in Scotland and Norther England between 2012-2018.
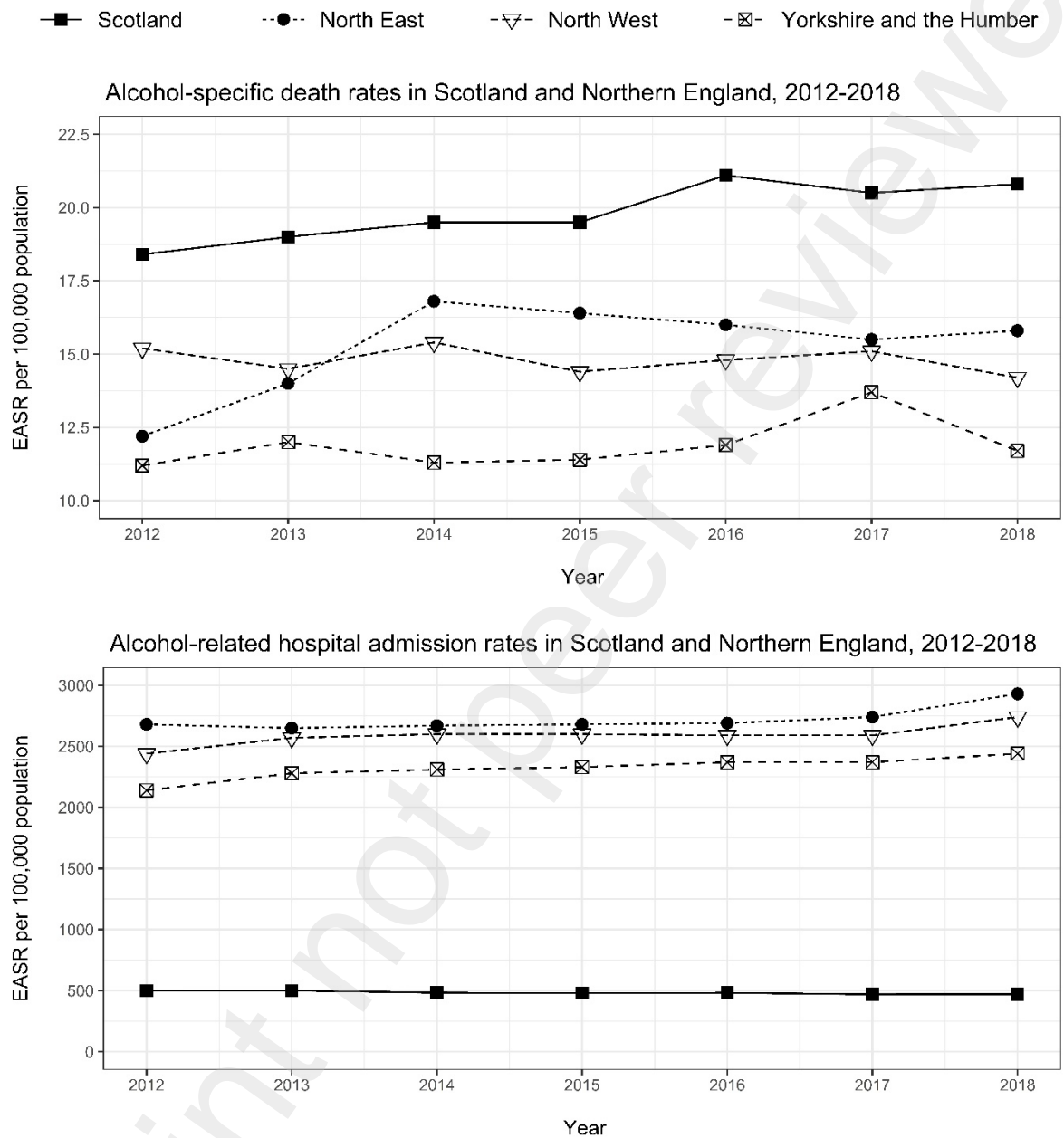
Source: Office of National Statistics. Alcohol-specific deaths in the UK, 2019; Public Health Scotland. Alcohol-Related Hospital Statistics Scotland 2019; Public Health England. Local Alcohol Profiles for England 2020; EASR = European Age Standardised Rate.