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Original Research

Evaluating the effects of minimum unit pricing in Scotland on the prevalence of harmful drinking: a controlled interrupted time series analysis

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ABSTRACT

Objectives: In May 2018, the Scottish Government introduced a minimum unit price (MUP) for alcohol of £0.50 (1 UK unit = 8 g ethanol) to reduce alcohol consumption, particularly among people drinking at harmful levels. This study aimed to evaluate MUP's impact on the prevalence of harmful drinking among adults in Scotland.

Study design: This was a controlled interrupted monthly time series analysis of repeat cross-sectional data collected via 1-week drinking diaries from adult drinkers in Scotland (N = 38,674) and Northern England (N = 71,687) between January 2009 and February 2020.

Methods: The primary outcome was the proportion of drinkers consuming at harmful levels (>50 [men] or >35 [women] units in diary week). The secondary outcomes included the proportion of drinkers consuming at hazardous (≥14–50 [men] or ≥14–35 [women] units) and moderate (<14 units) levels and measures of beverage preferences and drinking patterns. Analyses also examined the prevalence of harmful drinking in key subgroups.

Results: There was no significant change in the proportion of drinkers consuming at harmful levels (β = +0.6 percentage points; 95% confidence interval [CI] = −1.1, +2.3) or moderate levels (β = +1.4 percentage points; 95% confidence interval = −1.1, +3.8) after the introduction of MUP. The proportion consuming at hazardous levels fell significantly by 3.5 percentage points (95% CI = −5.4, −1.7). There were no significant changes in other secondary outcomes or in the subgroup analyses after correction for multiple testing.

Conclusions: Introducing MUP in Scotland was not associated with reductions in the proportion of drinkers consuming at harmful levels but did reduce the prevalence of hazardous drinking. This adds to previous evidence that MUP reduced overall alcohol consumption in Scotland and consumption among those drinking above moderate levels.

Introduction

The Scottish Government introduced a minimum unit price (MUP) for alcohol on 1 May 2018. This means retailers in Scotland cannot sell alcohol to consumers for less than £0.50 per unit (1 UK unit = 8 g/10 mL ethanol). In 2018, 44% of off-trade alcohol units were sold below £0.50 per unit in Scotland.[1,2] The associated legislation includes a 'sunset clause' that requires MUP to end after 6 years unless the Scottish Parliament votes for it to continue.[3] To inform this vote, the Scottish Government commissioned NHS Health Scotland (now part of Public Health Scotland [PHS]) to conduct a wide-ranging evaluation of MUP and report its findings in mid-2023.[3] PHS commissioned the present study as part of that evaluation to provide evidence of the impact of MUP on people drinking at harmful levels, typically defined in the United Kingdom

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as women consuming more than 35 units of alcohol per week and men consuming more than 50 units per week.

The Scottish Government and public health advocates argue that MUP is a well-targeted policy that concentrates price increases on the cheapest alcohol that is disproportionately purchased by those drinking at hazardous levels (i.e. 14–35 units a week for women or 14–50 units a week for men; approximately 20% of the population) or harmful levels (approximately 5% of the population).[4,5] These arguments are informed by model-based appraisals that suggest MUP leads to larger reductions in alcohol consumption among those drinking at harmful levels than those drinking at moderate levels.[4,6,7] They are also informed by evaluations of similar policies in Canada, where increases in minimum prices led to reductions in deaths and hospitalisations for conditions closely associated with heavy drinking (e.g. alcoholic liver disease).[8,9] However, evidence in the wider literature on alcohol pricing is more equivocal, with some studies suggesting heavier drinkers make smaller reductions in their alcohol consumption than other drinkers when prices increase,[10,11] whereas others suggest the opposite.[12] Researchers usually attribute lower price responsiveness among heavier drinkers to them switching their purchasing to cheaper products instead of buying less when prices rises, a behaviour that MUP hinders by preventing the sale of products at a low cost per unit of alcohol.

Evidence is therefore required on whether MUP effectively reduces harmful alcohol consumption. Evaluation findings to date suggest the policy was implemented largely as intended and reduced off-trade alcohol sales in Scotland by 3.5%.[1,13] However, analyses of changes in alcohol consumption among heavier drinkers report mixed findings. Analyses of household panel data show that the fifth of households that purchased most alcohol pre-MUP reduced their purchasing by more than the remaining four-fifths after the policy was introduced.[14,15] In contrast, an analysis of market research drinking diary data suggests MUP led to reduced alcohol consumption for the lightest drinking 90% of women but no statistically significant change for the highest consuming 10%, whereas consumption among men did not change significantly except for an increase among the highest consuming 5%.[16] However, these previous studies were limited by short pre- and post-intervention time series (e.g. 2015–2018) and in some cases had full-year breaks in the series where data were not available.[14–17] They also focus only on levels of consumption in different groups rather than the overall prevalence of hazardous and harmful drinking across the population.[14–16]

This study aims to provide further evidence regarding the impact of MUP on people drinking at harmful levels by (1) evaluating the impact of the policy on the prevalence of harmful drinking among adult alcohol consumers in Scotland, (2) also evaluating the impact of MUP on the prevalence of moderate and hazardous drinking (see Methods for definitions), and (3) developing understanding of the mechanisms of any identified effects by evaluating the impact of MUP on the beverage preferences and drinking occasion dynamics (e.g. occasions per week) of people drinking at harmful levels and of how impacts differ across sociodemographic groups.

Methods

Research design

The study used a controlled interrupted time series design based on repeat cross-sectional survey data. Open Science Framework pre-registration: https://osf.io/xe89r.

Data

We used data from the market research company Kantar's Alcovision survey. Alcovision is a continuously collected online survey of adults (aged ≥18 years) who are residents in Great Britain. It draws weekly cross-sectional quota samples based on age, sex, social grade, and geographic region from Kantar's online managed-access panel. All participants gave informed consent.

Alcovision oversamples Scotland residents and 18- to 34-year-olds to allow detailed analyses of these smaller populations. We constructed weights using a raking technique to match social grade, geographic region, age, and sex to the UK Census.[18]

Alcovision includes a short behavioural survey and a detailed 7-day retrospective drinking diary where participants report the characteristics of their drinking occasions over the last week working back in time from the day before the survey is completed. The resulting data set also includes sociodemographic characteristics collected separately by the managed-access panel. Kantar defines an occasion as a significant time, such as lunchtime, and participants can report a maximum of two on-trade (e.g. pub) and two off-trade (e.g. home) occasions each day.

The analytical sample comprises respondents between January 2009 and February 2020 who report drinking at least once per year and who are residents in Scotland (total $N = 38{,}674$; average monthly $N = 267$) or the neighbouring control area, Northern England, defined as the North-East, North-West, and Yorkshire & Humberside regions (total $N = 71{,}687$; average monthly $N = 494$). We do not use data beyond February 2020 because of the substantial impact of the COVID-19 pandemic on alcohol consumption.[18]

Measures

Minimum unit pricing

We created a binary variable categorising drinking diary weeks starting before 1 May 2018 as preintervention and those starting on or after this date as post-intervention. This means we treat any diary weeks containing dates both before and after 1 May as pre-MUP data, reflecting the potential for alcohol purchased before the introduction of the policy to be consumed afterwards.

Outcome measures

The primary outcome was the proportion of adult drinkers who drink at harmful levels. To align with previous MUP analyses,[6] we defined drinking at harmful levels as consuming more than 35 units of alcohol for women or more than 50 units for men across the diary week.

We calculated consumption in the diary week by summing the units consumed in each drinking occasion. Participants report the amount consumed in 'serves', which we converted to units by combining information on the packaging size (e.g. 440 mL can) of each serving with additional information we collected online on products' alcoholic content (alcohol by volume [ABV]). Where product-level ABV information was unavailable, particularly for wines, we used standard beverage-specific assumptions (approximately 10% of products; Supplementary Table 1). As a small number of respondents report unrealistically high levels of alcohol consumption within some occasions, we applied a capping process following consultation with clinicians.[18] We sequentially capped the maximum units reported for each single drink type on an occasion, each occasion, and each day to 40 (equivalent to a litre bottle of whisky). This process constrains weekly consumption to a maximum of 280 units.

There were 10 planned secondary outcomes split across three groups: other consumption levels, beverage types associated with harmful drinking in Scotland and occasion dynamics. For other consumption levels, we examined change in the proportion of adult drinkers who are (1) drinking moderately and (2) drinking hazardously. For beverage type, we examined change in the mean

proportion of alcohol consumption in the diary week among those drinking at harmful levels that is accounted for by (3) strong beer (≥6% ABV), (4) strong cider (≥6% ABV), (5) vodka and (6) alcohol consumed in the off-trade, as MUP particularly affects the price of these beverage types. For occasion dynamics, we examined change in the mean for people drinking at harmful levels of (7) number of drinking days per week, (8) number of units per drinking occasion, (9) maximum number of units in a single drinking occasion during the week and (10) the number of drinking occasions involving drinking alone. In addition to these measures of occasion dynamics, we conducted an unplanned secondary analysis of change in mean number of units per week for people drinking at harmful levels.

Subgroup analyses

We also examined change in the proportion of adult drinkers who are consuming at harmful levels within the following subgroups: married or living with a partner, living with one or more children aged <16 years, and social grade DE (semiskilled and unskilled manual workers, state pensioners, casual and lowest grade workers, and unemployed with state benefits only). Social grade is an occupation-based measure of socio-economic status based on the National Readership Survey. We selected these groups because of interest from policy-makers (e.g. living with children) or because prior evidence suggests MUP should particularly impact them (e.g. social grade DE).[6]

Statistical analysis

We used SARIMA models to evaluate the immediate effect of implementing MUP in Scotland on our primary outcome (the proportion of adult drinkers consuming at harmful levels), secondary outcomes, and the proportion within three sociodemographic subgroups drinking at harmful levels.[17]

We analysed monthly time series where possible, considering bi-monthly or quarterly series where the monthly series had zero observations in some periods. This was the case for two secondary outcomes: (1) the mean proportion of harmful drinkers' consumption that was strong beer (bi-monthly) and (2) strong cider (quarterly). Models were adjusted using data from the same period in Northern England and terms for autocorrelation, seasonality and the trend over time. To identify autocorrelation in the model residuals, we used autocorrelation and partial autocorrelation plots, which informed the selection of autoregressive (AR), moving average (MA), and seasonal terms. We then used Akaike information criterion (AIC) and Bayesian information criteria (BIC) statistics to select the most parsimonious model and performed portmanteau (or Q) tests to confirm that model residuals resembled a white noise process. When model residuals did not resemble white noise, we used the Kwiatkowski–Phillips–Schmidt–Shin (KPSS) unit root test and considered integration. To identify potential outliers or breakpoints, we used visual inspection of the outcome data series and included terms to adjust for these where model parsimony was improved.

Following model specification, we calculated sharpened q-values as described by Anderson et al. to adjust for multiple testing.[19] This was an unplanned additional robustness check. We used $\alpha = 0.05$ to determine statistical significance.

Sensitivity analyses

We conducted three planned sensitivity analyses for the primary outcome as follows. First, we moved the intervention point from May 2018 to June 2018 to allow for those drinking at harmful levels to deplete any alcohol stockpiled pre-MUP. Second, the gradual introduction of Universal Credit across the intervention period substantially affected the value and timing of social security payments in the United Kingdom and may have affected the financial position of adults consuming at harmful levels, with subsequent effects on their alcohol purchasing. We controlled for this in a sensitivity analysis by including a covariate in the model that measured the monthly number of households registered for Universal Credit in Scotland.[20] Third, we included an additional term in the SARIMA model to test for a change in the time trend after the implementation of MUP. Our primary analyses assume a step change, in line with modelling undertaken before the introduction of MUP,[4] but it is possible that those drinking at harmful levels changed their behaviour more gradually.

We also carried out further planned and unplanned sensitivity analyses using uncapped estimates of alcohol consumption. These analyses focused on only secondary outcomes affected by the capping process. Specifically, the mean proportion of alcohol consumption in the diary week among those drinking harmfully that is accounted for by strong beer (≥6% ABV), strong cider (≥6% ABV), vodka, and drinking in the off-trade, as well as the average number of units consumed per occasion, maximum number of units consumed during a single occasion in the diary week (all planned) and average number of units consumed per week among those drinking harmfully (unplanned).

All analyses were of weighted data using Stata version 16.

Results

Table 1 presents descriptive statistics for the yearly sample size and trends in outcome measures.

Primary outcome

There was no significant change in the proportion of drinkers consuming at harmful levels in Scotland ($\beta = 0.006$; 95% confidence interval [CI] = −0.011 to +0.023; Table 2, Fig. 1). This finding was consistent across the sensitivity analyses that used the subsequent data point in the series as the intervention point (June 2018), controlled for the rollout of Universal Credit in Scotland and included a term to capture a change in the postintervention trend (Supplementary Table 2).

Secondary outcomes

Immediately after the introduction of MUP, there was a significant reduction in the proportion of drinkers consuming at hazardous levels in Scotland (−3.5 percentage points; 95% CI = −0.054 to −0.017; Table 2, Fig. 1). However, there was no significant change in the proportion of drinkers consuming at moderate levels ($\beta = 0.014$; 95%CI = −0.011 to 0.038). This model controls for a breakpoint in the data series at the beginning of 2017.

There were no significant changes in the mean proportion of alcohol consumption in the diary week that is accounted for by strong beer ($\beta = 0.000$; 95% CI = −0.010 to +0.010), strong cider ($\beta = -0.003$; 95%CI = −0.009 to 0.003), vodka ($\beta = 0.017$; 95% CI = −0.011 to +0.045) or drinking in the off-trade ($\beta = 0.026$; 95% CI = −0.012 to +0.063). These findings were consistent in sensitivity analyses using an uncapped measure of alcohol consumption (Supplementary Table 2).

There were also no significant changes in the patterns of consumption during the diary week for most outcome measures, specifically, the number of drinking days per week, maximum number of units consumed in a single occasion during the week and the number of occasions involving drinking alone, including in sensitivity analyses using uncapped alcohol consumption. The direction of effect indicated a reduction in the mean number of drinking days per week, the mean number of units per occasion and the mean number of units per week for drinkers consuming at

Table 1
Sample size and weighted mean values of outcome measures (2009–2020).

Measure	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020[a]
Sample size												
Total	9989	10,094	10,287	10,484	10,385	10,338	10,162	10,067	8711	9290	9051	1503
Northern England	6489	6508	6604	6879	6781	6724	6615	6565	5687	6023	5860	952
Scotland	3500	3586	3683	3605	3604	3614	3547	3502	3024	3267	3191	551
Proportion of adult drinkers who are consuming at:												
Harmful levels												
Scotland	11.9%	12.1%	13.1%	13.5%	10.8%	9.7%	11.2%	11.9%	9.1%	8.8%	10.1%	9.0%
Northern England	13.5%	11.7%	13.3%	13.2%	11.8%	11.6%	11.6%	11.2%	10.6%	10.0%	9.7%	9.7%
Hazardous levels												
Scotland	29.9%	28.2%	27.7%	29.0%	28.6%	29.3%	26.7%	29.1%	26.7%	23.8%	23.5%	25.9%
Northern England	31.7%	30.2%	30.8%	31.1%	29.9%	29.8%	28.2%	28.3%	28.4%	25.2%	26.5%	25.9%
Moderate levels												
Scotland	58.1%	59.7%	59.2%	57.4%	60.6%	61.0%	62.1%	59.0%	64.2%	67.4%	66.4%	65.1%
Northern England	54.8%	58.1%	55.9%	55.7%	58.3%	58.7%	60.2%	60.5%	61.0%	64.8%	63.8%	64.4%
Mean proportion of harmful drinkers' consumption that is:												
Strong beer (≥6% ABV)												
Scotland	0.9%	0.9%	1.2%	0.5%	2.3%	0.4%	0.3%	0.8%	0.9%	0.6%	1.1%	0.1%
Northern England	1.3%	1.4%	1.5%	0.7%	0.9%	1.1%	0.5%	1.0%	0.8%	0.8%	1.0%	0.3%
Strong cider (≥6% ABV)												
Scotland	0.5%	0.4%	0.8%	0.5%	0.9%	0.8%	0.9%	1.2%	0.5%	0.8%	0.6%	0.2%
Northern England	0.8%	0.7%	0.6%	1.0%	1.1%	1.0%	1.9%	1.1%	0.8%	0.8%	1.1%	1.0%
Vodka												
Scotland	14.9%	16.3%	14.5%	16.3%	15.4%	11.7%	11.9%	12.3%	14.8%	15.3%	14.1%	20.2%
Northern England	6.5%	6.9%	8.8%	8.1%	6.9%	7.9%	7.1%	7.2%	9.8%	9.5%	7.8%	10.4%
Consumed in the off-trade												
Scotland	67.4%	72.9%	72.8%	67.0%	66.8%	69.3%	67.1%	66.4%	69.3%	71.0%	72.4%	69.0%
Northern England	68.5%	67.6%	65.4%	67.3%	66.8%	69.0%	69.6%	67.2%	68.8%	69.9%	71.5%	70.5%
Patterns of harmful drinkers' consumption												
Mean number of drinking days per week												
Scotland	4.2	4.5	4.2	4.0	4.0	4.0	4.1	3.8	3.6	3.4	3.6	3.2
Northern England	4.8	4.9	4.5	4.6	4.5	4.6	4.5	4.5	4.1	4.0	4.0	4.0
Mean number of units per occasion												
Scotland	12.9	12.4	12.5	12.8	13.2	12.6	12.5	13.0	15.0	17.0	14.4	16.5
Northern England	10.9	10.9	11.7	11.3	11.4	11.2	11.5	11.7	13.0	14.0	14.2	13.8
Mean units consumed on the heaviest occasion of the week												
Scotland	23.3	22.6	22.9	23.6	23.9	22.5	22.8	23.8	25.2	26.9	24.2	26.6
Northern England	20.2	20.0	21.6	21.0	20.9	20.7	20.5	21.4	22.7	23.7	23.9	23.8
Mean number of occasions involving drinking alone												
Scotland	1.0	1.2	1.1	1.2	1.2	1.4	1.6	1.1	1.1	1.0	1.2	1.1
Northern England	1.3	1.3	1.2	1.4	1.5	1.5	1.4	1.5	1.4	1.5	1.4	1.5
Mean number of units per week												
Scotland	69.0	68.3	68.6	71.2	69.4	67.0	68.1	69.2	64.5	68.9	63.0	61.2
Northern England	66.0	66.8	67.8	69.1	66.8	68.3	67.1	70.0	68.7	68.4	68.2	70.5
Proportion of adult drinkers who are harmful drinkers in the following population subgroups:												
Married or living with a partner												
Scotland	11.4%	11.7%	12.8%	12.7%	10.5%	8.5%	10.4%	11.4%	9.9%	8.5%	9.6%	8.4%
Northern England	12.8%	12.1%	13.1%	12.7%	11.6%	10.8%	11.0%	10.8%	9.5%	8.7%	9.1%	9.3%
Living with one or more children in the household												
Scotland	12.2%	12.5%	14.6%	16.9%	12.0%	8.6%	11.1%	12.4%	9.8%	9.1%	10.4%	9.3%
Northern England	13.3%	13.2%	13.8%	14.8%	12.6%	12.1%	11.4%	10.1%	10.6%	9.9%	11.9%	9.7%
Lower socio-economic group (DE)												
Scotland	11.4%	12.9%	13.4%	13.2%	12.1%	10.2%	10.9%	9.6%	7.7%	7.7%	8.4%	11.8%
Northern England	12.6%	11.2%	14.1%	13.4%	12.9%	9.7%	11.6%	10.7%	9.9%	11.7%	10.9%	9.9%

[a] January and February only in 2020. All outcome measures are time series of weighted measures constructed using data from self-reported drinking occasions in a 1-week retrospective drinking diary. Consumption levels are based on total units reported. Harmful = 35+/50+ units for women/men. Hazardous = 14–35/14–50 units for women/men. Moderate = 0–14 units. Those in social grade DE are defined as National Readership Survey social grade D or E (semiskilled and unskilled manual workers, state pensioners, casual and lowest grade workers, unemployed with state benefits only).

harmful levels. The magnitude of these reductions was similar to the 3.0–3.5% fall in alcohol sales by volume found in analyses of population-level sales data,[21] although the uncertainty around the effect estimates was high and the direct of effect reversed in sensitivity analyses.

For people drinking at harmful levels, there was a statistically significant drop in the mean number of units consumed per occasion ($\beta = -0.9$ units; 95% CI = −1.651 to −0.091) and mean number of units consumed per week ($\beta = -3.2$ units; 95% CI = −6.076 to −0.283). However, these results were not robust based on the sharpened q-values, which adjust for multiple testing ($q = 0.172$) or the sensitivity analysis using uncapped alcohol consumption, which found no significant change.

Subgroup analyses

There were no significant changes in the proportion of drinkers consuming at harmful levels among those who report being married or living with a partner, living with one or more children in the household or who are in a lower socio-economic group (DE) (Table 2). All model specification details are provided in Supplementary Table 3.

Discussion

The results above suggest the introduction of MUP in Scotland did not lead to a decline in the proportion of adult drinkers consuming alcohol at harmful levels. It also did not lead to any

Table 2
Estimated immediate effects of implementing minimum unit pricing among adult drinkers in Scotland.

Outcome measure	B	95% Confidence interval	*P*-value	*q*-value	*R*-sqr
Proportion of adult drinkers who are consuming at:					
Harmful levels	0.006	−0.011, 0.023	0.500	N/A	33.5%
Hazardous levels	−0.035	−0.054, −0.017	0.000	0.003	30.0%
Moderate levels	0.014	−0.011, 0.038	0.269	N/A	47.0%
Mean proportion of consumption for drinkers consuming at harmful levels:					
Strong beer (6%+ ABV)	0.000	−0.010, 0.010	0.988	N/A	8.5%
Strong cider (6%+ ABV)	−0.003	−0.009, 0.003	0.333	N/A	24.5%
Vodka	0.017	−0.011, 0.045	0.238	N/A	8.8%
Consumed in the off-trade	0.026	−0.012, 0.063	0.177	N/A	7.9%
Patterns of consumption for drinkers consuming at harmful levels:					
Mean number of drinking days per week	−0.023	−0.247, 0.201	0.839	N/A	48.1%
Mean number of units per occasion	−0.871	−1.651, −0.091	0.029	0.172	42.3%
Mean units consumed on the heaviest occasion of the week	0.565	−0.608, 1.737	0.345	N/A	29.2%
Mean number of occasions involving drinking alone	0.058	−0.251, 0.367	0.714	N/A	9.7%
Mean number of units per week	−3.180	−6.076, −0.283	0.031	0.172	18.5%
Proportion of adult drinkers who are consuming at harmful levels in population subgroups:					
Married or living with a partner	0.004	−0.014, 0.023	0.644	N/A	23.7%
Living with one or more children in the household	0.021	−0.006, 0.047	0.133	N/A	31.8%
Lower socio-economic group (DE)	0.000	−0.021, 0.020	0.982	N/A	25.7%

B = regression coefficient; *R*-sqr = *R*-squared; *q*-value = sharpened two-stage q-values. All outcome measures are time series of weighted measures constructed using data from self-reported drinking occasions in a 1-week retrospective drinking diary. Consumption levels are based on total units reported. Harmful = 35+/50+ units for women/men. Hazardous = 14–35/14–50 units for women/men. Moderate = 0–14 units. Those in social grade DE are defined as National Readership Survey social grade D or E (semiskilled and unskilled manual workers, state pensioners, casual and lowest grade workers, unemployed with state benefits only).
ABV, alcohol by volume; N/A, not available.

change in the types of alcoholic beverage consumed by this group, their drinking patterns, the extent to which they consumed alcohol while on their own or the prevalence of harmful drinking in key subgroups. However, the secondary analyses suggest the proportion of drinkers consuming at hazardous levels did decline.

The key strengths of this study are the large sample size and long time series provided by Alcovision, the controlled interrupted time series design and the testing of a wide range of secondary outcomes. There are three main limitations. First, the non-random sampling strategy used by Alcovision means our sample may not be wholly representative. This is a common problem across alcohol consumption surveys;[22] although we attempt to correct for it by weighting to census data some biases may remain. Second, although Alcovision uses largely consistent methods over time, we did identify and control for an unexplained breakpoint in 2017. Incomplete information on problems of this kind is commonplace when using commercial market research data but is often an acceptable limitation to gain the benefits of data sources that now play an increasingly large role in evaluating public health interventions. Third, self-reported alcohol consumption typically underestimates true consumption, although Alcovision combined methods, including recent recall and detailed occasion-focused reporting, that typically deliver more accurate estimates than the standard beverage-specific quantity frequency method.[23,24]

The decline in the prevalence of hazardous drinking in our findings is consistent with the decline in alcohol consumption found in previous evaluations of MUP in Scotland.[14,25] However, the lack of evidence for a decline in the prevalence of harmful drinking arising from MUP is contrary to model-based evidence that informed the introduction of the policy.[6] It also adds to previous inconsistent evidence on the impact of MUP in Scotland on those consuming at harmful levels.[14,16,26] One important caveat is the

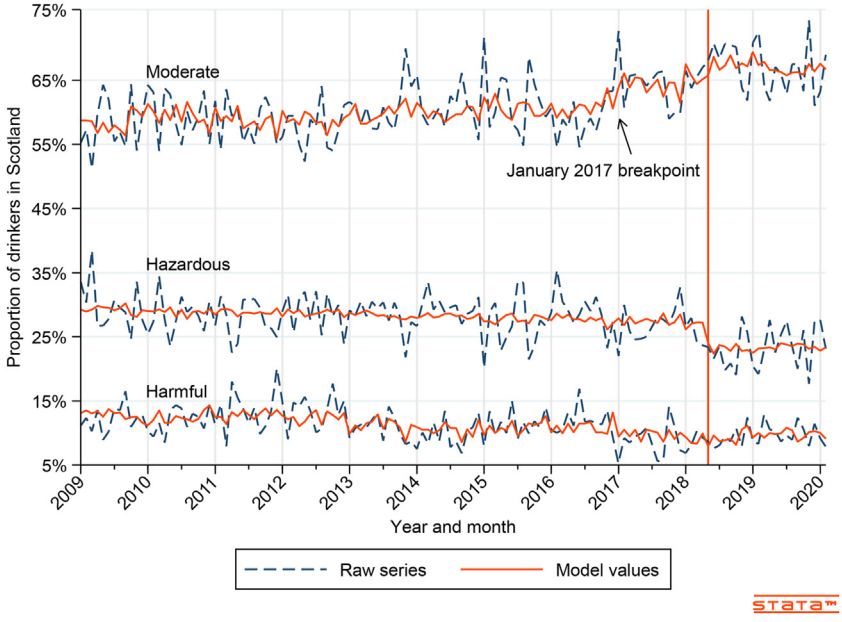

Fig. 1. Monthly proportion of drinkers consuming at harmful, hazardous and moderate levels in Scotland. Vertical line = implementation of minimum unit pricing, 1 May 2018.

measures used here and in previous studies do not map directly onto the standard measures of hazardous and harmful drinking used in key studies that informed the policy decisions on MUP.[6] Although those standard measures relate to individuals' typical weekly drinking, the evaluation studies use measures of household purchasing or individuals' alcohol consumption in the previous week. Moreover, the standard measures typically find approximately 5% of Scottish adults consume alcohol at harmful levels, but the studies of household purchasing only disaggregate the population into quintiles, while Table 1 suggests approximately 10% of adults drink at harmful levels. This implies caution is needed when comparing findings and translating categories of drinkers between evidence sources. Nonetheless, our findings add to consistent evidence that MUP led to reductions in alcohol consumption among those drinking above moderate levels but offers less certainty regarding the impact on those drinking at harmful levels.

The lack of change in the prevalence of harmful drinking may arise for several reasons. First, people drinking at harmful levels may be less responsive to price changes than lighter drinkers. Previous qualitative research and studies of purchasing behaviour among people with alcohol dependence (i.e. a group that comprises approximately 20% of those drinking harmfully in the United Kingdom and thus 1% of the overall population[27]) supports this view.[28,29] However, the very large price increases imposed by MUP on people drinking harmfully, their inability to switch to cheaper products and clear evidence of successful policy implementation and compliance,[1,30] mean their price responsiveness would need to be extremely low to negate any impact on consumption. Second, the changes in harmful drinking may have primarily affected those consuming at the highest levels and thus not affected the prevalence of harmful drinking. However, a recent study of the impact of MUP on people with alcohol dependence found no clear evidence of reduced alcohol consumption.[26] We have not presented any analyses examining this hypothesis because of small sample sizes and unreliable measurement of very high alcohol consumption levels. Third, people drinking at harmful levels may have adopted unsustainable strategies to temporarily manage the price rises caused by MUP. For example, there is evidence a minority of people with alcohol dependence responded to MUP by reducing spending on essentials, borrowing money and using their savings.[26] Longer term evaluation may therefore be required to fully understand the policy's impact on consumption. Finally, the current MUP may be set too low to generate detectable impacts. The £0.50 was initially proposed circa 2011 and would have affected approximately 70% of off-trade alcohol units sold at that time compared with 44% in 2018 when the policy was introduced.[1,2] The real-term value of the MUP has also fallen over time due to inflation. A review of the current £0.50 level is currently underway, with public health organisations calling for MUP to be uprated in 2024.[31] Although this weakens the effectiveness of the policy, it is not sufficient to explain the null results identified here because those drinking harmfully still faced significant price increases.

Further research that would strengthen understanding of the impact of MUP on people drinking at harmful levels include studies of alcohol-related harm. Such analyses have recently been published, showing a 13.4% reduction in alcohol-attributable deaths and a 4.1% reduction in alcohol-attributable hospitalisations in Scotland.[32] This provides the most direct evidence on the public health impact of MUP to date. Evidence from other jurisdictions that have introduced MUP, including Wales, Ireland and Australia's Northern Territory, would ideally strengthen conclusions, but a combination of the confounding from the COVID-19 pandemic and lower availability of high-frequency time series data for evaluation research in other jurisdictions means the Scottish evaluation offers the most robust evidence.[33] Finally, further understanding of how those drinking harmfully managed the price rises caused by MUP, if they did not reduce their consumption, would strengthen the understanding of the impact of pricing policies on those at greatest risk from their drinking.

Conclusions

MUP in Scotland was not associated with reductions in the prevalence of harmful drinking but was associated with reductions in the prevalence of hazardous drinking. This adds to a wider evidence base that MUP led to a reduction in overall alcohol consumption and consumption among those drinking above moderate levels.

Author statements

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Ethical approval

This study was approved by the University of Sheffield's ethics committee and conforms to the principles embodied in the Declaration of Helsinki. Use of these data is allowed under the terms of the contract and non-disclosure agreement between Kantar Worldpanel and the University of Sheffield, which requires research outputs to be submitted to the data provider ahead of publication. The data provider played no role in the conception, design, analysis, interpretation or write-up of the research and their right to request changes to written material is limited to matters of accuracy regarding the description of the Alcovision survey data, as this is a commercial product.

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The funders of the study (Scottish Government) provided feedback on study design as part of the wider MUP Evaluation Advisory Group. Public Health Scotland commissioned the research and provided feedback on some aspects of the design, analysis plan, interpretation and write-up in line with the research governance procedures of the wider MUP evaluation programme. The authors retained the right to make final decisions. The corresponding author had full access to all of the data in the study and had final responsibility for the decision to submit for publication.

Competing interests

No conflicts to declare.

Data sharing statement

The Alcovision survey is a commercial product and therefore cannot be made publicly accessible.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.puhe.2023.04.019.

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