Public Health Scotland

Evaluating the impact of alcohol minimum unit pricing (MUP) on alcohol-attributable deaths and hospital admissions in Scotland: Briefing paper

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Background

Minimum unit pricing (MUP) came into effect in Scotland on 1 May 2018. From that date, every drink containing alcohol has had a minimum price at which it can be sold based on the amount of pure alcohol it contains. The minimum price in Scotland is currently set at £0.50 per unit of alcohol.

The Monitoring and Evaluating Scotland's Alcohol Strategy (MESAS) MUP Evaluation Portfolio comprises a number of evaluation studies that are being undertaken to assess the impact of MUP.[1] The portfolio contains studies assessing compliance with and implementation of MUP, its impact on the alcoholic drinks industry in Scotland, changes in alcohol consumption, and changes in health and social harms.

The aim of this briefing paper

This briefing paper presents the main findings from a study that uses data on alcohol-attributable deaths and hospital admissions to evaluate the impact of MUP on alcohol-attributable mortality and morbidity in Scotland.[2,3]

The findings from this study have been reported by Public Health Scotland and The Lancet, addressing the following evaluation questions:

- How has MUP impacted deaths wholly attributable to alcohol consumption?
- How has MUP impacted hospital admissions wholly attributable to alcohol consumption?

We estimated the impact of MUP on alcohol-attributable deaths and hospital admissions in the Scottish population. The impact of MUP was also estimated by sex, age group and level of area-based socio-economic deprivation. In addition, the impact of MUP on deaths and hospital admissions partially attributable to alcohol consumption was estimated.

What we did

We used routine administrative data on alcohol-attributable deaths and hospital admissions to estimate monthly crude rates per 100,000 population. For wholly alcohol-attributable outcomes no further adjustment was required, as these outcomes are entirely attributable to alcohol consumption. For partially alcohol-attributable outcomes we used the International Model of Alcohol Harms and Policies (InterMAHP, version 3.0) to produce alcohol-attributable fractions (AAFs) for each partially attributable health condition in the study.[4] AAFs are used to express the proportion that alcohol consumption is estimated to contribute to a population health outcome. AAFs were calculated for each calendar year and population sub-group (country, sex, age group) and applied to counts of deaths and hospital admissions partially attributable to alcohol consumption, prior to calculating monthly rates. We describe changes over time in the rate of health harms both wholly, and partially, attributable to alcohol consumption in Scotland and England. We used a statistical method called controlled interrupted time series regression, which is widely used for estimating the impact of population-level interventions. This allowed us to take into account underlying trends and seasonal patterns in the data. By incorporating outcome data for a geographical control area, we were able to compare what happened in Scotland to what happened in an area where MUP was not implemented. In this analysis, England was our best available geographical control area. Using this method allowed us to estimate the overall effect of MUP on alcohol-attributable health harms in Scotland; we refer to this as the **controlled** model. Effect estimates with 95% confidence intervals (CI) were estimated. Significant results are reported when the 95% confidence interval does not include zero. When other important effects have been observed that are not statistically significant, we report on the direction of the effect and indicate that there was a higher degree of uncertainty around the effect.

We incorporated data on the extent of government restrictions during the COVID-19 pandemic, separately for Scotland and England, from the Oxford COVID-19 Government Response Tracker.[5] Incorporating this allowed us to take account of the fact that the level of government response influenced restrictions on the sale of alcohol through the on-trade (i.e. pubs, clubs, restaurants, and so on). In addition, restrictions matched the challenges faced from COVID-19 infection, so high levels of restrictions were generally imposed when the impact of COVID-19 was largest on hospital admissions and deaths.

We performed a range of additional analyses, including shortening our post-intervention time series to exclude the impact of the COVID-19 pandemic. This helped us to test the robustness of our results to changes in the analytical approach deployed.

The time period covered was January 2012 to December 2020.

The methods, data sources and all the additional analyses are described in full in the Public Health Scotland published report, and original research article published by The Lancet.[2,3]

What we found

The trends in health harms over time described in this briefing paper relate to the ratio of the monthly trend rate (Scotland:England). This measure allows us to consider how trends are changing over time, relative to the control group we define later in our statistical analysis. Doing this allows us to interpret changes over time, independent of any changes affecting both countries, for example from the COVID-19 pandemic.

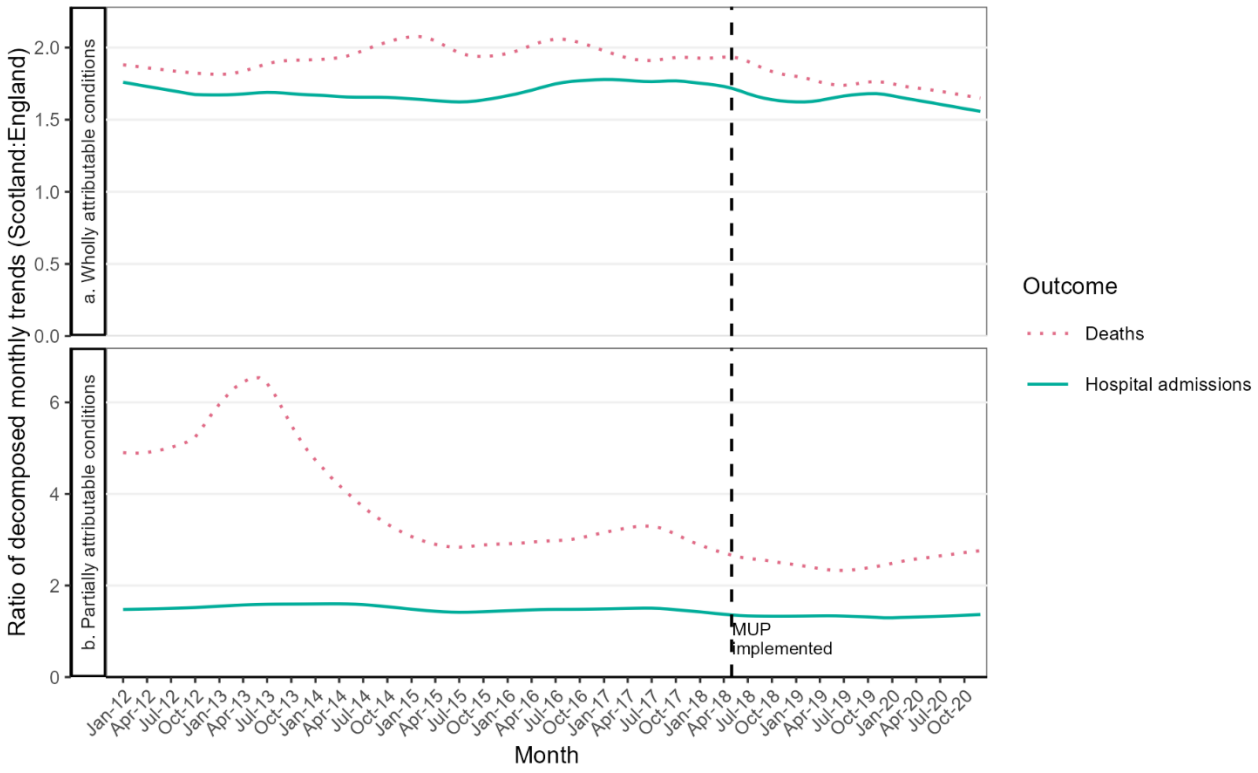
The results presented in this briefing are for the Scottish controlled model. These results allow us to estimate the impact of MUP based on the difference between outcomes following the implementation of MUP compared to a best estimate of what would have been observed had MUP not been implemented. This best estimate of what would have occurred in the absence of MUP was developed by controlling for differences in the trend and level of health harms – in England, where MUP has not been implemented, and in Scotland, by observing trends in health harms prior to MUP – as well as adjusting for differences in COVID-19 associated restrictions. This approach allowed us to estimate the impact of MUP by isolating it from other factors which might impact health harms, such as the COVID-19 pandemic. When we refer to a reduction, an increase, or no change in a health outcome following MUP implementation, this is our best estimate of the impact of MUP in Scotland in comparison to what could have been expected in the absence of MUP based on trends in England.

Further descriptive trends, and results from all the models (controlled, uncontrolled and sensitivity analyses), are presented in the Public Health Scotland published report and original research article published by The Lancet.[2,3]

Comparative trends in health harms attributable to alcohol consumption

The ratio (Scotland:England) of monthly trend rates for wholly attributable deaths slightly increased from the start of the study period until the end of the pre-MUP period (**Figure 1**), indicating a worsening of wholly attributable deaths rates in Scotland compared to England.

Figure 1. Ratio of decomposed monthly rates (Scotland:England) for deaths and hospital admissions, January 2012 to December 2020, (a) wholly attributable, and (b) partially attributable



On the other hand, patterns for wholly attributable hospital admissions remained relatively stable during this period. Following the introduction of MUP, the ratio of monthly trend rates for wholly attributable death rates decreased until the end of the study period; with

some variation observed in the latter half of 2019, indicating that wholly attributable death rates improved in Scotland in this period, relative to England. The patterns following the implementation of MUP were also observed for wholly attributable hospital admissions, with consistency in variations across both deaths, and hospital admissions, wholly attributable to alcohol consumption.

The ratio (Scotland:England) of monthly trend rates for partially attributable deaths increased from the start of the study period (2012), peaking in 2013, and falling sharply until 2015 (**Figure 1**). Following this, the ratio rose a little before starting to fall in 2017 and continued to do so throughout the remainder of the pre-MUP period. The pattern for partially attributable hospital admissions remained relatively stable during the same period. Following the implementation of MUP, the ratio of monthly trend rates for partially attributable death rates continued to decrease. However, from the end of 2019 to the end of the study period, rates started to increase at a greater rate in Scotland relative to England. During this same period, the ratio of monthly trend rates for partially attributable hospital admissions was relatively stable until the end of the study period.

Impact of MUP on deaths wholly attributable to alcohol consumption

Following more than two and a half years of implementation, our best estimate is that MUP significantly reduced deaths wholly attributable to alcohol consumption by 13.4% (95% CI: -18.4% to -8.3%) in Scotland (**Figure 2**), when using a method that accounts for deaths in a geographical control area (England), where the policy was not implemented. The method also takes account of underlying seasonal and secular trends. We estimate that an average of 156 (95% CI: -243 to -69) deaths wholly attributable to alcohol consumption were averted each year over the study period following MUP implementation. The overall reduction was driven by a significant 14.9% reduction (95% CI: -20.8% to -8.5%) in deaths from chronic causes wholly attributable to alcohol consumption.

We estimated significant reductions in deaths wholly attributable to alcohol consumption for both males (-14.8%; 95% CI: -18.7% to -10.7%) and females (-12.0%; 95% CI: -20.5% to -2.6%). By age, the greatest reduction was observed in the oldest age group (65 years and over: -26.7% (95% CI: -35.6% to -16.5%)) but a significant reduction was also

observed in the 35 to 64 year age group (-10.0%; 95% CI: -14.7% to -5.0%). All of these changes were driven by a reduction in deaths from chronic causes wholly attributable to alcohol consumption (**Figure 2**).

There was some indication of an increase in deaths from acute causes wholly attributable to alcohol consumption (6.6%; 95% CI: -13.7% to 31.8%) although this effect was more uncertain than the results for chronic causes, as indicated by the wide confidence interval including zero (**Figure 2**). Our results suggest that any increase in deaths from acute causes wholly attributable to alcohol consumption was likely to have been driven by males (4.4%; 95% CI: -1.5% to 10.6%), with little evidence of any change for females (0.2%; 95% CI: -3.5% to 4.2%).

We found the greatest reductions in deaths wholly attributable to alcohol consumption in the four most socio-economically deprived area-based deciles (**Figure 3**), following the implementation of MUP. There was little evidence of any change in any of the other deciles.

Our main estimate of a significant reduction of 13.4% in deaths wholly attributable to alcohol consumption was robust to a range of different conditions as tested through our sensitivity analyses, providing greater certainty in our main finding.

Impact of MUP on hospital admissions wholly attributable to alcohol consumption

Following the implementation of MUP, our best estimate is that MUP reduced hospital admissions wholly attributable to alcohol consumption by 4.1% (95% CI: -8.3% to 0.3%) in Scotland (**Figure 2**), although there was more uncertainty around this result than with deaths wholly attributable to alcohol. We estimate that an average of 411 (95% CI: -908 to 86) hospital admissions wholly attributable to alcohol consumption were averted each year over the study period following MUP implementation. The overall reduction was driven by a significant reduction in hospital admissions for chronic conditions wholly attributable to alcohol consumption (-7.3%; 95% CI: -9.5% to -4.9%).

We estimated a significant reduction in hospital admissions wholly attributable to alcohol consumption for males (-6.2%; 95% CI: -10.0% to -2.3%). There was some evidence of an

increase among females (3.1%; 95% CI: -2.8% to 9.3%) although this effect was more uncertain than that for males. By age, the evidence of MUP being associated with any changes in hospital admissions wholly attributable to alcohol consumption was limited. A reduction in hospital admissions wholly attributable to alcohol consumption was estimated for those aged 35 to 64 years (-4.8%; 95% CI: -9.4% to 0.2%); while there was some uncertainty around the presence of this effect, evidence for changes in other age groups was weaker.

There was some evidence of an increase in hospital admissions for acute conditions wholly attributable to alcohol consumption (9.9%; 95% CI: -1.1% to 22.0%) although this effect was more uncertain than that for wholly attributable hospital admissions due to chronic causes (**Figure 2**). Our results suggest that this increase was more likely to be driven by a significant increase in hospital admissions for acute conditions wholly attributable to alcohol consumption among females (15.6%; 95% CI: 2.1% to 30.9%), but with some evidence of an increase among males also (8.5%; 95% CI: -3.3% to 22.1%), although the effect for males was more uncertain.

We found the greatest reductions in hospital admissions wholly attributable to alcohol consumption in the four most deprived deciles (**Figure 3**), following the implementation of MUP. There was little evidence of any change in any of the other deciles, with the exception of decile 5 where an increase in hospital admissions wholly attributable to alcohol consumption was observed, although there was some uncertainty around this effect.

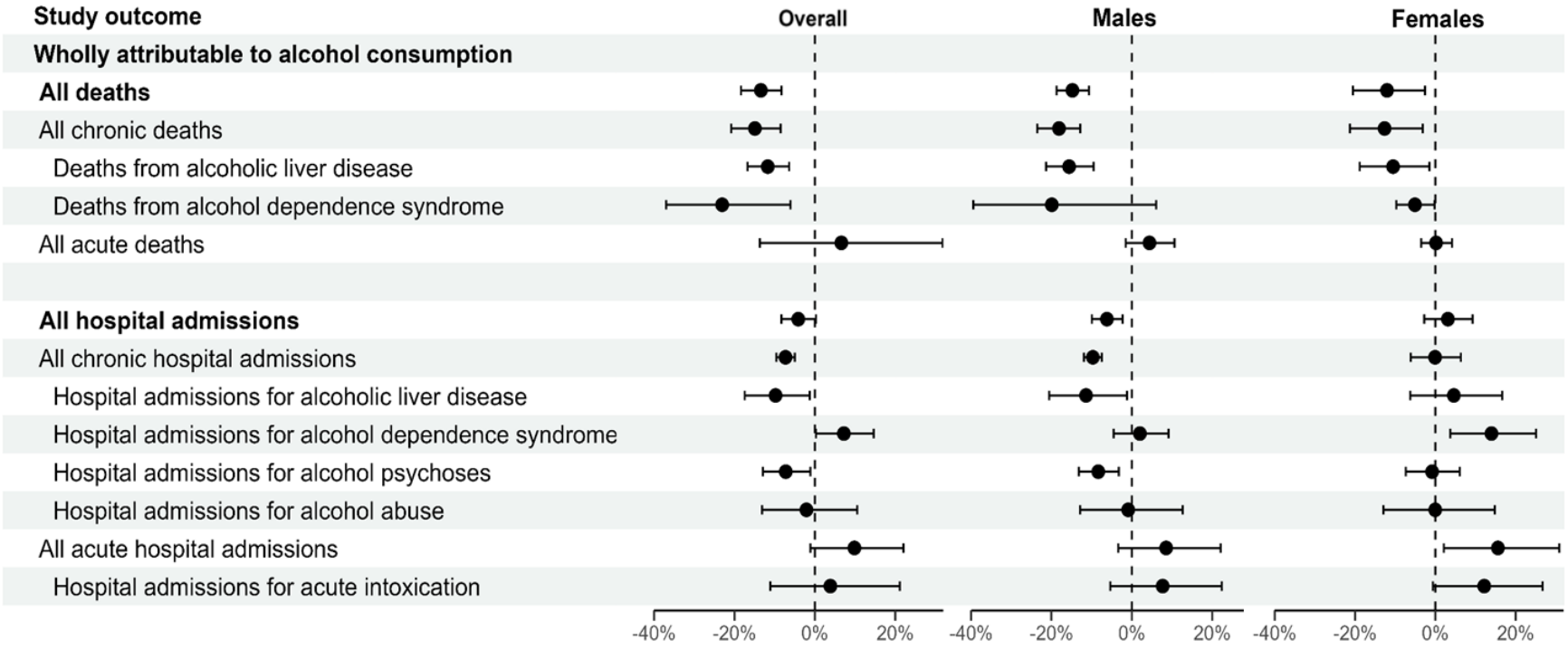
Results from the sensitivity analyses were varied, suggesting less certainty around the impact of MUP on hospital admissions wholly attributable to alcohol consumption, than on deaths.

Deaths and hospital admissions partially attributable to alcohol consumption

Deaths partially attributable to alcohol consumption were estimated to reduce by 8.4% (95% CI: -16.2% to 0.2%) following the implementation of MUP, although this effect was less certain than the results for deaths wholly attributable to alcohol consumption. Significant reductions in deaths from chronic causes partially attributable to alcohol consumption (-12.7%; 95% CI: -21.4% to -3.0%) offset a 7.8% increase (95% CI: -1.1% to 17.5%) in deaths from acute causes, although the presence of this effect on deaths from acute partially attributable causes was more uncertain.

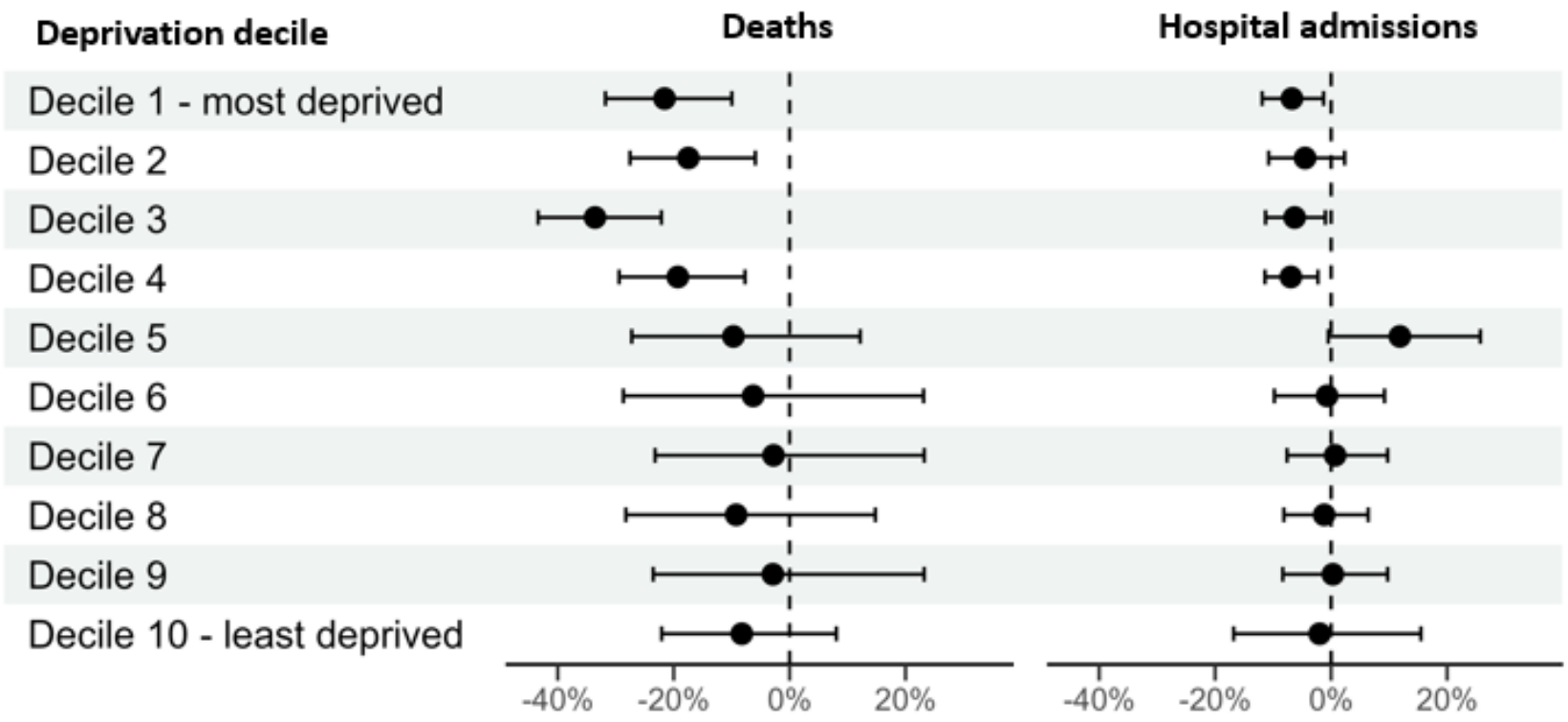
Hospital admissions partially attributable to alcohol consumption were estimated to have reduced by 3.4% (95% CI: -7.3% to 0.6%), again with greater uncertainty around the presence of this effect. This reduction was driven by significant reductions among males (-6.9%; 95% CI: -10.2% to -3.2%), particularly for chronic conditions. We estimated that the implementation of MUP was associated with a significant increase in female hospital admissions for acute conditions partially attributable to alcohol consumption (6.1%; 95% CI: 0.7% to 11.7%).

Figure 2. Percentage change in wholly attributable outcomes following MUP implementation



Note: Models include trends in deaths or admissions (as per the outcome of interest) in England (geographical control) as a covariate, adjustment for underlying seasonal and secular trends, and for the introduction of COVID-19-related restrictions. Effect estimates (●) are statistically significant to the 95% level where the confidence limits (|——|) do not cross zero.

Figure 3. Percentage change in wholly attributable outcomes following MUP implementation, by deprivation



Note: Models include trends in deaths or admissions (as per the outcome of interest) in England (geographical control) as a covariate, adjustment for underlying seasonal and secular trends, and for the introduction of COVID-related restrictions. Effect estimates (●) are statistically significant to the 95% level where the confidence limits (|——|) do not cross zero.

Conclusion

We conclude that MUP has been effective in reducing levels of alcohol-attributable harm in Scotland. The strongest supporting evidence was that MUP significantly reduced deaths wholly attributable to alcohol consumption. Overall reductions in alcohol-attributable harm were mostly driven by reductions in chronic outcomes. There were increases in some acute outcomes, although these results were more uncertain than results for chronic outcomes. Acute outcomes make up a relatively small proportion of alcohol-attributable harm and were largely offset with reductions in chronic outcomes, resulting in an overall net reduction. We have shown the greatest reductions to have occurred in the 40% most socio-economically deprived areas in Scotland, suggesting that MUP acted to reduce inequalities in alcohol-attributable health harms in Scotland.

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