Potential effects of minimum unit pricing at local authority level on alcohol-attributed harms in North West and North East England: a modelling study

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Scientific summary

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Scientific summary

Introduction

Alcohol is the fifth largest cause of years of life lost in England, affecting NHS resource use, crime rates, use of social services and care to support families and children, and work outcomes for employers. Across nine government office regions and 151 upper-tier local authorities, the rate of health harms per population varies substantially, including by age, gender and deprivation (measured by the Index of Multiple Deprivation quintile).

A 50p minimum unit price for a unit of alcohol (i.e. 10 ml of pure ethanol) was implemented in Scotland in May 2018. Previous research used the Sheffield Alcohol Policy Model to estimate the national impact of minimum unit pricing on deaths and hospitalisations, NHS costs, crime rates and work absence for different population subgroups: age; sex; socioeconomic status; and moderate, increasing-risk and high-risk drinkers.

There is strong interest in English regions and local authorities in a potential minimum unit price for alcohol at local authority level. Legal advice suggested that local authorities could ask for powers under the Sustainable Communities Act (Great Britain. *Sustainable Communities Act 2007*. London: The Stationery Office; 2007), and local authorities would require evidence on harms caused by alcohol and the potential impact of minimum unit pricing for alcohol at local authority level.

This study provides evidence on local consumption, purchasing, prices paid and harms, and adapts previous modelling to local authorities. We examined 23 upper-tier local authorities in the North West region, 12 upper-tier local authorities in the North East, each government office region, and (by summing nine regions) England as a whole. We estimated the impact on alcohol-attributable deaths, hospitalisations, crime rates, health inequalities, alcohol consumption, consumer spending, and retailers' and government revenues. We tested a base-case minimum unit price of 50p per unit, and conducted sensitivity analyses for minimum unit prices of 30p, 40p, 60p and 70p per unit.

Methods

Estimating local consumption of alcohol

We used data from the Health Survey for England 2011–13 (sample size, $n = 24{,}685$) to develop two statistical models and generate a simulated local survey for each upper-tier local authority (e.g. a simulated health survey for Sefton). The Health Survey for England gathers data on the mean weekly consumption of alcohol in units and a respondent's age, sex and ethnicity, and has a sample population weight for each respondent (typically ≈ 6000). We obtained each respondent's upper-tier local authority of residence. From Public Health England, we obtained two locality-level variables: the alcohol-attributable hospital admissions rate for 2013/14 and the alcohol-related mortality rate for 2013.

Two regression models were developed: a logistic regression estimating the probability of abstaining and a multinomial regression estimating the probability of drinking in any one of six categories of mean weekly consumption. We used these regression results to calculate a new population weight for each individual for each upper-tier local authority. The results showed that the probability of each individual drinking at a particular level was statistically related to the individual's age, sex, Index of Multiple deprivation quintile and ethnicity; to the local authority of residence's alcohol-attributable admission rate and alcohol-related mortality rate; and an indicator variable for the government office region of residence.

Estimating price distributions for each local authority by beverage category and population subgroup

For local alcohol price estimates, we estimated the prices paid at that time for 10 beverage categories: beer, cider, wine, spirits and ready-to-drinks (RTDs), split by off-trade (supermarkets and shops) and on-trade (pubs, bars, etc.). We analysed the Living Costs and Food Survey 2-week purchasing diary for 10,065 individuals with 57,581 alcohol transactions during 2012–14. A statistical model relates the probability that an individual buys a particular beverage category at a particular price band per unit of alcohol (split into 50 bands from 5p per unit through to 250p per unit) to individual characteristics (age, sex, equivalised income quintile, drinker type) and to three locality variables [outlet density (estimated for each upper-tier local authority), alcohol-attributable hospital admissions rate for 2013/14 and average house price for 2017].

The resulting price distribution estimates were calibrated to match market research data provided by CGA (CGA Strategy Ltd, Stockport, UK) and Nielsen (Nielsen Holdings plc, New York, NY, USA) at government office region level.

Estimating preferences for each local authority by 10 beverage categories (beer, cider, wine, spirits and ready-to-drinks, split by on-trade and off-trade) and population subgroup

We estimate the percentage of alcohol purchased in each of the 10 beverage categories for each population subgroup, using data from the Living Costs and Food Survey. Preferences for each upper-tier local authority are calculated empirically.

Baseline harms data

Harms were evidenced from routine data at upper-tier local authority level on mortality, hospitalisations and crimes. A total of 45 separate conditions defined in the *International Statistical Classification of Diseases and Related Health Problems*, Tenth Revision, (e.g. oesophageal cancer, falls) were examined. Mortality rates per 100,000 population were obtained for each upper-tier local authority by four age groups, sex and Index of Multiple Deprivation quintile for 5 years pooled (2012–16). Hospital Episode Statistics data for 2012/13 to 2016/17 in England were analysed to count numbers of person-specific admissions (i.e. the same person admitted twice counts only once) using the 'broad-measure' approach.

Police-recorded crime statistics were obtained from the Office for National Statistics for each upper-tier local authority (for the period of April 2016 to March 2017) for 14 offence categories. We separated four age groups (18–24, 25–34, 35–54 and $\geq$ 55 years) and sex. Figures were uplifted for under-recording using Home Office 'multipliers'.

Relationship between alcohol consumption and risk of harms

We used previously published methods to model the risk of harm. The relative risks of mortality and of hospitalisation for chronic conditions were modelled using risk functions from international literature. Acute conditions (affected by intoxication) use risk functions, which probabilistically relate mean weekly consumption to occasion-level patterns of drinking and, hence, risk.

For crime, we used alcohol-attributable fractions derived from the Offending, Crime and Justice Survey. The approach calculates the slope of a linear risk function relating the known maximum daily consumption in the previous 7 days to the probability of committing each offence, separately for males and females.

Modelling

Data on alcohol consumption and prices paid were combined to estimate baseline purchasing patterns for each age–sex–Index of Multiple Deprivation quintile and drinker group. A counter-factual price distribution was computed; for example, all prices of < 50p per unit were assumed to rise to exactly the threshold level. The price increases faced by each population subgroup were combined with price elasticities to estimate changes in alcohol consumption. Population subgroup changes in consumption were combined with 45 health conditions, risk curves to estimate changes in harm. The annual impact on NHS budgets was estimated. Crime outcomes were modelled using the Home Office's costs of crime to society. Costs are inflated to 2017 prices and future costs are discounted at 3.5%.

The Sheffield Alcohol Policy Model, local authority version, extends previous versions to include full stratification by Index of Multiple Deprivation quintile, a revised list of health conditions and updated risk curves for alcohol-related injuries.

Analysis plan

We estimated the impact of minimum unit pricing policies for 23 North West and 12 North East upper-tier local authorities and nine government office regions, and the national impact. The dimensions of impact examined were changes in alcohol purchasing, consumption and consumer spending; changes in hospital admissions, morbidity rates and deaths for 45 different health conditions affected by alcohol; changes in life expectancy and quality adjusted life years, changes in alcohol attributable NHS costs; changes in alcohol attributable crime rates; and changes in the costs of crime to society. The outputs are stratified by drinker group (moderate, increasing risk and high risk) and Index of Multiple Deprivation quintile. Reductions in health inequalities are analysed using the slope index of inequality for alcohol-attributable mortality.

Results

It proved feasible to develop a local authority-level model: the Sheffield Alcohol Policy Model, local authority version.

The results show that current estimated alcohol consumption and alcohol-related harm is higher in the North West upper-tier local authorities than the national average for England. Only three out of 23 local authorities had an estimated mean consumption that was lower than the average for England. All 23 local authorities had a higher estimated proportion (than national) of people drinking at high-risk levels. For mortality, the annual alcohol-attributable death rate per 100,000 population varies; the highest, in Blackpool, is more than double the lowest, in Cumbria. Summing 23 local authorities gives an estimated number of annual alcohol-attributable deaths of 1791. We estimate that there are 108,403 alcohol-attributable hospitalisations annually for the region. The model estimated that the annual NHS cost attributable to alcohol consumption varies from £10M to > £75M across the local authorities, equating to £504M for the region. The number of alcohol-attributable crimes for the North West is estimated at 340,000, with the highest rate (Blackpool) being around double that of the lowest local authority (Cheshire East).

The mean annual expenditure on alcohol is estimated at £450 per drinker. It varies by drinker group: moderate, ≈ £200 per year; increasing risk, ≈ £1000 per year; and high risk, ≈ £2500 per year. The average moderate drinker (55.5% of the North West population) is estimated to consume 1 unit per week of 'cheap' alcohol (priced at < 50p per unit), and spend around £21 per year on this. For high-risk drinkers (5.3% of the population), the average consumption of 'cheap' alcohol is estimated at almost 40 units per week.

With the introduction of a 50p per unit minimum unit price, alcohol consumption is estimated to reduce by 5.1% for the region, with larger reductions among high-risk drinkers (−7.7%, ≈ 6.0 units per week). The modelling suggests that the impact on mortality could be substantial, with an estimated regional reduction of ≈ 205 deaths per annum (−11.4%). There are larger estimated reductions in Liverpool, Blackpool and Salford, and lower estimated reductions in Bury, Knowsley and Cheshire East. The estimated reduction in hospital admissions is almost 6000 per annum for the region (−5.5%), with an estimated reduction in NHS annual costs of almost £12M. The number of crimes committed in the North West is estimated to fall by approximately 8500 annually. The estimated impact of a 50p per unit minimum unit price for alcohol at local authority level is greater in the North West upper-tier local authorities than in England overall, because there are higher levels of baseline harm and higher levels of estimated consumption of 'cheap' alcohol (i.e. priced at < 50p per unit). The results are similar for the North East region, which has the largest estimated impact from a 50p per unit minimum unit price in terms of reductions in mortality (17.4%) and hospital admissions (7.9%) of any region in the country.

The estimated effects on consumer spending based on the Sheffield Alcohol Policy Model, local authority version, are as follows. The average moderate drinker in the North West region, currently purchasing 1 unit per week at below the 50p threshold, would see an estimated annual change in spending of just £2 extra per year. For increasing-risk drinkers, this would be £11 extra per year, and for high-risk drinkers it would be an estimated £57 extra per year. Annual revenues to off-trade (supermarkets and shops), after deducting value-added tax and alcohol duty paid to the government, are estimated to rise by £63M. After tax, revenues in the on-trade (pubs, bars, clubs and restaurants) are estimated to fall by around £4.7M, because of the impact of 'cross-price elasticities': changes in the purchasing of one product that occur when another product changes in price.

A 30p per unit minimum unit price would be estimated to have around one-tenth of the impact of a 50p per unit minimum unit price, and a 40p per unit minimum unit price would have around half of the estimated impact. A threshold of 60p or 70p per unit would increase the estimated effects by a factor of around 1.8 and 3.0, respectively.

The model-estimated likely effects on health inequalities were measured using the slope index of inequality. There is substantial current inequality in mortality rates between the very most and very least deprived area in each local authority. The estimated impact of 50p per unit minimum unit price is not only to lower the average mortality rate within each local authority, but also to reduce the inequality between the most and least deprived. This happens because the most deprived heavy drinkers are estimated to reduce their absolute levels of consumption the most (because they drink the most 'cheap' alcohol).

Discussion

The model results suggest that a 50p per unit minimum unit price could be an effective policy in reducing alcohol-related deaths, hospitalisations and crimes for every upper-tier local authority and government office region in England, and also in reducing health inequalities. The majority of estimated impact occurs in those 4–7% of people in the population who drink at 'high-risk' levels, that is those who drink a substantial proportion of very cheap alcohol and spend around an estimated £2500 annually.

One limitation (and strength) is that we synthesise evidence from multiple sources measuring alcohol consumption; prices paid; and incidence of diseases, mortality and crime. The price elasticities used are from a detailed analysis of 9 years of the Living Costs and Food Survey, as used for modelling for Scotland. Previous sensitivity analyses using alternative price elasticities showed that effects could be somewhat higher or lower than our base case, but that patterns of impact (e.g. comparing moderate, increasing-risk and high-risk drinker subgroups, or different minimum unit price thresholds) remain

the same. An important limitation is that we have not examined 'cross-border' purchasing of cheaper alcohol outside the geography where a minimum unit price for alcohol is set at local authority level. We did not find evidence to estimate the scale of this. It would depend on the geography: a larger implementation area means greater travel distances to any 'border'. If it were substantial, then these results would somewhat overestimate the impact. When evidence emerges from Scotland on the extent of cross-border purchasing following minimum unit price implementation, that could help inform adjustment to the estimates. Our analysis is conservative (i.e. underestimating the likely effects) in the sense that it models changes to prices only of products currently below the minimum unit price threshold. We assume that suppliers or retailers do not adjust prices upwards for other products. If they did, then reductions in purchasing and consumption could be larger. We previously found that the Sheffield Alcohol Policy Model underestimated the impact of changes in minimum unit price (in Canada). Deep discussion of strengths and limitations of the Sheffield Alcohol Policy Model has occurred for 10 years, through scientific peer review and critiques produced by consultants commissioned by the alcohol industry and a free market-oriented think tank. Detailed rebuttal of these critiques was evidence reviewed by Scottish, European and, most recently, UK Supreme Courts.

Localities will consider taking these findings forward. Some upper-tier local authorities have considered applying to the UK Home Secretary via the Sustainable Communities Act 2007. This requires (1) evidence on the likely impact on the health and well-being of their population and (2) a public consultation exercise. This evidence delivers (1) and a basis for (2).

We strongly recommend further research on two topics heavily discussed in stakeholder engagement. The first is to estimate the impact of a minimum unit price for alcohol at local authority level on social care harms and costs, especially the harms children experience as a result of parents' and carers' alcohol consumption. The second concerns workplace outcomes and economic consequences across a range of sectors. As well as these, further updates using any emerging evidence from Scotland, including cross-border purchasing, and research to apply the methods used here on other unhealthy products would be useful.

In conclusion, this study has delivered an evidence synthesis and modelling to produce estimates of the likely impact of a minimum unit price for alcohol at local authority level, which suggest that it could be an effective public health policy with greater effectiveness in the North West and North East regions of England than for the national average, and that it could reduce health inequalities.

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