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PHR Project:15/129/19 - Appraising the effect of implementing local Minimum Unit Pricing under the Sustainable Communities Act on alcohol consumption and health in the North West of England

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1. Project title

Appraising the effect of implementing local Minimum Unit Pricing under the Sustainable Communities Act on alcohol consumption and health in the North West of England

2. Background:

2.1. Context for the study

The health consequences of alcohol consumption are estimated to cost the NHS £3.5 billion a year, with wider social costs of £21 billion.(1) Alcohol use is widespread in the UK with approximately two thirds of men and half of women reporting drinking in the past week.(2) Each year in England there are over a million hospitalisations and 6500 deaths related to alcohol.(2) However, there is considerable regional variation in alcohol consumption and related harms. In general, higher levels of consumption are associated with greater harms, although there is regional variation in the strength of this relationship.(3) This variation emphasises the need for not only sub-national alcohol consumption and harm prevalence data, but also information as to the likely differential impact of alcohol policies between areas.

In 2013, of the nine English Government Office Regions, the North West (NW) region had the second highest proportion of people who reported 'binge drinking' (i.e. more than 8 units on one occasion for men and more than 6 units on one occasion for women, among people who consumed alcohol in the last week). The NW region has, for the past decade, also had the highest alcohol-related death rates in the country.(4) In 2014, alcohol-related mortality rates were 55.6 per 100,000 population compared to the English average of 45.5 per 100,000 population.(5) Rates of hospitalisation and road traffic accidents due to alcohol are also higher in this region that the national average.(5) As Local Authorities (LAs) carry much of the responsibility for addressing high levels of alcohol consumption in their communities, there is considerable regional interest in identifying and implementing effective alcohol policy options to improve this situation.

There is a substantial body of evidence that alcohol pricing policies are effective in reducing alcohol consumption and harms,(6-8) including a minimum 'floor' price below which alcohol cannot be sold.(9) The evidence for one specific type of floor price, Minimum Unit Pricing (MUP) is particularly robust.(10, 11) Under MUP, the floor price for alcohol is based on the

number of alcohol units in the beverage purchased in either the on- or off-trade, where 1 unit equals 8g (i.e. 10mL) of pure alcohol.(11) For example, under a 50p MUP, a bottle of wine containing 10 units could not be sold for less than £5. Any additional profit gained under this system would be kept by the retailer rather than being collected as additional government revenue as for a tax-based pricing policy (although there may be increased VAT revenue). National implementation of MUP was originally endorsed under the 2012 Alcohol Strategy,(12) however, this reform was not enacted with the national policy focus instead remaining on individual and industry responsibility initiatives. Further evidence regarding the effects of MUP is in section 2.2 below ('Existing alcohol pricing research').

Local Authorities currently utilise a range of alcohol policy tools to meet their responsibility in addressing alcohol consumption and harms, for example, they have a role in liquor licensing and commissioning treatment.(13) The policy options available to LAs, however, do not extend to the local introduction of MUP, despite the comparatively strong evidence for its effectiveness. While there is no UK precedent for the implementation of MUP at the regional level, there is a strong interest among LAs in the North of England in doing so. In particular, a consortium of LAs in the NW region with a commitment to MUP, the 'Tackling Cheap Alcohol Group' (TCAG), sought legal advice to identify an alternative, local level, avenue for its introduction. The TCAG received advice from Philip Kolvin QC that the Sustainable Communities Act 2007, 2009 (14, 15) provides a realistic means by which MUP could be implemented.

The Sustainable Communities Act 2007 and subsequent Amendment (14, 15) is legislation which provides a mechanism by which LAs can propose the introduction of measures to improve community health and well-being, defined as "…the degree to which persons resident in an area identify with that area and receive an increased quality of life as a result of the nature and the environment of the area".(14, p. 7) Such measures "…may cover anything from policy changes to legislative barriers."(16, p.5) The Act is intended to be used in circumstances where LAs may not otherwise have the power to effect change. Proposals under the Act are considered by government, as represented by the Secretary of State.

To make a proposal under the Sustainable Communities Act, the TCAG were advised that it is first necessary to obtain local level evidence of current levels of alcohol consumption and harms and how these would change under MUP. Such evidence is required to underpin the local consultation processes required to make a proposal under the Act. Discussions we have had with stakeholders in the NW region regarding their evidence needs have been the genesis of this research proposal. Our aim is to produce the required local level evidence regarding the local level effect of introducing MUP. This will fulfil not only the immediate needs of LAs in the NW, but also have several other benefits as discussed under 2.4 below ('Rationale for current study').

2.2. Existing alcohol pricing research: the case for MUP

It is well established that policies which increase the price of alcohol are linked to lower levels of alcohol consumption and further, that lower levels of consumption are associated with a reduction in alcohol related harms including health care costs and mortality.(7, 8, 17, 18) There is also a clear social gradient in alcohol related harms, such that those in lower socio-economic groups experience more harm at comparable levels of consumption to those who are more affluent.(19, 20) Given the existence of underlying socio-economic differences in levels of harm relative to alcohol consumption, it is particularly important that any analysis of pricing policy examine whether policy effectiveness varies by population subgroups and also whether the policy operates to widen or narrow existing inequalities.

Alcohol prices can be influenced by government through taxation and other pricing policies. As noted above, in the UK a specific type of floor price, MUP, has been considered as a

national level policy and its likely effects extensively researched, primarily using the Sheffield Alcohol Policy Model (SAPM), described in more detail below.(21) Broadly, the effects of MUP on consumption are greatest among those who drink the most heavily. For example, when the effects of a 45p MUP were modelled for England for 10 years, those classified as 'harmful drinkers' were estimated to reduce consumption by 138.2 alcohol units fewer per year per person compared to 1.6 units fewer for 'moderate drinkers'.(11) These consumption reducing effects also followed an income gradient, with greater reductions in consumption among those in the lowest income quintile compared to the highest (299.9 units per year reduction compared to 34.3 units). Importantly, the inequality reducing consumption effects were matched by health benefits, with those in the lowest socio-economic groups estimated to gain more quality-adjusted life years and avoid more premature deaths compared to those in the highest group. A similar pattern of results has been found when MUP has been modelled for Scotland, Northern Ireland, the Republic of Ireland, and Wales.(22-25) Although the policy has not yet been implemented in any UK setting, confidence is increased in the modelling work through a Canadian adaptation project. An adapted SAPM was used to prospectively estimate the effect of minimum pricing in Ontario and British Columbia,(26) and these modelled estimates were compared with a subsequent evaluation of the real implementation in British Columbia. The results indicated that the Canadian adapted model produced conservative (i.e. slightly smaller) estimates of the benefits of the real implemented minimum pricing intervention.(9)

More recent analysis has compared the effectiveness and inequality reducing effects of MUP with different taxation policies. In this analysis simulated tax increases were set to achieve an overall 4.3% population-level mortality reduction, the same overall level of mortality reduction predicted by the modelling of a 50p MUP. Three tax policies were examined: 13.4% duty increase, 4% ad valorem tax, and 22p/unit volumetric tax. Once again, MUP was estimated to achieve a greater reduction in alcohol consumption among 'harmful drinkers' than 'moderate drinkers' and to have health (mortality) inequality reducing effects.(27) For both consumption and mortality outcomes, MUP (along with volumetric taxation) was more inequality reducing than other tax policies modelled.

2.3. Localisation of existing alcohol policy modelling infrastructure

While most of the policy analyses undertaken to date using SAPM have focussed on modelling the effect of MUP at a national level, the model has been adapted for other policies and to different levels of geography. For example, it has been used to examine the impact of alcohol screening and brief interventions (SBI) in primary care internationally (28, 29) and alcohol tax pass-through nationally.(30)

NIHR-funded work to adapt the model to produce local estimates of alcohol consumption and harms is currently being finalised (the project funded by NIHR School for Public Health Research finishes in March 2017). This will pilot the model locally in 2 or 3 LAs and examine the effects of two policy types, (1) increasing access to identification and brief advice in primary care, and (2) changing licensing policies and practices locally moving from a lower to higher intensity policy (measured on several dimensions using an annual Home Office Survey of licensing practices). This NIHR SPHR work provides a base for the proposal set out here in that it has involved obtaining or generating LA level data for key model inputs regarding consumption and harms. The distinction between the ongoing current work and the proposed work here is that the NIHR SPHR work is not focussed on locally implemented pricing policies, whereas this project specifically focusses on obtaining necessary data on local pricing and developing the model to undertake appraisal of local MUP strategies. This project will also allow us to take into account heterogeneity between areas when estimating the effects of MUP, including not only known underlying regional variation in consumption and harms(3) but also market research evidence regarding Local Authority level beverage

preferences and prices paid. This will allow understanding of the potential for gains across a wide spectrum of outcomes to inform policy decisions.

2.4. Rationale for current study

In this section we outline the benefits of the proposed project.

- Value to policy stakeholders

Locally – A local MUP is the strongly preferred alcohol policy option by LA stakeholders, however, evidence for effectiveness is required. The effectiveness of alcohol MUP as a harmful consumption reducing and NHS cost reducing intervention has previously only been modelled at the national level in the countries of the UK. However, as MUP has not been introduced at the national level, and there is a potential route for its introduction at a sub-national level, it is essential that decision-makers have access to robust estimates of the likely impact of this policy at a lower level of geography. This project will be the first to model the estimated effectiveness of introducing MUP (set at different price per unit threshold levels) for each small geographical area (in this case LA) within a larger region in which it is proposed the intervention could be collectively introduced.

There is a clear potential route to impact for the evidence generated. Firstly, it will be used to inform a public consultation process to gauge public and other stakeholder support for locally-introduced MUP. Secondly, it will provide evidence to inform government decision-making: specifically, as to whether granting local decision-makers the authority to implement such a policy would provide an effective and equitable means for addressing local alcohol problems. The project will ensure evidence is in place to inform policy decisions in the NW of England and other regions. The Sustainable Communities Act 2007 provides the mechanism for adoption and the legal advice received by stakeholders so far clarifies the crucial role of evidence in that process. Even if that intended route to adoption does not succeed, the project findings would still have broader usefulness by contributing to knowledge about local area variation in alcohol consumption, harms, pricing and MUP effectiveness. This is consistent with the general trend towards evidence based policy, the continuing priority of inequalities reduction and the desire for robust analysis of return on investment from policies.

Nationally & internationally - Alcohol industry groups are currently challenging the Scottish Government regarding the legality of MUP under EU law. The European Court of Justice has ruled that MUP may be legal if it can be shown to be less restrictive of the free market or more beneficial than other options such as taxation. The project proposed here will add to the evidence base by demonstrating not only which socio-demographic groups gain the most from MUP, but also which localities in the country gain the most. Such evidence will certainly be of interest to national government departments and other stakeholders considering the evidence for the effects of MUP as a policy in the UK.

- Adding to the evidence base

Analysing the effect of MUP at lower levels of geography will also allow better understanding of the scale of effect that general price based policies might have in areas with different socio-demographic characteristics and the extent to which there is variation between areas. Local modelling will show how the consumption changes implied by MUP are estimated to change harms and other outcomes. This will also provide information on how much consumption needs to change and in what groups in order to achieve certain levels of outcome. This could help to inform targets for reducing alcohol consumption (in order to reduce harms), even if that change in consumption is achieved by means other than MUP.

- Development of and validation of methods

The project will involve consideration of four important areas where methods development may be of wider benefit. Firstly, we will be examining reweighting the Health Survey for England individual level data such that, having adjusted the sample weight for each individual it becomes (for example) a simulated Health Survey for Manchester or a simulated Health Survey for Warrington. Secondly, similar methods reweighting will be applied to the Living Costs and Food survey which contains data both on prices paid and amount of alcohol purchased. This will need to be aligned with the local pricing data we will obtain from a market research company. Thirdly, the project will also include sensitivity analyses to take account of the potential effects of cross border purchasing. Fourthly, undertaking analyses at both local and regional level will allow us to cross check whether the outcomes at one level of geography are consistent with those obtained at another i.e. adding up LAs to give regional estimates and adding up regions to give national estimates.

In each case, whilst we have core ideas for the process to be followed there will undoubtedly be methodological tweaks and learning from the project. Importantly these methods issues are not specific to alcohol but are potentially generalisable to risk factors and health behaviours around food, diet, physical activity, smoking and many other public health topics.

- Added value to NIHR

We believe the proposed project represents good value for money because it takes advantage of considerable prior investment and infrastructure. Benefits to the project of this considerable previous investment include existing expertise, prior methodological development, datasets, model structures and stakeholder networks. In particular, work funded through the NIHR SPHR to respond to local evidence needs regarding other policy options including intensity of licensing activity and ongoing work on access to specialist alcohol treatment services means that the team are aware of the challenges in using local data and have already addressed many relevant issues (e.g. development of methods to address small count data). This theme of building on prior work is also strategically important for the future both in terms of developing research which addresses LA level needs and engaging in co-production of evidence statements that reflect the science and are fit for purpose in the decision making arena.

3. Research objectives

The proposed study aims to estimate the impact of Minimum Unit Pricing (MUP) for alcohol in the North West (NW) region of England by adapting an existing alcohol policy model. Legal advice says this evidence is required for a core group of Local Authorities (LAs) to make a submission under the Sustainable Communities Act. We further aim to estimate the impact of MUP for every LA in the North East and for seven other Government Office Regions (GOR).

These aims will be achieved via meeting the following objectives:

1. Engagement (throughout project)
We will engage with LAs in the NW region, their legal advisors, and related stakeholders so that the evidence generated is fit for purpose.

2. Data acquisition and analysis (months 1-8)
We will:

a) Gather/generate evidence on local patterns of alcohol consumption in upper tier LAs in the NW region by age, gender, IMD deprivation quintile using statistical methods to

reweight the Health Survey for England alcohol consumption data to be locally representative.

b) Obtain data from a commercial market research company (CGA Ltd) on local price distributions for 10 alcohol categories to show the proportion of units currently purchased below specified price levels (e.g. % off-trade cider sold below 45p/unit)
c) Gather/generate evidence on alcohol purchase quantities and prices paid in upper tier LAs by age/gender/deprivation using statistical methods to reweight the Living Costs and Food Survey to be locally representative.
d) Gather data on alcohol related mortality (from ONS mortality data) and hospitalisations (Hospital Episode Statistics) for LAs in the NW region.

3. Synthesis (months 5-8)
The above data sources will be integrated into an adapted version of the existing alcohol policy model version 3.

4. Impact analysis: NW region (months 9-13)
We will model the estimated impact of a local MUP at 9 price/unit thresholds i.e. 30p, 35p, 40p, 45p, 50p, 55p, 60p, 65, 70p for

a) the NW Region as a whole
b) each NW LA individually
c) the core group of LAs planning submission to Sustainable Communities Act

Impacts will be modelled for the following outcomes (adults 18+):

- alcohol consumption
- consumer spending
- hospitalisation rates (43 alcohol related conditions defined using ICD10 coding)
- mortality rates (43 conditions)
- Quality Adjusted Life Years
- NHS cost savings

Subgroup analysis of inequalities in impact will be undertaken for age, gender, IMD deprivation quintile, and alcohol consumption (moderate/increasing risk/increased risk).

5. Impact analysis: Other regions (months 13-16)
We will replicate the impact analysis for 9 price/unit thresholds for each of the other 8 GORs (North East [by region and individual LAs], Yorkshire & Humber, East Midlands, West Midlands, East of England, London, South East, South West).

6. Dissemination & pathway to impact (months 12-18)
To maximise impact we will:

- Co-produce evidence statements in a form suitable for a legal case under the Sustainable Communities Act
- Produce a detailed technical report with an executive summary setting out methods and findings
- Produce a high quality peer reviewed journal article targeted at the Lancet or BMJ
- Co-produce, by jointly working with LAs, other stakeholders and representatives of the public, summary documents and materials for dissemination on the internet. This will allow LA officers, elected members and the public to understand methods, findings and implications.

4. Research design

The proposed project design is an evidence synthesis. We will gather evidence on alcohol purchasing, consumption and harms for each LA in the NW region. An adapted Sheffield Alcohol Policy Model will generate analysis of local MUP policies.

Evidence gathering & synthesis (months 1-8)

To estimate the health and economic impact of a local MUP, evidence is required on:

- Levels and patterns of alcohol consumption
- Current prices paid for alcohol products
- Responsiveness of the population's purchasing and consumption to price changes (price elasticities)
- Current alcohol related hospitalisation and mortality
- Changes in risk of mortality and hospitalisation when consumption changes (risk functions)
- Costs of NHS care

The evidence gathering and synthesis builds upon work currently funded by the NIHR School for Public Health Research. That work, due for completion in early 2017, is adapting the Sheffield Alcohol Policy Model to utilise LA-level data to produce localised evidence of alcohol consumption and harms and to model the effects of licensing intensity and alcohol screening and brief advice. It does not allow for modelling of pricing policies as proposed here.

- Consumption

Individual level data from the 2011-2013 Health Survey for England (HSE) will be used. Newly-developed statistical methods will be used to re-weight each individual within the dataset to create simulated datasets which are representative of each upper tier LA using age, gender, Index of Multiple Deprivation (IMD), and ethnicity as well as LA level factors including rate of alcohol related hospital admissions. The current version of the model is a statistical model of probability of abstention using a Probit model, and then levels of consumption (given a person drinks) using an Ordered probit model. This work is still developing with alternative statistical models being tested. A version was taken to the recent international alcohol epidemiology conference for feedback from the wider research community.(31)

- Purchasing Quantity & Price Data

Individual diary data in the 2006-2013 Living Costs and Food Survey (LCF) records quantities and prices for beer, cider, wine, spirits and ready-to-drinks (RTDs) both on- and off-trade. This data will be reweighted to take into account LA factors, again following the principles described in the previous section. This has not begun yet and will have an additional challenge in that the Living Costs and Food survey contains data both on prices paid and amount of alcohol purchased. That is, the resulting distribution of simulated purchase quantities for each age/gender/IMD subgroup in the model will need to be consistent with the simulated distribution of consumption for each age/gender/IMD subgroup from the Health Survey for England. Further, the resulting price distribution for each beverage category will need to be aligned with the local pricing data to be obtained from a market research company (see next paragraph).

Most importantly for this project, we have negotiated to obtain commercial market research data on the prices paid for alcohol in each TV region from Nielsen and CGA Ltd. This provides a breakdown of actual sales of different beverage types in each LA. These are crucial to the realistic assessment of MUP policies at local level because it is known that LCF data somewhat under-represents the purchasing of cheaper alcohol nationally (we

already adjust our nationally modelled LCF price distributions to actual sales prices on a national basis) and this is likely to be more substantial in some regions of the country. As described in the previous paragraph, we will adjust the local simulated LCF data to reflect these actual local sales price distributions for each beverage using methods which have already been utilised nationally.(32)

- Price Elasticities

We will use the same price elasticities developed for previous analyses of MUP policies.(18) These are based on a pseudo-panel approach to the cross-sectional LCF Survey to estimate the own- and cross-price elasticities of off- and on-trade beer, cider, wine, spirits and ready-to-drinks in the UK. The pseudo-panel with 72 subgroups was defined by birth year, gender and socioeconomic status.

- Mortality Rates and Morbidity / Hospitalisation Rates

ONS Mortality Data (2011-13) has already been obtained through our NIHR SPHR project for each upper tier LA for 43 conditions split by age, gender and IMD deprivation quintiles.

Hospital Episode Statistics Data (2011-13) has already been obtained through our NIHR SPHR project for each upper tier LA for 43 conditions split by age, gender and IMD deprivation quintiles.

Details on the 43 conditions are available in "Table 8.1: Health conditions included in the model" in the "Univ. of Sheffield - Technical Appendix for the Sheffield Alcohol Policy Model Version 3.0 for England" available online via the website of the journal plosmedicine.(27)

Policy impact assessment adapting the Sheffield Alcohol Policy Model version 3 to North West region (months 9-13)

In overview, the Sheffield Alcohol Policy Model (SAPMv3) will be further adapted for LA use to allow for appraisal of the effects of local pricing policies. Over 8 years SAPM has been described in academic literature (11, 27, 32, 33), and used for national level policy analysis.(22, 34) It comprises two sub-models; 'policy-to-consumption' (P2C) and 'consumption-to-harm' (C2H).

For the P2C modelling, when a MUP policy e.g. 50p per unit is applied in the model, the prices of all purchases in the LCF below 50p per unit are assumed to increase to exactly that level. This changes the price distribution for 120 population subgroups analysed in SAPM. Price elasticities then estimate mean change in purchasing quantity and consumption) by subgroup. These changes are applied to each individual within the HSE base population.

In the C2H model, we then calculate effects of this revised consumption on health. Published literature feeds the epidemiological modelling to estimate impact on health outcomes including mortality, morbidity, Quality Adjusted Life Years (QALYs) and NHS costs for each LA.

More details are given in sections below of the specific components in terms of the study setting and target population, analysis of inequalities using IMD and socioeconomic status, the details of the planned MUP interventions to be analysed, and the proposed health and economic outcomes and the time horizon of analysis. Sensitivity analyses to account for the potential effect of cross border purchasing are outlined in Section 8 'Methods'.

Engagement for impact & analysing other regions (months 13-18)

The engagement with stakeholders is crucial to the proposed research project and indeed has provided the very genesis of it. We will engage in regular communication with stakeholders throughout months 1-12 regarding LA evidence priorities.

In months 13 to 18, we will enter a period of intense stakeholder and PPI engagement to support the co-production of reader-friendly evidence summaries for use in supporting a submission under the Sustainable Communities Act. We will have quarterly meetings with the Tackling Cheap Alcohol Group (TCAG). As well as these, we will host a major stakeholder event, open to stakeholders from across the region with an interest in public health policy. Here we will present and discuss the model results for NW region and further refine the evidence statements to ensure fitness for purpose and clarity to a range of recipients including LA officers and elected members, their legal advisors, and the public.

A final set of engagements with stakeholders in the North East will also take place where the research team will present the analysis for the other 8 GORs, including an analysis for individual LAs in the North East. This will support the finalised design of the project research report and evidence statements.

5. Study setting and target population

Setting(s)

- North West region:

The North West is chosen as the primary setting of interest for two reasons. Firstly, there is evidence of high levels of alcohol consumption and related harm in this region compared to the national average.(4, 5) Secondly, there is strong interest from a group of local public health stakeholders in pursuing the introduction of MUP via the Sustainable Communities Act. Before this avenue can be followed, it is necessary for locally-specific evidence as to the estimated effects of MUP to be obtained. We propose to model the effects of MUP for:

- The North West region of England as a whole
- Individually for each of the 23 upper tier LAs independently
- The core group of LAs in the North West region who intend to make a direct submission for a MUP provision via the Sustainable Communities Act

- The other 8 Government Office Regions:

Modelling will also be undertaken in other regions to investigate how model results vary by area and provide other areas with summary level evidence. As there are comparably high levels of alcohol consumption and harms in the North East, and strong stakeholder interest and support via the Association of Directors of Public Health (North East), we propose to also model the effects of MUP for:

- The eight other regions of England (each as a whole): North East, Yorkshire & Humber, East Midlands, West Midlands, East of England, London, South East, South West.
- Each of the North East upper tier LAs individually

Target population

The primary target population examined in the proposed research is adults aged 18+ in the North West region of England. Results will show changes in consumption and harms at population total and subgroup level. Subgroups will be defined based on gender, age groups, IMD deprivation quintiles and drinker group

- moderate – those drinking within the recent new UK guidelines of 14 units/week,
- increasing risk – those drinking above guidelines but below 35/50 units/week for women and men respectively
- increased risk (formerly called harmful drinking) – those drinking above 35/50 units/week for women and men respectively.

6. Socioeconomic position and inequalities

The primary modelling analysis is for the entire population aged 18+. However, the modelling will involve subgroup analyses, including socioeconomic position and inequalities. Specifically, we will be able to ascertain inequalities of impact of MUP for each outcome measure (i.e. consumption, spending, hospitalisation rates, mortality rates, Quality Adjusted Life Years and NHS cost savings) for sub-groups defined by age, gender, IMD deprivation quintile and alcohol consumption. Given the comparatively high levels of deprivation, alcohol consumption and harms in both the North West and North East in relation to the rest of England, consideration of inequalities is of key interest.

Previous national levels estimates of the effect of MUP on different income and socio-economic groups imply that the greatest gains in QALYs and reductions in premature deaths are among the most disadvantaged social groups.(11) Further, when different alcohol pricing policies are compared, MUP or an alcohol-content based tax would deliver larger reductions in health inequalities than tax increases (based on either the current UK tax system or on product value).(27) Evidence produced in this study will provide local decision makers with local information as to the likely scale of health inequality reduction under different levels of MUP.

7. Planned interventions

The intervention will be the assumed introduction of Minimum Unit Pricing (MUP) under the Sustainable Communities Act 2007.

We will model the introduction of the MUP by assuming that the products priced below the threshold are increased to exactly the threshold price. This may be conservative and underestimate the effects because it is possible that retailers and manufacturers will also adjust the prices of other products to maintain price differentials and premium status of brands.

The effects of a price increase for a particular on purchasing are twofold:

- Firstly, the level of purchasing of the product itself would be directly affected e.g. a price increase in off-trade beer would reduce the purchased quantity of off-trade beer purchased (what we call the ‘own price elasticity’ for the product).
- Secondly, consumers might also shift the purchasing of other products e.g. substituting by buying slightly more off-trade cider, or reducing the purchase of products that they usually buy alongside off-trade beer which are ‘complements’ (these effects are captured in the ‘cross-price elasticities’).

We capture both of these effects and examine them for each of the 120 subgroups within the Sheffield Alcohol Policy Model.

Levels at which the implementation of an MUP intervention will be modelled

We propose to model the MUP intervention at nine different levels: 30p, 35p, 40p, 45p, 50p, 55p, 60p, 65p, 70p - and for each of the Settings and the Target Population groups identified above.

Who will deliver the intervention?
The intervention will not in practice be delivered in our study. Our proposed study is a necessary step toward implementation. It will provide the evidence base for a case to be submitted under the Sustainable Communities Act.

Discussions with stakeholders suggest that in practice the implementation of the intervention under a Sustainable Communities Act provision would be through the mechanism of a condition of the retailers' license to sell alcohol. That is, it would be implemented by LA licensing authorities. Enforcement would be similar to the enforcement of the recently implemented government "ban on below cost selling" for alcohol. This requires retailers not to sell below (a very low) threshold price for each alcohol product (set at the tax duty payable on the product plus 20% VAT payable on that duty).(10) Enforcement of the ban on below cost selling essentially requires monitoring of retailers by Police and Trading Standards to ensure they are not selling below these prices.(35) Our stakeholder discussions so far suggest similar enforcement practices would be applied to a local MUP intervention.

Comparison with no MUP
The comparison condition is 'No provision for a Minimum Unit Price'. That is, we essentially assume that prices for alcohol products remain unchanged for the comparator.

Our recently published analysis(27) of price distributions for England as a whole showed that the proportion of alcohol units sold below the 9 proposed thresholds to be analysed were:

Threshold:	% of alcohol units in England sold below threshold levels (2014 prices)
30p	2.9%
35p	5.7%
40p	12.0%
45p	23.6%
50p	34.5%
55p	42.9%
60p	50.9%
65p	55.4%
70p	58.8%

[Footnote: This analysis used individual LCF data from 2001-2009 combined with off-trade data price from Nielsen (year = 2011) and data for the on trade from CGA Ltd (year = 2011)].

The NW region has a higher than average proportion of people in more deprived settings than the national average. We anticipate that when we obtain the equivalent data specific to NW region data there will be a slightly higher proportion of the units sold which are in the cheaper prices bands.

8. Methods

This study is a prospective evidence synthesis and health and economic impact assessment of the introduction of MUP. In this section we provide some further detail on the structure of the Sheffield Alcohol Policy Model version 3 (SAPMv3) and planned adaptation.

SAPMv3 is a deterministic mathematical simulation model which provides a comprehensive framework for appraising the potential impact of a wide range of alcohol policy options on a

wide range of outcomes including alcohol consumption, spending on alcohol, health and the associated costs to the NHS. SAPM consists of two distinct models; the first is an individual econometric simulation which estimates the impact of a policy on the distribution of alcohol prices and the resulting impact on alcohol purchasing and consumption. The second model is an epidemiological cohort model which simulates the impact of changes in alcohol consumption on alcohol-related mortality and hospital admissions, the resulting changes in the structure of the population, and the associated costs to the NHS. As there is significant variation across the population in terms of alcohol consumption, prices paid, patterns of drinking and alcohol-related health outcomes, SAPM is stratified throughout by age, gender, socioeconomic status and level of drinking.

The current version of the model has been calibrated in several ways. Individual level data in the LCF survey are adjusted so that the overall price distribution for England matches actual sales data price distributions from CGA/Nielsen. The LCF purchasing data are also adjusted to match HSE self-reported consumption levels. The risk functions for 100% alcohol-attributable acute and chronic health conditions and for partially alcohol-attributable acute health conditions are calibrated to match observed sub-group specific levels of harm in terms of hospitalization and mortality rates.

The adaptations to make the model useable at LA level have already begun through funding from NIHR SPHR. This will generate a pilot version of the model (SAPM-LA) to be tested in 2-3 local authorities before March 2017. It includes analysis of the HSE using a method of statistical reweighting for the sample weight for each individual. As part of the proposed project we will also re-weight the LCF Survey data and align it with the data we have negotiated to buy from CGA/Nielsen on TV region pricing and sales data. This will provide estimated LA level price distributions. Finally, alcohol related hospital admission rates and mortality rates for each of the 43 conditions will be analysed by LA. These we have already obtained, again as part of the NIHR SPHR programme.

For considering cross border purchasing issues, we plan to also utilise one further piece of research infrastructure which has been part of the NIHR SPHR programme. This is a postcode level database of all on-trade and off-trade outlets selling alcohol in the UK, including classification of outlet subtypes (e.g. local pub, nightclub, sports and social club, supermarket, convenience store etc.). As part of our previous MRC and more recently NIHR SPHR programme, we purchased this dataset for 2003, 2007, 2010, 2013 and 2016, and have developed detailed measures of each UK postcode's exposure to alcohol availability and examined these measures over time. In this project we propose to use these data to inform scenarios for sensitivity analyses around cross border purchasing. It is logical that a local MUP policy's effectiveness may be reduced if only a small geographical area is included in the provision, because people travelling to neighbouring LAs could diminish effects. We will use the outlet postcode data to configure sensitivity analysis scenarios estimate based on exposure to outlets in neighbouring LAs. For example, we will estimate the percentage of people who live within say 5km of an off-trade outlet in another LA (one without a MUP) and perhaps assume that they would be unaffected by MUP implementation. Sensitivity analyses on the proportion of purchases affected will be explored. The exact specification of the cross border sensitivity analyses is not yet decided and will be informed by engagement with project stakeholders.

9. Outcome measures

The primary outcomes of interest under each level of MUP in comparison to non-implementation of MUP are the estimated changes in alcohol consumption and spending on

alcohol and estimated changes in alcohol-related health outcomes i.e. hospitalisations, deaths avoided and quality adjusted life years, and healthcare costs.

Changes in alcohol consumption and spending:
Using the price elasticities developed for previous analyses of MUP policies,(18) we will use the P2C component of SAPM V.3 to quantify the changes in levels of alcohol consumption and spending according to alcohol consumption group and deprivation quintile. This will be reported in annual spending and weekly spending per person. It will also be reported for the total population so that an assessment of the impact on retailers can be seen.

Changes in health outcomes:
- Using the above consumption change data, we will then model the impact of these changes on morbidity, mortality, Quality Adjusted Life Years (QALYs) and NHS costs. To achieve this, the C2H component of SAPM models the disease prevalence for 43 acute and chronic health conditions for which there is evidence they can be either wholly or partly attributable to alcohol.
- Estimated impact on reductions in hospitalisation rates (for 43 alcohol related conditions) will be reported for the whole population and also by socioeconomic group to examine reductions in health inequalities.
- Impact on mortality will focus on numbers of alcohol-related deaths avoided
- The effects of other diseases (i.e. competing risk whereby people will die of other causes rather than alcohol related diseases) are also included in SAPM and this enables an estimation of the increase in Quality Adjusted Life Years lived due to the policy
- NHS Cost savings will be estimated based on the numbers of people estimated to be suffering from alcohol related conditions each year and the costs of their care. We do not plan to revise this component of the model during this project as it was recently revised to examine tax policy options for England.(27)

Discounting:
Costs and QALYs in future years are both discounted in line with NICE Public Health Methods Guidance.(36) This guidance recommends using 1.5% for costs and QALYs because public health interventions usually act over the long term, and this is considered to be in line with the option used in the NICE Guide to the methods of technology appraisal for interventions which have effects lasting for many years. In practical terms, for many interventions in public health where the intervention occurs over a relatively short period earlier in people's lives but the benefits accrue mostly at the end of their lives, the use of this set of discount rates will give approximately the same result as a 3.5% discount rate on costs and a 1.5% rate on benefits used by the Department of Health, in line with their interpretation of the Treasury Green Book.

10. Assessment and follow up

The evidence synthesis and modelling will use a time horizon of 20 years from the date of policy implementation. This horizon was chosen because review of the evidence for the lag between changes in consumption and changes in heath harms shows that the lag time varies by disease and the achievement of ‘full effect’ can be up to 20 years.(37)

The cumulative impact of changes in consumption over time on the risk of alcohol-related health harm will be calculated using evidence for each modelled health condition on:
1) The time to first effect on risk from a change in consumption
2) The time to the full effect on risk from a change in consumption
3) The distribution of effect across the intervening time period

A time horizon of 20 years is chosen as this is the time by which the 'full effect' of the policy on health has been realised.

11. Sample sizes for evidence to be used

The proposed project is a synthesis of evidence and policy modelling exercise. As the policy intervention to be modelled would apply at the population level, the target population is the entire North West region n=5,594,000 (NW GOR population aged 18+).

The sample size for the key datasets to be used in the modelling is as follows:

Health Survey for England (HSE)
The 2011-2013 HSE provides individual-level (n= 24,685), past-year consumption data for four beverage types (beer & cider, wine, spirits, ready to drinks) measured in alcohol units by 'mean weekly' and the 'peak daily' (i.e. consumption on heaviest drinking day in survey week). As HSE does not distinguish on and off trade consumption and combines beer and cider, these categories are apportioned using LCF data. This data is reweighted to generate a simulated LA specific Health Survey e.g. a Health Survey for Manchester. In that sense the most important 'n' sample size in the model is this n=24,685 simulated Manchester (or whichever LA is being modelled) residents.

Living Costs and Food Survey (LCF)
As LCF data are provided nationally, reweighting by age, gender and IMD quintile will be conducted for each upper tier LA. The sample size of a single year of LCF ranges from 3,400-6,600, with smaller samples in more recent years. For the full set of LCF data we plan to use, covering years 2006 to 2013, the sample size is approximately n=39,000 individuals in 60,000 households.

CGA / Nielsen Local Prices & Sales data
Off-trade data will be purchased from Nielsen and is available at TV region level (similar boundaries to Government Office Region). Data is based on full sales data from all outlets of major national retailers combined with data from a representative sample of smaller outlets, with full coverage for an estimated 75% of all alcohol sold. On trade data from CGA Ltd is available at LA level and comes from sales data from a stratified sample of over 60,000 outlets across the country combined with data on the location type and size of all trading outlets (c. 130,000).

Hospital Episode Statistics (HES)
The dataset provides details of every hospital admission for the LA of residence of the population (i.e. we will use the complete dataset, not a sample). For the NW region there were approximately n=91,000 individuals admitted to hospital with an alcohol-attributable condition during 2012/13.

ONS mortality
The dataset provides details of every death for the LA of residence of the population (i.e. we will use the complete dataset, not a sample). For NW region there were approximately n=1,200 individuals who died of an alcohol related condition during 2013.

13. Ethical arrangements

The modelling component of the work uses secondary data only. Therefore the ethical requirements of the project relate to ensuring appropriate procedures are followed in the acquisition, handling, storage and reporting of these data. Existing agreements with data custodians will be reviewed to determine whether variations or new agreements are

required. A written determination will be sought from the ScHARR Ethics Committee, University of Sheffield regarding whether a full ethics review is required for this evidence synthesis project involving secondary data, and if so, approval will immediately be sought.

Both the stakeholder engagement and the PPI activities planned are intended to support the direction and dissemination of the research, rather than to constitute 'human research' in their own right. Both streams of activity are therefore exempt from ethical review.

14. Research governance

The University of Sheffield will be the research sponsor and host organisation with AB as the Principal Investigator. He will be supported in this role by PB who will manage project communications, key stakeholder engagement processes, PPI and project dissemination, and by CA who will lead data procurement and evidence synthesis. DG will be responsible for data management and security. Monthly progress meetings will be scheduled involving the PI and all CIs and a record of key decisions made will be kept. Quarterly stakeholder meetings will be organised in conjunction with the nominated representative of the chair of the Tackling Cheap Alcohol Group. Meeting agendas will be distributed prior to all stakeholder meetings and minutes circulated to attendees afterwards.

A project Advisory Group will be established to provide comment on the methods and will include members with relevant public health and academic expertise. This group will meet three times over the course of the project with interim communication as necessary via telephone and email. Tentative membership of the advisory group includes:

Helen Tomkys	Head of Alcohol Programme	Department of Health
Clive Henn	Senior Alcohol Advisor	Public Health England
Clare Perkins	Director	Public Health England, North West KIT
Sacha Wyke	Senior Analyst	Public Health England, North West KIT
Kate Sweeney	PHE lead, Official Statistics	Public Health England, North West KIT
Frank de Vocht	Senior Lecturer	University of Bristol

Financial management support will be provided by staff in the University of Sheffield Research Office. A formal agreement will be established with a lead stakeholder regarding their role in facilitating stakeholder engagement and a graphic design company will be engaged to professional design LA project summaries.

AB will take responsibility for ongoing communication with and formal reporting to NIHR, with contribution from PB. Any unanticipated delays in progress will be reported to NIHR. We have confirmed that the UK Centre for Tobacco and Alcohol Studies drinker panel (comprised of members of the general public) will provide PPI, full details of which are included in the application form.

15. Project timetable and milestones

The project will run for 18 months from April 2017 and involve 3 phases: (1) evidence gathering and synthesis, (2) impact assessment, and (3) development of evidence statements, comparative analysis and dissemination. Stakeholder engagement will occur throughout the life of the project. The proposed project milestones are as follows:

1.	Obtain necessary ethics/data approvals	April 2017
2.	Initial stakeholder engagement meeting with North West TCAG	April 2017
3.	Localised NW consumption estimates	Sept 2016

4.	Progress report 1 to funder	Nov 2017
5.	Modelling of impact of MUP for NW region (as a whole) complete	Feb 2018
6.	Modelling of impact of MUP for NW region (individual LAs) complete	April 2018
7.	Stakeholder engagement meeting to present regional evidence to TCAG and plan major stakeholder engagement event:	April 2018
8.	Progress report 2 to funder	May 2018
9.	Major stakeholder event NW	June 2018
10.	Evidence statements available	July 2018
11.	Modelling for all other regions complete	July 2018
12.	Major stakeholder event NE	July 2018
13.	Final project report to funder	Sept 2018

Year	2017									2018								
Quarter	Q2			Q3			Q4			Q1			Q2			Q3		
Month	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Project month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Phase 1 – Evidence gathering & synthesis																		
Obtain data/ethics approvals	M1																	
Acquire & prepare CGA data																		
Localise LCF by price distrib's						M3												
Localise HSE data																		
Prepare local harm & demog's																		
Progress report 1								M4										
Phase 2 – Impact assessment																		
Model MUP effect NW region											M5							
Model MUP effect all LAs																		
Model MUP effect core LAs																		
Cross border analysis													M6					
Model validation/QA																		
Progress report 2														M8				
Phase 3 - Development of evidence statements, comparative analysis & dissemination																		
Evidence statements & PPI																M10		
Model for NE (region & LA)																		
Model for other regions																M11		
Dissemination & final report																		M13
Stakeholder engagement																		
Formalise agreement with HF																		
Project meeting visits to NW	M2												M7					
Major stakeholder event NW															M9			
Project meeting visits to NE																		
Major stakeholder event NE																M12		

16. Expertise and contributions of the research team

University of Sheffield: The University of Sheffield Alcohol Research Group has an international reputation in alcohol policy modelling and a strong track record of joint project delivery. Recent and current projects have made methodological innovations to inform policy decisions regarding alcohol pricing, screening and brief interventions, drinking guidelines and specialist treatment provision.

Professor Alan BRENNAN (Health Economics & Decision Science) is a leading researcher in public health related health economic decision modelling. AB was one of the originators of SAPM and has driven its further development and application, resulting in many high level publications and major international policy impact.(10, 32, 33, 38) As PI he will be responsible for strategic management.

Dr Penny BUYKX (Senior Research Fellow in Public Health), is experienced in managing complex quantitative projects focussing on local level alcohol interventions. PB will be responsible for day to day management of the project, liaison with key stakeholders, PPI engagement, and academic and lay dissemination.

Mr Colin ANGUS (Research Fellow in Health Econ & Decision Sci) As senior SAPM analyst, CA has led the adaptation of the model for several countries and to lower level geographies, including local authority level. With expertise in measuring geographic variability in alcohol availability, CA will drive methodological development and oversee the preparation of the project technical report.

Dr John HOLMES (Senior Research Fellow in Public Health) has been extensively involved in previous SAPM projects, including leading key background publications.(11, 37) JH will utilise his strong policy stakeholder networks to maximise research reach.

Professor Petra MEIER (Public Health) is one of the originators of SAPM and lead author of a recent SAPM publication highlighting the health inequality-reducing potential of MUP.(27) PM will act in an advisory role.

Dr Duncan GILLESPIE (Research Associate in Health Econ & Decision Sci) has an in-depth knowledge of SAPM data requirements and structures. DM will lead on data acquisition.

Dr Robert PRYCE (Research Associate in Health Econ & Decision Sci, early career researcher). RP will take responsibility for data modelling and report preparation under the direction of CA

17. Partner collaboration

We have agreement from the TCAG (whose membership includes key decision makers in the North West Local Authorities) to contribute throughout the life of the project by meeting regularly with the research team to discuss their evidence needs and emerging findings. They are also willing to support a major stakeholder event to communicate findings to other relevant audiences. We have been in discussions with stakeholders in the region about alcohol pricing policy since 2009 and in discussions specifically about this proposal since December 2014. Andrew Taylor, project manager at the former public health charity Healthier Futures, and key member of the TCAG up until March 2017, provided us with access to the legal advice regarding the Sustainable Communities Act as a potential route for introducing MUP. We have also consulted Margaret Carney, Chief Executive of Sefton Local Authority and chair of the TCAG. Both AT and MC emphasised strongly, and on behalf

of the broader group, that this project is a very high priority. As reassurance of their support, they have provided detailed letters at both the outline and full-bid stage. Additionally, one stakeholder will take a formal role in facilitating links between the research team and the TCAG. There is strong interest in the project from other regions and we have therefore proposed to replicate the methods in the North East of England, which has similarly high levels of alcohol consumption and harms to the North West. We have formed links with the Association of Public Health Directors for the North East, and have written confirmation of stakeholder support in that region from the vice-chair, Amanda Healy.

This application also benefits from our collaborator status with the UK Centre for Alcohol and Tobacco (UKCTAS). We have sought input from the UKCTAS PPI panel made up of 40 adult members of the general public who occasionally or regularly drink alcohol regarding our lay summary. As the output of the research is planned to be used to support a public consultation process, it is essential that in addition to a project technical report, we produce a plain English summary of the evidence generated. Input from the UKCTAS drinker panel will therefore be sought to provide feedback on early drafts of this and in identifying and selecting routes for public dissemination.

Informally, we will continue to utilise our strong links to the NIHR School of Public Health Research (SPHR), with AB, JH and PM all co-investigators on the wider grant and all team members currently working on the alcohol work package. Sheffield has been approved as a continuing member of the SPHR2 round. The broader SPHR network has tremendous expertise in data availability, local area analysis, local context relevance to emerging findings, and avenues for dissemination and this will further enhance the delivery of this project through opportunities to consult with other public health researchers and decision makers.

18. Dissemination strategies and outputs

- A number of dissemination avenues will be used to promote project outputs:
- Statements of Evidence suitable for submission under the Sustainable Communities Act will be developed
- A full report will be submitted to the NIHR
- Papers highlighting methodological advances and key results will be submitted to high impact peer-reviewed public health and policy journals
- We will present findings at carefully selected conferences; with national level presentation focussing on policy relevance and international presentation highlighting methods for local area estimation
- Lay summaries of key findings and their implications will be prepared for the general public. This will include a version specific to the NW region, and another of more general interest. Summaries will be communicated via local public health stakeholders, the Sheffield Alcohol Research Group website and Twitter feed. We will also use the public engagement infrastructure available through our membership of UKCTAS (e.g. blogging, video production)
- We will promote further media dissemination: we have institutional support for and personal experience in developing media releases and responding to media requests
- Policy briefings will be prepared to engage with policy stakeholders such as local directors of public health, charities, Public Health England, and the Department of Health. Where opportunities arise we will also engage with relevant parliamentary processes (e.g. enquiries and consultations)

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