

# Independent Review of the Liquor Licensing System in Northern Ireland including the Surrender Principle

## Appendices

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# Independent Review of the Liquor Licensing System in Northern Ireland including the Surrender Principle

## Appendices to Final Report, August 2024

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## Appendix 1: Measures of alcohol retail outlets

The Northern Ireland Department for Communities (NI DfCom) provided data on the location and type of alcohol outlets within Northern Ireland in 2017 and 2022.

In 2022 data on all alcohol outlets' location were provided in full address ('street name + building number') format, including the postcode and the projected coordinates of the postcode as stated in the [Central Postcode Directory | Northern Ireland Statistics and Research Agency \(nisra.gov.uk\)](#).

The 2017 dataset contained information on the location of public houses, off-licences and hotels (but not other alcohol outlets). The location of the premises were reported via postcode projected coordinates.

The data were carefully cleaned and geocoded into a Geographic Information System (GIS) (ArcGIS v.10.6.) using the projected postcode coordinates of each outlet in the 2022 and 2017 databases. We received 3155 and 1948 outlets with licences to sell alcohol operating in 2022 and 2017, respectively. For 2022, we removed five duplicates and detected four outlets in 2022 with incomplete data on address, postcode and coordinates, which could not be geocoded. Additionally, we identified three outlets in 2017 with incomplete data. The final sample of outlets were 3148 and 1945 for 2022 and 2017, respectively, with a geocoding success higher than 99%.

We used Super Output Areas (SOAs) (n=890) as our geographic units. SOAs were developed by NISRA as a small unit for the release of census data. The Northern Ireland Index of Multiple Deprivation (2017) was released at this level allowing us to explore density and availability by deprivation. NB: Following a public consultation a new statistical geography for NI was released in 2023 to support the 2021 Census. This occurred after the start of our project, so we have used SOAs as they matched the timelines for this report.

In our analysis we include two measures of alcohol retail outlets. The first is a measure of alcohol outlet availability expressed as outlet counts per 10,000 persons within each SOA. Population data were retrieved from the NISRA 2020 Mid-Year population estimates for each SOA: <https://www.nisra.gov.uk/publications/2020-mid-year-population-estimates-northern-ireland>.

The second is a measure of alcohol outlet density (Kernel Density Estimation) that takes account of both the spatial distribution of outlets and their proximity to where people live across NI. We used Kernel Density Estimation (KDE) to measure the density of outlets. KDE creates a smooth, continuous surfaces over a geographical area (this time Northern Ireland) that allows the identification of areas with high or low densities of alcohol outlets. In KDE, a bandwidth is selected which is a radius of influence we expect each outlet to have. In this case an 800m bandwidth (approximately equal to a 10-minute walking distance) was applied and 100sqm pixels (a division of the surface area with densities measured for each grid point). KDE essentially explores the overlapping bandwidths at each grid point (or not) with a density value given for each pixel of the grid surface. Higher values indicate areas with higher densities of alcohol outlets. Rather than reporting the number of outlets per SOA, the KDE value represents a proximity-weighted estimate of the density of each outlet type per sqkm. KDE values were assigned to SOAs using population weighted centroids. A population weighted centroid is an adjusted central point of an areal unit that takes into account the population distribution in the areal unit. The centroid represents a point where most of the population are located. NISRA provides population-weighted centroids for output areas, smaller statistical geographic units than SOAs, so each SOA

may cover several output areas. KDEs were extracted for each OA, then the SOA density value calculated as the mean KDE value of the OAs falling within the SOA boundaries.

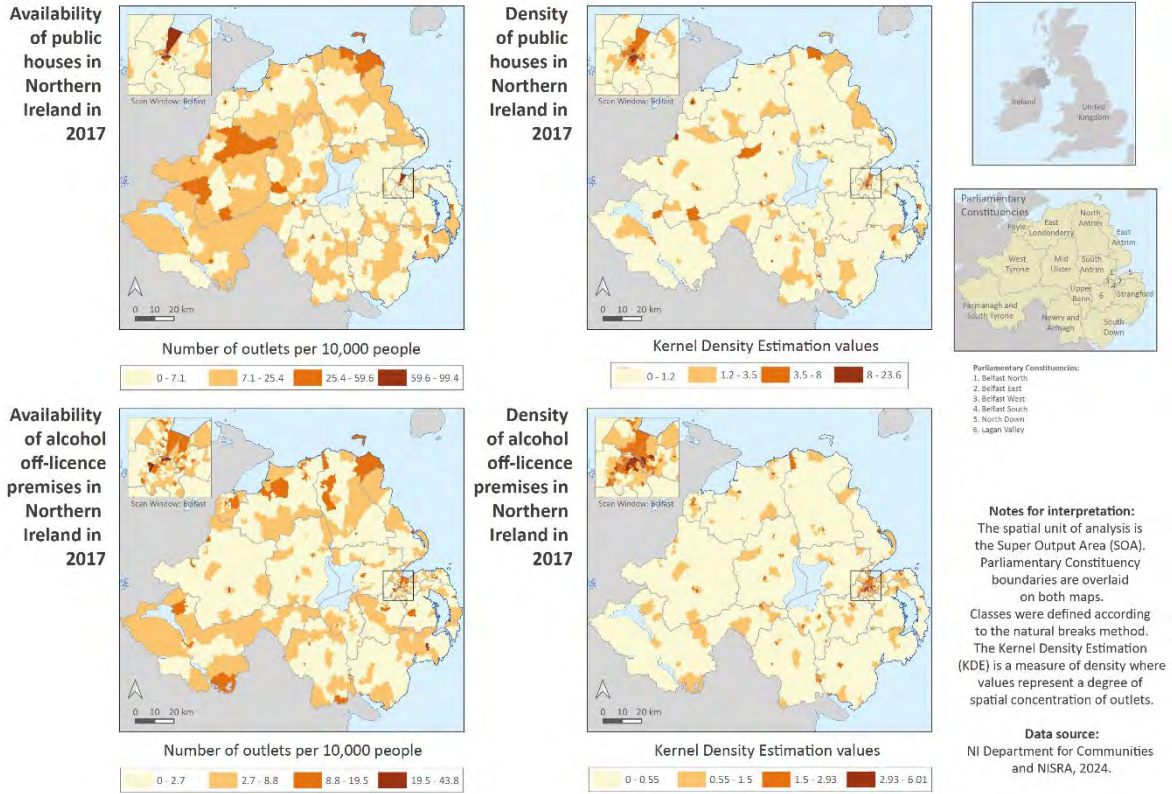
We used this method to calculate KDE estimations for the following alcohol outlet types:

1. Density of Public Houses in 2017 and 2022, and average of both years.
2. Density of Off-licences in 2017 and 2022, and average of both years.
3. Density of Public houses and off-licences combined in 2017 and 2022, and average of both years.
4. Density of all alcohol outlets (public houses, registered clubs, restaurants, hotels and guest-houses, other on-premises and off-licences) in 2022.

Sensitivity analyses exploring varying kernel parameters of 400m and 1600m bandwidth were conducted per each combination of outlet types (public houses, off-licence, both public houses and off-licences and all) and years (2017, 2022 and average 2017-2022).

# Appendix 2: Availability and density of pubs in NI

Figure A1: availability and density of pubs in NI using NISRA 2017 data.



## Appendix 3: Methods for estimating risk of hospitalisation and death from an alcohol-specific condition relative to the density of outlets

We received data from the Honest Broker Service (HBS) in Northern Ireland. The HBS manages data access requests for the Health and Social Care (HSC) Northern Ireland and the Department of Health and provide access for researchers who require access to administrative data for approved projects.

The analysis consisted of three datasets:

1. 'Demographics': all people living in Northern Ireland at least at one point between 1<sup>st</sup> Jan 2012 and 31<sup>st</sup> Oct 2023. Include information on sex, month/year birth, month/year death or deduction, as well as data on their neighbourhood characteristics (income decile, urban/rural and KDEs provided to Honest Broker for data linkage).
2. 'Inpatients': all hospital episodes that occurred in Northern Ireland between 1<sup>st</sup> Jan 2012 and 31<sup>st</sup> Oct 2023.
3. Alcohol specific deaths 2012 – 2023 (partial year for 2023).

We used the ONS definition of Alcohol Specific disease with the ICD codes listed below to identify alcohol specific mortality and hospitalisations (Figure A2)

**Figure A2: ICD-10 Codes for Alcohol Specific disease definition**

ICD-10 code	Description of condition
E24.4	Alcohol-induced pseudo-Cushing's syndrome
F10	Mental and behavioural disorders due to use of alcohol
G31.2	Degeneration of nervous system due to alcohol
G62.1	Alcoholic polyneuropathy
G72.1	Alcoholic myopathy
I42.6	Alcoholic cardiomyopathy
K29.2	Alcoholic gastritis
K70	Alcoholic liver disease
K85.2	Alcohol-induced acute pancreatitis
K86.0	Alcohol-induced chronic pancreatitis
Q86.0	Fetal-induced alcohol syndrome (dysmorphic)
R78.0	Excess alcohol blood levels
X45	Accidental poisoning by and exposure to alcohol
X65	Intentional self-poisoning by and exposure to alcohol
Y15	Poisoning by and exposure to alcohol, undetermined intent

Source: Office for National Statistics

To explore whether the risk of experiencing an alcohol-specific hospitalisation or death, was associated with the density of outlets in any given area we identified all the people having alcohol-related hospital admission, or dying from an alcohol specific disease, over the time period.

For hospitalisations individuals living in Northern Ireland (at least at one point) between 1<sup>st</sup> Jan 2012 and 31<sup>st</sup> Oct 2022 were categorised between 0 (not having alcohol related hospital episode) and 1 (having alcohol related hospital episode).

Individuals were classified by sex (men vs women), age (15-24 (18-24 for death); 25-34; 35-44; 45-54; 55-64; 65-74; 75-84; +85 years old), neighbourhood income deprivation (NIMDM) inputted as per 2017, and urban/rural status as per 2017 and neighbourhood alcohol outlet densities estimated as KDEs. We considered different types of alcohol outlet densities, including:

1. Public Houses density only as per 2017 and 2022, and average between both years.
2. Off-licence density only as per 2017 and 2022, and average between both years.
3. Public houses and off-licence density as per 2017 and 2022, and average between both years.
4. All alcohol outlets (public houses, registered clubs, restaurants, hotels and guest-houses, other on-premises and off-licences) as per 2022.

For hospitalisations we performed logistic regression to analyse the relationship between the outcome variable (having or not having alcohol related hospitalization episode) and the predictors (sex, age, neighbourhood income decile, urban/rural and alcohol outlet KDE). KDEs were treated as quintiles, with the lowest quintile encompassing areas with a density value of 0 only, and the rest of quantiles formed by quartiles. Unadjusted and adjusted models considering different combinations of outcome-predictor variables were tested.

## Alcohol specific mortality cox proportional model

The mortality statistics provided by HSC are based on when the alcohol specific death occurred. The HBS data is routinely updated and therefore contains cases where cause of death has changed or finalised after official statistics have been produced and published. As a result, the alcohol specific deaths produced in Table A1 below may vary slightly to the numbers published in the official statistics.

Our data is at the individual-level and contains everybody who is registered with a General Practitioner (GP) from January 2012 – September 2023. Using area-level information provided for each individual in the data we were able to match onto each person area-level characteristics. These included the average income level of the area as well as the Kernel Density Estimate (KDE) of alcohol availability. The KDE of alcohol availability is a measure of the number of licenced premises in an 800-metre radius. This is a continuous measure however, we break this down into quintiles of lowest availability, low availability, middle availability, high availability, and highest availability. In this analysis we define lowest availability as the areas where the KDE of alcohol availability is 0. We then split low availability, middle availability, high availability, and highest availability into four equal quantiles.

Table 15 is our main table of analysis with all covariates. We fit a Cox Proportional Hazard Model for all the data. Alcohol licences are issued/renewed every 5 years. We have data for the 2017 and 2022 licences. As a result, we use the mean KDE for 2017 and 2022 and use this throughout our analysis. The KDE for our baseline analysis is for pubs and for the off-trade together. In addition, we present this graphically in Figure A3. Analysis time is in months.

*Figure A3: Cox proportional hazards regression using pubs and off-trade KDE values at 800m*



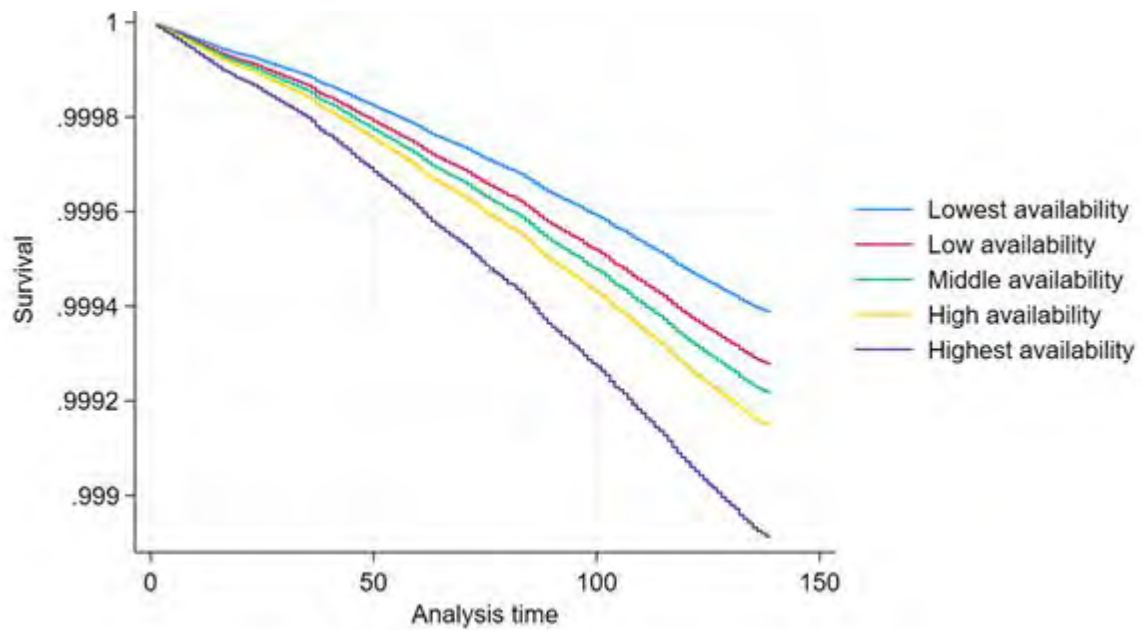


Table A1: Cox Proportional Hazard Model for pubs and off-trade in Northern Ireland 800m using mean KDE estimate

	Hazard Ratio	Standard Error	T-Stat	P value	95% Confidence Interval
Outlet Density					
Lowest Availability	Reference				
Low availability	1.18*	0.12	1.69	0.09	0.97,1.43
Middle availability	1.28**	0.13	2.52	0.012	1.06,1.55
High availability	1.39***	0.14	3.39	0.001	1.15,1.69
Highest availability	1.78***	0.18	5.85	0	1.47,2.16
Income Decile					
1 (Lowest)	2.45***	0.21	10.24	0	2.06,2.91
2	1.96***	0.17	7.55	0	1.65,2.34
3	1.88***	0.17	6.87	0	1.57,2.25
4	1.84***	0.17	6.67	0	1.54,2.19
5	1.75***	0.16	6.14	0	1.46,2.09
6	1.67***	0.15	5.58	0	1.39,2.00
7	1.57***	0.15	4.65	0	1.30,1.89
8	1.37***	0.13	3.29	0.001	1.14,1.65
9	0.99	0.1	-0.06	0.954	0.81,1.21
10 (Highest)	Reference				



Urban == 1	1.83***	0.09	12.88	0	1.67,2.01
Age Category					
18-24	Reference				
25-34	6.57***	2.59	4.78	0	3.03,14.21
35-44	29.29***	11.16	8.86	0	13.88,61.82
45-54	81.50***	30.91	11.6	0	38.75,171.41
55-64	95.41***	36.18	12.02	0	45.38,200.61
65-74	63.69***	24.23	10.92	0	30.22,134.25
75-84	24.96***	9.66	8.31	0	11.69,53.30
85+	5.34***	2.44	3.66	0	2.18,13.10
Male == 1	1.88***	0.07	17	0	1.74,2.02
N = 1,881,939					
Notes: * p < 0.10, ** p < 0.05, *** p < 0.01					

## Appendix 4: Method for modelling alcohol-related crime relative to density of outlets

The number of crimes directly attributable to alcohol (hereinafter ‘alcohol-related crime’) were provided annually from 2012/2013 to 2022/2023 by the Police Service of Northern Ireland (PSNI) at electoral ward level (n=462 neighbourhood units). Alcohol-related crime referred to any notifiable offence (crime) where it is perceived by the victim or any other person that the effects of alcohol consumption on the offender or victim was an aggravating factor.

Alcohol crimes were classified into several categories as presented in Table A2. Given the large number of different categories and subcategories, we reclassified all the data provided into two main groups of crimes: 1) “violence against the person” and 2) “sexual offences”. Alcohol crimes from the following classes were disregarded due to low numbers: “Robbery, Burglary, theft”, “Criminal damage”, “Drug offences, possession of weapons, miscellaneous crimes against society”, “Public Order” and “Non-Recordable Offences”.

Table A2. Alcohol crime categories provided by PSNI

Crime classifications provided	Time period covered	Reclassification for analyses
Violence against the person and Sexual Offences (combined)	Each financial year 2012/13 to 2022/23	Both violence against the person and sexual offences
Violence with Injury (including homicide and death or serious injury caused by unlawful driving) <ul style="list-style-type: none"> <li>- 5D Assault with intent to cause serious harm</li> <li>- 8N assault with injury</li> </ul>	Each financial year 2012/13 to 2022/23  Five years combined, 2013/14 to 2017/18 and 2018/19 to 2022/23 Five years combined, 2013/14 to 2017/18 and 2018/19 to 2022/23	Violence against the person
Violence without injury <ul style="list-style-type: none"> <li>- 104 Assault without injury on a constable</li> <li>- 105A Assault without injury</li> </ul>	Each financial year 2012/13 to 2022/23  Five years combined, 2013/14 to 2017/18 and 2018/19 to 2022/23 Five years combined, 2013/14 to 2017/18 and 2018/19 to 2022/23	
Sexual offences	Five years combined, 2013/14 to 2017/18 and 2018/19 to 2022/23	
Robbery, Burglary, theft	Each financial year 2012/13 to 2022/23	NA
Criminal damage	Each financial year 2012/13 to 2022/23	NA
Drug offences, possession of weapons, miscellaneous crimes against society	Each financial year 2012/13 to 2022/23	NA
Public Order	Each financial year 2012/13 to 2022/23	NA
Total police recorded crime	Each financial year 2012/13 to 2022/23	NA
Non-Recordable Offences	Each financial year 2012/13 to 2022/23	NA

The number of alcohol-related crimes were grouped into five years from 2018-19 to 2022-23 within each reclassified group: 1) Violence against the person, 2) sexual offences, and 3) both violence against the person and sexual offences combined. Although the resolution of the

records provided within the “violence against the person” category could allow a more granular yearly analyses, the records within the “sexual offence” category were grouped into the mentioned five years, preventing us from conducting a yearly analysis. To maintain consistency in the analyses across categories, we grouped the number of crimes within that five-year period. Average numbers of crimes per year across the period from 2018-19 to 2022-23 were then calculated for all crime groups. We then standardised such average numbers of crime per the total number of populations within each ward (neighbourhood) and created a rate of number of alcohol crimes per 10,000 persons for each crime reclassified group.

KDE values for the health analysis were recalculated to get Ward level values using the same method for SOAs but this time averaging the Output Area values across the Wards. Data on the usual population, income deprivation and urbanicity for each Ward were downloaded from NISRA.

Usual population data from the 2021 Census for each ward was directly downloaded from NISRA. We used an ESRI shapefile of the ward’s boundaries obtained from NISRA to estimate the area of each feature as sq km within a GIS environment using ArcGIS 10.1. We estimated the population density using the data on usual population and the sq km area for each ward.

Data on income deprivation for each ward was obtained from the 2017 NI Multiple Deprivation Measures (NIMDM). The NIMDM included a specific domain to measure income deprivation, in which each ward is ranked according to their value of the proportion of the population living in households whose equivalised income is below 60 per cent of the NI median.

Data on urbanicity for each ward was downloaded by the NISRA Urban-Rural classification. The latest release of this classification was in 2015, and ward-level data were recorded under a former ward division from 1992. The latest up to date ward-level units we were using in this piece of work does not coincide or nest within the 1992 ward division. So, we needed to engineer a method to transfer Urban-Rural data recorded at smaller units, like output areas (n=5,022), to the current wards (n=462). We downloaded a file which contained a classification of each output area units into “urban” and “rural” categories according to a NISRA Settlement classification: <https://www.nisra.gov.uk/sites/nisra.gov.uk/files/publications/settlement15-guidance.pdf>. The NISRA Settlement classification classified each output area into eight bands (from A to H), including different levels of urbanicity. NISRA considered the features coded as from band A to E as “urban”, since they covered settlements with more than 5,000 inhabitants (please, see: <https://www.nisra.gov.uk/sites/nisra.gov.uk/files/publications/review-of-the-statistical-classification-and-delineation-of-settlements-march-2015%20%281%29.pdf>). Otherwise, features coded as from bands G to H were coded as “rural” (settlements with less than 5,000 inhabitants).

We used the ArcGIS 10.1 intersection tool (from the geoprocessing toolbox) to count how many either urban or rural output populated-weighted centroids were located within the boundaries of each ward. We then classified each ward entity into “urban”, “rural” or “mixed” using the information of how many output area centroids they have of each type. If a ward only accounted for “urban” or “rural” output area centroids, they were classified as “urban” or “rural”, respectively. Otherwise, if a ward entity included both urban and rural output area centroids, it was classified as “mixed”. This urban/rural/mixed reclassification method was conducted in accordance with NISRA guidelines, replicating the analysis performed by NISRA for urban-rural classification at the 1992 ward level.

We calculated descriptive tables to account for the median crime rates across different types of neighbourhoods, by alcohol outlet density quintiles, deprivation quintiles, urban/rural categories and population density quintiles.

Alcohol outlet density quintiles were formed considering all wards with 0 density (no outlets) in the first quintile, and then sort the rest of wards as quintiles.

Kruskal Wallis non-parametric tests were performed to account for significance at the 95% level.

We fitted a negative binomial regression model to account for the frequency of crime events of each type (violence against the person, sexual offences or both) across neighbourhoods with varied alcohol outlet density. Negative binomial regression models were considered to account for overdispersion in our data. We fitted different models varying the alcohol outlet density measure to account for 1) only off-licences, 2) only public houses, 3) both off-licences and public houses, 4) all on-premise alcohol outlets, and 5) all alcohol outlets. In all models, we considered the alcohol outlet density measure as a continuous variable. Similarly, all models were adjusted by neighbourhood income deprivation quintile, urban/rural status and population density.

## Appendix 5: Methods for Economic Analyses

Economic outcomes are obtained from survey data sources in which economic activity is classified according to the Standard Industrial Classification (SIC) 2007. Northern Ireland license categories are mapped to relevant SIC 5-digit industry level (the most detailed classification of economic activity possible in the SIC) and analysis is then conducted at the level of these sectors. Table A3 shows the mapping of license categories to SIC codes and the distribution of licenses across categories in 2020. 96.47% of license categories are mapped to an industrial classification code.

*Table A3. Mapping of license categories onto Standard Industrial Classification (SIC) areas of economic activity*

License categories	Licenses in 2020	%	SIC code	SIC Description
Public Houses	1224	44.82%	56302	Public houses and bars
Off-licenses	615	22.52%	47250	Retail sale of beverages in specialised stores
Hotels	159	5.82%	55100	Hotels and similar accommodation
Guest houses	30	1.10%	55200	Holiday and other short-stay accommodation
Restaurants	614	22.48%	56101	Licensed restaurants
Conference Centres	32	1.17%	NA	NA
Higher Education Institutions	21	0.77%	NA	NA
Theatre	20	0.73%	NA	NA
Racetrack	1	0.04%	NA	NA
Ballroom	0	0.00%	NA	NA
Refreshment Rooms	7	0.26%	NA	NA
Seamen's Canteens	1	0.04%	NA	NA
Non-seagoing Vessels	4	0.15%	NA	NA
Indoor Arena	1	0.04%	NA	NA
Outdoor Stadia	2	0.07%	NA	NA

### Employment

Note that this approach is identifying sectors which are relevant to the sale of alcohol. Detailed SIC codes are the most detailed way types of economic activity can be identified, but these sectors may contain firms which do not sell alcohol, and the importance of alcohol across the sectors will be variable. The detail is not available in the survey data underlying these analyses to specifically identify alcohol-attributable employment/turnover. The results presented here should therefore be interpreted as the total economic impact of sectors which are relevant to the sale of alcohol, rather than a direct economic impact of the sale of alcohol specifically.

Employment data are obtained from the Office for National Statistics (ONS) via the [nomis](#) service, which provide aggregated data from large survey datasets maintained by ONS and the Northern

Ireland Statistics and Research Agency (NISRA). Employment data are obtained for the years 2010 to 2022 for the five sectors identified in Figure 13 in the main report.

The employment data are provided as the number of local units in each of nine size bands, with the number of local units in each employment size band rounded to the nearest five to avoid disclosure issues. A local unit is a statistical unit within an enterprise, defined as the individual site situated in a geographically identified place. One enterprise can consist of multiple local units. There are nine employment size bands for which the number of local units are reported:

- 0 to 4 (micro)
- 5 to 9 (micro)
- 10 to 19 (small)
- 20 to 49 (small)
- 50 to 99 (medium-sized)
- 100 to 249 (medium-sized)
- 250 to 499 (large)
- 500 to 999 (large)
- 1000 or more (large)

As we do not have individual firm level data from which to calculate total employment, we construct an estimate of total employment from the categorised data. To do so we fit a parametric distribution to the data separately for each year and sector, and then use the estimated parameters of the fitted distribution to calculate the mean employment.

There are several potential distributions which can be used to model employment data. Appropriate distributions to use for modelling employment are distributions constrained to positive values only (as employment cannot be negative) and are non-symmetric (i.e. allow for outliers - small numbers of firms which are particularly large employers). Commonly used statistical distributions which have these properties are the exponential, lognormal, gamma, and Weibull distributions. Each of these distributions are applied to the employment data, and the Akaike Information Criterion (AIC) is used to select the distribution which best fits the data.

Estimated separately for each sector and year, the gamma distribution is most often found to be the best fitting distribution, and so this distribution is selected. Multiplying the total number of firms by the mean employment per firm calculated from the estimated gamma distribution parameters gives our estimate of total employment for the respective sector each year.

## Turnover

Turnover data is available as the number of enterprises in each of 10 turnover size bands (measured annually in thousands of pounds):

- £0 to 49
- £50 to £99
- £100 to £199
- £200 to £499
- £500 to £999
- £1,000 to £1,999
- £2,000 to £4,999
- £5,000 to £9,999
- £10,000 to £49,999
- £50,000+

Total turnover is estimated using the same methods as for employment - assuming a parametric distribution for turnover, estimating the parameters of the distribution, and using the estimated parameters of the distribution to calculate mean turnover which is multiplied by the number of enterprises to give a total. For turnover, the same process of model selection is used as for the employment distributions. In this case, the lognormal distribution is selected.

## Limitations to the analysis

There are several limitations to this analysis and caveats which must be considered when modelling employment and turnover this way. Modelling of the employment and turnover distributions introduces statistical uncertainty into the estimates of the parameters. This uncertainty is addressed using Monte-Carlo simulation methods which are discussed in further detail below.

The grouped data used for the modelling also produces uncertainty in the form of open-ended top categories. When there are outliers in the data (small numbers of firms with particularly large employment or turnover), results will be particularly sensitive to the choice of distribution used in the modelling and the extent to which the statistical model chosen can accurately model the tail of the distribution, where data is sparse. This could lead to conservative estimates of turnover and employment, if the statistical model chosen fits the tail of the distribution poorly.

It is also the case that modelling the distributions from these grouped data will likely provide conservative estimates of changes over time in employment and turnover, as movements in the distribution will only be picked up to the extent that firms cross the thresholds listed above, e.g. a firm with £49 million turnover one year could then report £10 million of turnover in the following year, but would be grouped in the same turnover category despite turnover declining by almost 80%.

Another limitation to the analysis is the impact of the Covid-19 pandemic. The main results of our analysis show no significant fall in turnover during the pandemic for on-trade sectors, as would be expected. Limitations in the data and methodology make large changes due to the pandemic difficult to model. Firstly, there may be lags in the reporting of turnover in the underlying survey data. Secondly, as discussed above, the grouped data on which the statistical modelling of the distribution of turnover is based can lead to conservative estimates of changes over time, even when those changes are proportionately large. Thirdly, the impact of the pandemic on the shape of the turnover distribution may be such that the statistical models chosen are a poorer fit to the data during this period and do not adequately capture the change in average turnover as a result.

## Hours and earnings

Information on hours and earnings is obtained from the Labour Force Survey (LFS). The LFS is a quarterly-conducted survey of a representative sample of UK households which collects detailed demographic and labour market information about the respondents. This analysis uses the quarterly LFS files from January-March 2010 to October-December 2022 (52 quarters in total). The key variables used in the analysis are:

- **Usual hours.** Hours usually worked by the respondent in a typical working week.
- **Hourly wage.** Average hourly wage. Calculated by dividing gross weekly earnings in the week the respondent was surveyed by usual weekly hours.
- **Full time status.** Self-reported binary variable indicating whether a full-time or part-time worker.
- **SIC-2007 code.** The 4-digit standard industrial classification (SIC) code identifying the sector of employment.



Note that some of the sectors included in our analysis of employment and turnover are 5-digit SIC industries, but the LFS data only contains SIC codes at the 4-digit level. Where this is the case, we assume the average hours and earnings within a 5-digit SIC industry are equal to that of the parent 4-digit industry. For example, where we analysed SIC industry **56101 Licensed Restaurants** for employment and turnover, we here analyse hours and earnings for 5610 Restaurants and mobile food service activities and use these as a proxy for the hours and earnings of **56101 Licensed Restaurants**.

As the Labour Force Survey is a UK wide survey, the quarterly data files contain only very small numbers of observations when the data are filtered to employed individuals working in the alcohol sectors in Northern Ireland. This small sample issue is a particularly acute problem with earnings data, which are only provided by those in waves 1 and 5 of the 5 waves of respondents surveyed in each quarter.

As there are insufficient observations for an analysis of changes over time in the Northern Ireland subset of the data for the specific industries we analyse, the quarterly datasets are pooled together. This produces 4,624 observations of individuals who are employed or self-employed in Northern Ireland in the SIC industries of interest for analysis. All statistics presented from the LFS data are calculated as averages over the full 2010-2022 period. Earnings data are adjusted for inflation to January 2022 prices using the consumer price index (CPI) measure of inflation. All estimates are weighted using the LFS sample weights to ensure estimates are representative of the population.

## Statistical uncertainty

As the methods for analysing the nomis employment and turnover data relies on the estimation of distribution parameters, the employment and turnover totals presented here are subject to statistical uncertainty around the estimates of those parameters.

To assess the impact of this uncertainty on the conclusions, a Monte-Carlo simulation approach was taken. It is assumed that each distribution parameter which is estimated with uncertainty is normally distributed with a mean equal to the point estimate of the parameter and a standard deviation equal to the standard error of the point estimate.

Using this assumption of normality, a random value is drawn for each of the two parameters of the gamma distribution used to model the distributions of turnover and employment. From these simulated distributions, the mean and total employment/turnover are calculated for each sector and year. This process is repeated 1,000 times to produce 1,000 different estimates of total employment and turnover which reflect the range of possible figures for mean and total employment and turnover. The uncertainty around the total employment estimate is then represented as a 95% confidence interval calculated as  $m \pm 1.96 * s$ , where  $m$  is the mean of the simulated total employment/turnover and  $s$  is the standard deviation.

Figures A4 and A5 present the time series of employment and turnover (respectively) for each sector, showing the confidence intervals. For employment, the 95% confidence intervals in every sector are too wide to conclude that any of the observed changes over time are statistically significant, except for public houses and bars in which employment is significantly lower in 2022 than it was in 2010. The “Holiday and other short stay accommodation” sector is subject to a large degree of uncertainty.

In the case of turnover, the changes between 2010 and 2022 are statistically significant in each sector except “Retail sale of beverages in specialised stores”. For those sectors which exhibited a noticeable decline in turnover during the Covid-19 period (restaurants, public houses and bars, and hotels), the Covid-era declines are also statistically significant.



## Appendix 6. Stakeholder and community perspectives: data gathering and analysis

We first explain the sampling process of selecting eight diverse communities in Northern Ireland. We then go on to discuss the methods of data gathering and analysis of the community visits, which consisted of scoping of licensed premises, interviews with national and local stakeholders and focus groups with local community members.

Ethics approval was obtained by the General University Ethics Panel (Approval No. 1015).

### Sampling of case study communities

Using data collected for the 2021 Register of licences, we split the NI District Electoral Areas into quartiles by outlet density (on-licences per 10k population). For each DEA, key SES data was gathered from the associated NISRA District Electoral Area (2014) Information page (e.g. [Lisburn South](#)). Selected data were proportion of homes owner-occupied; proportion of population educated to degree level; and proportion of population in paid employment. DEAs were split into quartiles for each of these indicators and assigned a rank (Q1-4). DEAs were given an overall SES ranking based on the combination of the separate SES indicator rankings. The religious characteristics of each DEA were also recorded (proportion Catholic / Protestant).

Based on this data a long list of 18 DEAs was selected, which also incorporated a representative range of settlement sizes, crosschecked against the NISRA 2015 classification of Settlements (2xA; 1xB; 2xC; 4xD; 5xE; 4xF). The selection also ensured a range of three further indicators: coastal; inland; border. DEAs selected for the longlist were further assessed for socioeconomic indicators using NISRA data. The long list was discussed with the research team and the project reference group, and agreement was reached on a final selection of eight target areas that were considered to provide a reasonable representation of community types.

It is important to note that before the start of data collection, members of the research team visited each community to get a feel for the residential and retail areas and the location, distribution and nature of licensed premises in each area and visiting premises. This enabled us to build up a clear profile of the community and gain insights into the patterns and dynamics of the licensed trade in each area.

### Scoping of licensed premises

In total, we visited over 60 licensed premises and completed 20 informal interviews across the case study communities.

Scoping of licensed premises took place during daylight hours (between 9am and 3pm) for safety of the research team. We visited a diverse spread of smaller and larger venues, as well as food focussed establishments and more traditional drinking focussed establishments. When visiting premises, we asked to speak to the owner of the premises. If they were unavailable, we asked to speak to the employee themselves.

The interviews were informal and unstructured, as they were not guided by a topic guide. The conversations took place at a table in the premises away from other customers. We asked general questions about the nighttime economy in that area, their experiences of the trade and current challenges, and their views on the licensing system. Brief notes of the conversations were taken discreetly either during or after the conversations, and then written up in full afterwards, or the next day.

The fieldnotes included a visual assessment of the location and setting (is the venue close to other retail outlets and / or licensed premises? Is the area primarily residential?); amenity (What is the physical condition of the surrounding area? Are there obvious signs of deprivation (closed shops, street homelessness etc.)? Is there significant litter?); indicators of community affiliation (Are there flags, painted kerbstones, murals or other obvious signs of community religious / political affiliation near the location?); type of venue – off-licence (Is it an independent or part of a franchise? Is it within a supermarket? Does it sell other groceries?); type of venue - public house (is it in a ‘traditional’ style or a modern bar? Does it have multiple rooms? Does it appear to be ‘wet-led’, or does it have a prominent food offer?).

## Stakeholder interviews

In total, we completed 47 interviews with national and local stakeholders, of which 31 were formal (recorded) and 16 were informal (written as fieldnotes) (see Table A4).

National and local stakeholders were required to sign an informed consent form in order to take part in the formal interviews. Semi-structured one-to-one interviews were carried out either in person or online, as preferred by the stakeholder.

*Table A4: Stakeholder interviews (National stakeholders are No. 1-14; local stakeholders are No. 15-31)*

<b>Interview number</b>	<b>Stakeholder category</b>
1.	On-trade
2.	Producer
3.	Licensing Stakeholder (Private Sector)
4.	Licensing Stakeholder (Private Sector)
5.	Licensing Stakeholder (Private Sector)
6.	Health
7.	Health
8.	Trade (Other)
9.	Off-trade
10.	Police
11.	Police
12.	Police
13.	Politician
14.	Licensing Stakeholder
15.	Producer
16.	On-trade
17.	Police
18.	Police
19.	Politician
20.	Health
21.	Health
22.	Health
23.	Licensing Stakeholder (Public Sector)
24.	Politician
25.	Licensing Stakeholder (Public Sector)
26.	Police

27.	Police
28.	Politician
29.	Politician
30.	Trade (Other)
31.	Politician

### **National stakeholders**

National stakeholders represented a mix of the retail trade, regulation, policy, enforcement, journalism and health. We carried out initial desk research to identify the key umbrella organisations representing these sectors in Northern Ireland. From this, and with initial support from the DfC to identify individuals within those organisations, we drew up a list of eight individuals to form the project reference group. These represented key Government departments, retail, production, health, licensing law and public health. Informal discussions were carried out with reference group members and further advice sought as to possible targets for national stakeholder interviews.

From this we developed a long list of 30 possible interviewees. The research team considered the options against a simple decision matrix, seeking to include representation of the key sectors identified in the proposal. We also added a consumer group in order to ensure the views of consumers were included. We were conscious that trade and consumer groups especially held strong, often publicly expressed, views on licensing and the surrender principle in particular. We ensured that no public view on the surrender principle was over-represented in our interview sample.

The topic guide for national stakeholders was tailored to each stakeholder, but generally covered the following topics: General views of the licensing system; Implementation of the current system; View on the surrender principle; Views on opening hours; and Alcohol supply and market dynamics.

### **Local stakeholders**

Local stakeholders included individuals who have a direct knowledge or role in the licensing system in that case study community. Purposive sampling included on-trade licensees (including pubs, restaurants, other), off-trade licensees (diverse in size), local police, local health or treatment service providers, and local elected representatives.

For recruitment, a member of the research team sent out an email invitation that gave an overview of the review and information about their participation in the study. Contact details for local stakeholders were found from a desk-based search. If emails could not be found, local stakeholders were contacted by telephone. Once contact had been returned by email or phone, a member of the research team then sent out an information sheet with further details of the study. If stakeholders agreed to take part in an interview, we arranged a date and time to meet, either in person during the community visits, or online via Microsoft Teams.

The topics guide for local stakeholders was tailored to each stakeholder, but generally covered the following topics: Role and knowledge of the community; How alcohol affects this community; Where people buy alcohol in this community; Positive impacts of the number and range of premises that sell alcohol; Negative impacts of the number and range of premises that sell alcohol; Are there too many/too few/just the right number of premises that sell alcohol (shops/pubs/late-night premises/community clubs); Premises opening hours/closing times; and General views on the licensing system set-up and priorities including surrender principle and objections.

## Focus groups

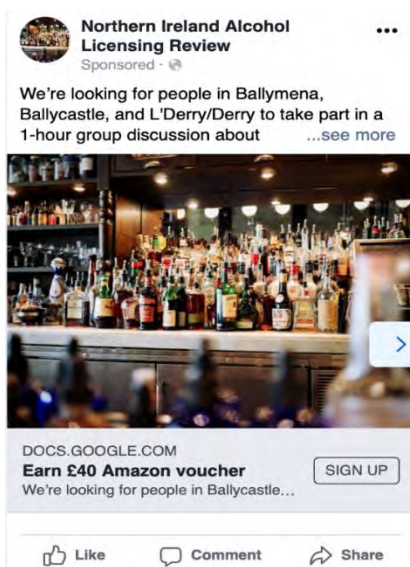
In total, we completed 11 focus groups with 101 participants aged 18 and over (57 male; 33 female) (see Table A5). Most participants who took part were aged between 36-55 years, with the fewest aged between 18-25 years. Participants were eligible to take part so long as they were not directly involved with licensed premises.

Table A5: Breakdown of focus groups (attendance per community/stakeholder)

Focus group number	Focus group area	Attendance
1	Enniskillen	5
2	Belfast	10
3	Belfast	8
4	Belfast	7
5	Carryduff	12
6	Ballycastle	8
7	Ballymena	12
8	Ballymena	8
9	Derry	9
10	Derry	11
Focus group number	Stakeholder type	Attendance
11	On-trade	11

The groups were advertised using online and on-the-ground methods. Facebook adverts were created for each case study community that targeted men or women over 18 years who work or live in the case study community (see Figure A6). Interested participants were then directed to a sign-up form via Google docs where contact details were provided and accessible only to the research team. All participants who had signed up were then notified by email with the address of the venue that was being used for hosting the focus groups. Participation included an incentive (£40 Amazon gift voucher) which was emailed to all participants after the group discussion.

Figure A6: Example Facebook advert for focus group recruitment





A member of the research team also handed out flyers (see Figure A7) in some of the case study communities, with permission from local councils. The A5-sized flyer was created by a trusted professional graphic designer. The flyer had similar information to that of the Facebook advert, but with the addition of a QR code, which took interested people directly to the Google doc sign-up form.

Figure A7: Example flyer for focus group recruitment

**EARN £40  
AMAZON  
VOUCHER**  
FOR 1 HOUR CHAT  
ABOUT BARS  
IN YOUR AREA

We're looking for people in Carryduff, Belfast Botanic and Belfast Titanic to take part in a 1-hour group discussion about where and how alcohol is sold in your neighbourhood (shops, bars, clubs etc.). Everyone is welcome who lives or works in the community! Please pass on to your friends / family / colleagues (over 18s only).

These focus groups are being organised by the University of Stirling to allow members of the public to have their say in a review of Northern Ireland's alcohol licensing system.

**WE'LL BE DOING IN-PERSON GROUPS WITH TEA / COFFEE / SANDWICHES / SNACKS AS FOLLOWS:**

- Belfast Botanic from 5.30pm on Wednesday evening 18th October
- Belfast Titanic from 4.00pm on Thursday evening 19th October
- Carryduff from 5.30pm on Friday evening 20th October

If you can make these dates, or if you would be interested in taking part in a separate online session, scan the QR code, or contact:

**JORDAN MACLEAN**  
07961072867 Jordan.maclean1@stir.ac.uk

**UNIVERSITY of STIRLING**

**FAQS**

Any other questions, please email:  
Jordan.maclean1@stir.ac.uk

**WHO IS CONDUCTING THE GROUPS?**  
The groups will be facilitated by two researchers based at the University of Stirling, Niamh Fitzgerald and Jordan Maclean. The discussions will form part of an independent review of alcohol licensing system in Northern Ireland. The University of Stirling is leading this review.

**WHERE WILL THEY BE HELD?**  
In neutral community venues - details will be provided along with more information if you fill out the form below.

**WHAT'S INVOLVED?**  
You'll join a group of about 8 people to discuss your thoughts. Niamh and Jordan will take you through some simple questions, but it's mostly a chance for you to say what you think.

**I DON'T DRINK ALCOHOL, CAN I STILL TAKE PART?**  
Yes, as long as you are over 18 years old.

**WHAT QUESTIONS WILL BE ASKED?**  
We'll ask things like where people drink in the community, what kinds of premises there are selling alcohol, what you think of the premises, as well as your views on the need for more or less places that sell alcohol.

**WILL I BE IDENTIFIED?**  
No. All participants will be anonymous in the reporting of the review.

**WILL THERE BE SNACKS?**  
Yes! We'll provide tea, coffee, sandwiches and biscuits/snacks.

**HOW DO I GET PAID?**  
We'll pass on Amazon gift vouchers by email within 24 hours of taking part.

**UNIVERSITY of STIRLING**

Focus groups were held in a central location in a quiet room. These were recommended to us by stakeholder interviewees or were found from a desk search of local organisations prior to each visit. Neutral venues were chosen which ranged from local sport and leisure centres, and further education colleges. A member of the research team contacted venues in each community and booked them for the date and times required. Before the focus groups, all participants were contacted to confirm their attendance. As participants arrived at each venue, one member of the research team read through the information sheet about the review, while the participants were asked to sign a written consent to participate in the focus groups. Refreshments were also provided.

Two members of the research team facilitated each group discussion. The semi-structured topic guide consisted of several activities. The first was a mapping activity where printed maps of the case study community were given to the group. A member of the research team used Google Maps to show the distribution of licensed premises (e.g., shops, bars/pubs, late-night premises, restaurants, hotels, cinemas) using different coloured pins. The group was asked to comment on the spread and number of premises, whether they recognised any of them and any changes over time. Then we asked them whether they thought there were too many, too few, or just the right amount of certain types of premises in their community. Related to this, we asked them to consider: positive/negative impacts of premises on the community; whether there's a demand for certain premises types or more of a certain type? (think about what drinks they serve or what kind of people drink there – is there a demand for anything different?); and whether there are too many premises of a similar type/or too many close together?



We then moved onto discuss some technicalities of the system. We first discussed the amendment to later closing times and asked whether they had noticed any changes in this area and if they thought premises closed too early, too late, or just about the right time. We then briefly introduced the surrender principle and compared it to the rest of the UK, and then asked for their thoughts on it. We then asked what they thought the purpose or objectives of a licensing system should be and gave some examples of how objectives are used in Scotland and England/Wales. Then we had a discussion on the granting of licences and compared Northern Ireland's system for licensing through the local county courts to that of Scotland and England/Wales which is administered through the local councils.

## Analysis

The stakeholder interviews were audio recorded on either Microsoft Teams if the interview was online, or on a Sony ICD-PX240 digital Dictaphone if it took place in person. The focus groups were recorded using a Blue Yeti microphone and saved directly on a work laptop. The recorded files were uploaded onto a confidential folder on SharePoint that was only accessible to the research team. The audio recordings were then sent to a trusted transcription company who transcribed verbatim. Once the transcripts were returned, members of the research team checked the transcripts for accuracy.

A coding framework was developed based on the topic guides and the aims and background of the review. A long list of codes was produced, and the team then worked together to shorten this into a more concentrated list of codes. Initial codes were discussed and combined into a draft coding framework which was tested on a sample of transcripts (n=3). All transcripts were then uploaded onto NVivo 20 and coded by two members of the research team, who met regularly during coding to discuss and challenges or concerns. They also kept a live codebook on SharePoint, where codes were refined and checked by other members of the research team. Although the transcripts being coded came from two separate parts of the project – stakeholder interviews and focus groups – which each had their own interview guide, the questions were broadly similar, focussing for example on the current distribution of licenses in the local area, which allowed us to code them using the same coding framework. However, there were instances where certain groups could speak more to certain elements of the interview guide than others, for example licensing officers could speak to the technical details of the licensing system, whereas focus group participants were less able to do so.

Once all transcripts had been coded, the codes were extracted into separate files for analysis. Two members of the research team deductively developed themes based on the structure of the report. Another member of the team gathered verbatim quotes from the extracted codes that fit within each of the themes. A few quotes were selected to represent each theme, and these were presented at an international conference on alcohol policy. The themes were then refined in discussion with another member of the research team. The transcription of the verbatim quotes in the report was based on standard orthography and punctuation, with the omission of intonation and interruptions to promote ease of readability. For short segments of text, less than a line, the transcription flowed with the rest of the text, whereas for longer exchanges, two lines or more, the transcription was separated and indented from the text.

As the informal conversations with owners or employees of licensed premises were not recorded, we did not quote those participants directly, but rather mentioned general points in relation to the themes of the report. The fieldnotes from the scoping of licensed premises were not used directly in the report but supplemented our understanding of the codes and themes recorded in the national and local interviews and focus groups.

## Appendix 7: Review of International Licensing Systems with Availability Caps

Table A6: The type of approach used to limit alcohol retail licences by jurisdictions in North America

State / Province	Limit proximity to other locations	Government alcohol monopoly	Limit rate per population	Dry areas (prohibition)	Limit absolute number	Limit by geographic area	Total number of approaches
<b>American States</b>							
Alabama	X	X		X			3
Alaska	X		X	X			3
Arizona	X		X				2
Arkansas	X		X	X			3
California	X		X				2
Colorado	X						1
Connecticut			X				1
Delaware	X						1
Florida	X		X	X			3
Georgia	X			X			2
Hawaii	X						1
Idaho	X	X	X				3
Illinois	X						1
Indiana			X				1
Iowa		X				X	2
Kansas	X			X			2
Kentucky			X	X			2
Louisiana	X						1
Maine	X	X			X		3
Maryland	X	X	X		X	X	5
Massachusetts	X		X	X			3
Michigan	X	X	X	X			4

State / Province	Limit proximity to other locations	Government alcohol monopoly	Limit rate per population	Dry areas (prohibition)	Limit absolute number	Limit by geographic area	Total number of approaches
Minnesota	X		X	X			3
Mississippi	X	X		X			3
Missouri	X						1
Montana	X	X	X	X			4
Nebraska	X						1
Nevada							0
New Hampshire	X	X		X			3
New Jersey	X		X	X			3
New Mexico	X		X				2
New York	X			X			2
North Carolina	X	X		X			3
North Dakota							0
Ohio	X	X	X	X			4
Oklahoma							0
Oregon		X	X				2
Pennsylvania	X	X	X	X			4
Rhode Island	X		X				2
South Carolina	X						1
South Dakota			X	X			2
Tennessee	X		X	X			3
Texas	X			X			2
Utah		X	X				2
Vermont		X		X			2
Virginia		X					1
Washington	X		X		X		3
West Virginia	X	X		X		X	4
Wisconsin	X		X	X			3

State / Province	Limit proximity to other locations	Government alcohol monopoly	Limit rate per population	Dry areas (prohibition)	Limit absolute number	Limit by geographic area	Total number of approaches
Wyoming		X	X				2
<b>Canadian Provinces</b>							
Alberta	X	X		X			3
British Columbia	X	X			X		3
Manitoba		X			X		2
New Brunswick		X					1
Newfoundland & Labrador	X	X		X			3
Northwest Territories		X		X			2
Nova Scotia	X	X					2
Nunavut		X		X			2
Ontario		X		X	X		3
Prince Edward Island		X					1
Quebec		X					1
Saskatchewan		X	X				2
Yukon	X	X	X	X			4
<b>Total n (%)</b>	<b>42 (66.7)</b>	<b>31 (49.2)</b>	<b>28 (44.4)</b>	<b>30 (47.6)</b>	<b>6 (9.5)</b>	<b>3 (4.8)</b>	<b>-</b>

Table A7: An overview of approaches to limiting alcohol retail availability in jurisdictions in North America. References to legislation are given in Table A8.

Jurisdiction	Setting and product with controls	Description of legislation
<b>Limit the rate of alcohol retail licences per population</b>		
Alaska	On-sale spirits, wine, beer	Restaurant or eating place licences permit beer and wine to be sold for consumption on-site in places where 50% or more of sales are derived from food and are issued at a rate of 1 per 1,500 population. Other on-sales licences are generally issued at a rate of 1 per 3,000 population. This includes a pub licence which allows the sale of beer or wine at outlets located on a college or university campus, a recreational licence which permits the sale of beer or wine one hour before and after a recreational event, and a beverage dispensary licence which permits the sale of spirits, wine, and beer for consumption on-site
	Off-sale spirits, wine, beer	Package store licences (liquor store) allows the holder to sell any kind of alcoholic beverages (spirits, beer, wine) for consumption off-site and are generally issued at a rate of 1 per 3,000 population
Arizona	On-sale spirits, wine, beer	Bars (selling spirits, wine, and beer) or beer and wine bar licences are issued at a rate of 1 per 10,000 population increase
	Off-sale spirits, wine, beer	Liquor store licences are issued at a rate of 1 per 10,000 population increase
Arkansas	Off-sale spirits, wine, beer	Off-sales liquor store licences are limited to a rate of 1 per 7,500 population
California	On-sale spirits, wine, beer	On-sale general licences are limited to a rate of 1 per 2,000 population
	Off-sale spirits, wine, beer	Off-sale general licences are limited to a rate of 1 per 2,500 population and off-sale beer and wine licences are limited to a rate of 1 per 2,500 population. Off-sale beer and wine licences in combination with off-sale general licences may not exceed a rate of 1 per 1,250 population
Connecticut	Off-sale spirits, wine, beer	Package store permits are limited to a rate of 1 per 2,500 population. A package store permit allows the retail sale of all types of alcohol for consumption off-site
Florida	On-sale spirits	There are no restrictions to the number of licences to sell beer and wine, however on-sale licences to sell spirits are limited to 1 per 7,500 population. This excludes restaurants/eateries where 50% or more of gross sales are from food or large hotels
	Off-sale spirits	There are no restrictions to the number of licences to sell beer and wine, however off-sale licences to sell spirits are limited to 1 per 7,500 population
Idaho (control state)	On-sale spirits	Spirits are only sold in state-operated stores and contract retail stores. Licences to sell spirits by the drink are limited to a rate of 1 per 1,500 population. Sales of spirits by the drink are banned in Franklin and Madison counties
Indiana	On-sale spirits, wine, beer	On-sale three-way permits (permitting the sale of spirits, wine, and beer) are limited to a rate of 1 per 1,500 population
	On-sales wine, beer	On-sale two-way permits (permitting the sale of wine and beer) are limited to a rate of 1 per 1,500 population

Jurisdiction	Setting and product with controls	Description of legislation
	On-sales beer	On-sale one-way permits (permitting the sale of beer) are limited to a rate of 1 per 1,500 population
	Off-sales beer	Off-sale beer permits are limited to a rate of 1 per 2,000 population in populations <15,001; in populations between 15,001-80,000 the permitted rate is 1 per 3,500 population; in populations larger than 80,000 the permitted rate is 1 per 6,000 population
	Off-sale spirits, wine	Off-sales liquor permits are limited to a rate of 1 per 2,000 population in populations <15,001; in populations between 15,001-80,000 the permitted rate is 1 per 3,500 population; in populations larger than 80,000 the permitted rate is 1 per 6,000 population
Kentucky	Off-sale spirits	In cities with a population greater than 100,000, retail package licences which permit the sale of spirits off-site are limited to a rate of 1 per 1,500 population. In all other cities, the permitted rate is 1 per 2,300 population
Maryland (control state)	Off-sale spirits, wine, beer	A permitted rate is not set at State-level, however there is legislation for municipalities within the State. For example, in Allegany County, Class A licences cannot exceed a rate of 1 per 1,300 population (with no more than two licences of any type issued each year) and in Carroll County, the equivalent permitted rate cannot exceed 1 per 5,000 population. In Charles County, off-sale licences may not exceed a rate of 1 per 3,500 population. In Frederick County there may be 1 licence per 4,000 population of the following: off-sales beer licences, off-sales beer and wine licences, and off-sale beer, wine, and spirits licences. In Harford County, there may be 1 licence per 3,000 population of the following: off-sales beer licences, off-sales beer and wine licence, and off-sale beer, wine, and spirits licence. In Howard County, the aggregate rate of off-licences selling beer, beer and wine, and beer, wine and spirits may not exceed 1 per 4,000 population. In St Mary's, there can be no more than 1 Class A licence per 1,350 population
	On- or off sale spirits, wine, beer	In Allegany County, Class D licences cannot exceed a rate of 1 per 1,300 population no more than two licences of any type can be issued each year. In Cecil County, the aggregate rate for all licences may not exceed 1 per 400 (excludes restaurants and hotels). In Washington County, the permitted rate for all licence types is 1 per 3,000 population
Massachusetts	On-sale spirits, wine, beer	On-sale licences are limited to a rate of 1 per 1,000 population up to a population of 25,000 and thereafter a rate of 1 per 10,000 population
	Off-sale spirits, wine, beer	Off-sales licences are limited to 1 per 5,000 population
Michigan (control state)	On-sale spirits, wine, beer	The state controls spirits at wholesale-level. Public licences for the sale of alcoholic liquor for consumption on-site should not be issued if it would result in more than 1 licence per 1,500 of population or major fraction of 1,500 population
	Off-sale spirits, wine, beer	The state controls spirits at wholesale-level. In cities, incorporated villages, or townships, the commission shall issue only 1 specially designated merchant license for each 1,000 of population, or fraction of 1,000
Minnesota	Off-sale spirits, wine, beer	No off-sale intoxicating liquor license may be issued in any city at a rate of more than 1 per 5,000 population

Jurisdiction	Setting and product with controls	Description of legislation
	On-sale spirits, wine, beer	In cities with a population <500, a maximum of three licenses; in cities with a population between 500-2,500, a maximum of four licenses; in cities with a maximum population between 2,500 to 5,000, a maximum of five licences, in cities with a population of between 5-10,000, not more than six licences, in cities with a population between 10,001-20,000, a maximum of 12 licences; in cities with a population between 20,001 to 45,000, a maximum of 18 licenses. Above that, there is a rate of 1 per 1,500 population up to 200 licences. Clubs, theatres, wine establishments, hotels and bowling alleys are exempt
Montana (control state)	On-sale wine, beer	In populations <500, one retail wine and beer licence is permitted. In areas with more than 500 inhabitants and not more than 2,000 inhabitants, one retail beer and wine license is permitted for every 500 inhabitants. In local areas of more than 2,000 inhabitants, four retail beer and wine licenses for the first 2,000 inhabitants, two additional retail beer and wine licenses for the next 2,000 inhabitants or major fraction of 2,000 inhabitants, and one additional retail beer and wine license for each additional 2,000 inhabitants
	Off-sale spirits	Spirits can only be sold by state agency stores. There may be 1 agency liquor store in a population of up to 12,000, above which, there may be one agency liquor store per 40,000 population
New Jersey	On- or off-sale spirits, wine, beer	No new Class C retailer licences (permitted to sell spirits, wine, or beer, in on- or off-sales settings) can be issued until the rate is fewer than 1 per 3,000 population
New Mexico	On- or off-sale spirits, wine, beer	The maximum number of retail licenses to be issued is 1 per 2,000 population
Ohio (control state)	Off-sale spirits, wine, beer	Class C licences (permitted to sell spirits, wine, and beer in off-sales settings) are issued at a rate of 1 per 1,000 population
	On-sale spirits, wine, beer	Class D licences (permitted to sell spirits, wine, and beer in on-sales settings) are issued at a rate of 1 per 1,000 population
	Off-sale spirits, wine, beer	Five state liquor stores or agencies may be established in each county. One additional store may be established in any county per 20,000 population above the first 40,000 population
Oregon (control state)	Off-sale spirits	Spirits are sold in retail stores operated and managed by state-approved agents. Grocery and convenience stores with a retail sales licence to sell spirits are limited to 1 per 15,000 population (this quota does not include grocery or retail stores which only sell beer or wine)
Pennsylvania (control state)	On-sale spirits, wine, beer	Generally, on-sales outlets are limited to a rate of 1 per 3,000 population. This includes restaurants, bars, taverns, eating places and clubs
	Off-sale spirits, wine, beer	Generally, off-sales outlets are limited to a rate of 1 per 3,000 population
Rhode Island	On-sale spirits, wine, beer	Class C retail licences which permit sales of spirits, wine, and beer to be consumed on-site and do not require the sale of food are limited to a rate of 1 per 1,000 population



Jurisdiction	Setting and product with controls	Description of legislation
	Off-sale spirits, wine, beer	Class A retail licences which permit sales of spirits, wine, and beer to be consumed off-site are limited to a rate of 1 per 6,000 population in populations larger than 20,000 and 1 per 4,000 population in populations smaller than 20,000
Saskatchewan (control state)	Off-sale spirits, wine, beer	Limits on number of retail store permits as follows: 0-499 population: 0 stores; 500-1,000 population: 1 store; 1,001-2,500 population: 2 stores; 2,501-5,000 population: 3 stores; 5,001-10,000 population: 4 stores; 10,001-15,000 population: 5 stores; 15,001-20,000 population: 6 stores; thereafter, a maximum rate of 1 per 7,500 population
South Dakota	Off-sale spirits, wine, beer	In populations <1,000 there can be a maximum of 2 licences, above which the permitted rate is 1 per 1,500 population
	On-sale spirits, wine, beer	In populations <1,000 there can be a maximum of 3 licences, above which the permitted rate is 1 per 1,500 population
Tennessee	On- or off-sale spirits, wine, beer	No more than one licence may be issued per 8,000 population
Utah (control state)	On-sale sprits, wine, beer	Restaurant licences that can sell spirits, wine, and beer are limited to a rate of 1 per 4,467 population
	On-sale, wine, beer	Restaurant licences that can sell wine and beer are limited to a rate of 1 per 6,817 population
	On-sale beer	Bars that sell beer for consumption on-site are limited to a rate of 1 per 10,200 population
	On-sale beer	Taverns that sell beer for consumption on-site are limited to a rate of 1 per 73,666 population
	Off-sale spirits and wine	Spirits and wine and beers stronger than 5% ABV can only be sold in state-owned stores and package agencies. State liquor stores that sell spirits and wine are limited to a rate of 1 per 48,000 population. Package agency stores that sell spirits and wine are limited to a rate of 1 per 18,000 population
Washington	On-sale spirits, beer, wine	The combined total number of spirits, beer, and wine nightclub licenses, and spirits, beer, and wine restaurant licenses (excluding private club licenses) shall not exceed a rate of 1 per 1,200 population
Wisconsin	On-sale spirits, wine, beer and off-sale wine and sealed spirits	Broadly interpreted to be issued at a rate of 1 per 500 population
Wyoming (control state)	Off-sale spirits, wine, beer	The number of retail licences issued is based on the following: a maximum of 2 licences in a population of <500, above which there can be 1 additional licence for each additional 500 population up to a population of 9,500. Over 9,500 population, the rate changes to 1 per 3,000 population
	On-sale spirits, wine, beer	The number of retail licences for restaurants in cities and towns is limited to a maximum of 2 in populations smaller than 7,500 people, 6 in populations between 501 and 20,000, 10 in populations between 20,001 and 30,000. Over 30,000 population, a rate is applied of 1 per 7,500 population
Yukon (control state)	Off-sale spirits, wine, beer	When considering an licence application for an off-sales outlet, the board will consider density targets for each area. In guidance, the specified rate is 1 per 1,000 population
<b>Limit the absolute number of alcohol retail licences</b>		

Jurisdiction	Setting and product with controls	Description of legislation
British Columbia (control state)	Off-sale, spirits, wine, beer	Moratorium on new licensee retail stores until July 1 2032
	Off-sale wine	Moratorium on new wine store licences (in perpetuity) meaning no new licences can be issued
Maine (control state)	Off-sale spirits	There is a limit on the number of agency liquor stores (the only outlets permitted to sell spirits) within different population bands as follows: in populations <=2,000 a maximum of one licence, increases to three for populations thereafter up to 5,000, then four for populations up to 10,000, then six for populations up to 15,000, then seven for populations up to 20,000, then eight for populations up to 20,000, then nine for populations up to 30,000, then 10 for populations up to 45,000, then 11 for populations up to 60,000, then for populations over 60,000, a maximum of 12 licences
Manitoba (control state)	Off-sale wine	Legislation states that a maximum of eight specialty wine stores are authorized to operate in Manitoba to sell wine and wine-based products
Maryland (control state)	On- and off-sale spirits, wine, beer	A permitted number is not set at state-level, however there is legislation for municipalities within the state. For example, in Allegany County, there may be no more than 60 Class C licences (clubs which can sell alcohol for consumption on- or off-site) at any one time. In Prince George's County there are limits on the absolute number of licences which vary according to licence type
Ontario (control state)	Off-sale wine	No more than 292 offsite winery retail store licences may be in effect at any given time
	Off-sale wine, beer	No more than 450 total beer and cider grocery store licences and beer and wine grocery store licences may be in effect at one time
Washington	Off-sale spirits, wine, beer	The Alcoholic Beverage Control board has established moratorium zones which are areas where the board has limited the number of new licences that can be issued or prohibited the issuance of new licences. For example, there is a maximum number of Class A licences (permits off-sale spirits, wine, and beer) of 250 and Class B (permits sale of beer and wine) of 275 (has some exclusions such as grocery stores where alcohol sales do not exceed 15% of total volume of gross receipts annually). Moratoriums are in effect for five years
<b>Limit alcohol retail licences by geographic area</b>		
Iowa (control state)	Off-sale spirits, wine, beer	A class "E" liquor control license, which permits the sale of spirits, wine, and beer in off-sales settings, may be issued to a city council for outlets located within the limits of the city if there are no class "E" liquor control licensees operating within the limits of the city and no other applications for a class "E" license for outlets located within the limits of the city at the time the city council's application is filed.
Maryland (control state)	Off- and on-sale spirits, wine, beer	This is not set at state-level, however there is legislation for municipalities within the state. For example, in Anne Arundel County, the Board may limit the number of licences in a specified area to the existing number of licences or a number they see fit, which is imposed for between 1-4 years. In Baltimore City and Montgomery County, 'bounded' areas have been identified where no more licences can be issued

Jurisdiction	Setting and product with controls	Description of legislation
West Virginia (control state)	Off- and on-sale spirits, wine, beer	Per market zone, there may be one or more Class A (on-premise) retail licences and one or more Class B (off-premise) retail licences, provided that the number of Class B licences shall not exceed 150% of the number of Class A licences

Table A8: References for legislation set out in Appendix Table A7

<b>Jurisdiction</b>	<b>Legislation</b>
Alaska	AK § Stat 04.11.400 (2023)
Arizona	AZ Rev Stat § 4-206.01 (2022)
Arkansas	AR Code § 3-4-201 (2020)
British Columbia	BC Reg 241/2016
California	CA Bus & Prof Code § 23816, § 23817 & § 23817.5 (2023)
Connecticut	CT Gen Stat § 30-14a (2023)
Florida	FL Stat § 561.20 (2023)
Idaho	ID Code § 23-903 (2023)
Iowa	IA Code § 123.30 (2022)
Indiana	IN Code § 7.1-3-22-3 & § 7.1-3-22-4 (2022)
Kentucky	KY Rev Stat § 241.065 & § 241.066 (2022)
Maine	28-A ME Rev Stat § 453 (2022)
Manitoba	CCSM cL153
Maryland	MD Alcoholic Beverages Code § 9-1602, § 9-1604, § 11-1601, § 12-1602, § 16-1601, § 17-1601, § 18-1601, § 20-1601, § 22-1601, § 23-1601, § 25-1601, § 26-1601, § 28-1601 & § 31-1601 (2022)
Massachusetts	MA Gen L ch 138 § 17 (2022)
Michigan	MI Comp L § 436.1531 & § 436.1533 (2023)
Minnesota	MN Stat § 340A.412 & § 340A.413 (2023)
Montana	MT Code § 16-2-109 & § 16-4-105 (2023)
New Jersey	NJ Rev Stat § 33.1-12.14 (2023)
New Mexico	NM Stat § 60-6A-18 (2021)
Ohio	OH Rev Code § 4301.17 (2023)
Ontario	O Reg 746/21
Oregon	ORS §471.001
Pennsylvania	P.L.707, No.230
Rhode Island	RI Gen L § 3-5-16 (2023)
Saskatchewan	SS 1997, c A-18.011
South Dakota	SD Codified L § 35-4-10 & § 35-4-11 (2023)
Tennessee	TN Code § 8-107 (2021)
Utah	UT Code § 32B-6-203, § 32B-6-303, § 32B-6-403 & § 32B-6-703 (2023)
Washington	WA Rev Code § 66.24.420 (2023)
West Virginia	WV Code § 60-3A-7 (2023)
Wisconsin	WI Stat § 125.51 (2023)
Wyoming	WY Stat § 12-4-201 & § 12-4-413 (2022)
Yukon	SY 2022 c140 § 37

Table A9: Details of approaches to allocating alcohol retail licences in jurisdictions with availability caps

Jurisdiction	Transfers permitted within county?	Private sales permitted?	Additional information
<b>Highest bidder wins</b>			
Indiana	Yes	Yes	When a licence becomes available, the licensing department shall offer the opportunity to bid on it and the licence is awarded to the highest eligible bidder. Within 30 days of the auction, the purchaser must submit a completed application alongside payment for the winning bid amount, in addition to usual licensing fees. When a licence is sold privately, the transfer sale price must be submitted to the licensing board who then publishes these figures.
Montana (control state)	Yes	Yes	On-sale licences that become available are subject to a competitive bidding process where applicants can bid for the opportunity to apply for a licence. The highest bidder wins the right to apply. The minimum bid is set at 75% of market value of the licence compared to licences with the same type and privileges in the same quota area or similar area. The successful bidder must apply within 60 days of being notified of success and must be in operation within 12 months. They must pay the winning bid alongside usual licensing fees. The licence may not be transferred within one year.
New Jersey	Yes	Yes	Licences that become available are subject to a competitive bidding process where applicants can bid for the opportunity to apply for a licence. A minimum bid requirement and other conditions and requirements for issuance may be established. The licence is issued to the highest qualified bidder upon payment of the bid amount and licensing fees.
Pennsylvania (control state)	Yes	Yes	A business seeking a restaurant licence can bid on a licence offered through an auction. The licence is awarded to the highest responsive bidder. There is a minimum bid amount of \$25,000 and the bid must be paid within two weeks and transfer must be filed within six months. Auctioned licences are subject to the original conditional licensing agreements.
<b>Licence lottery</b>			
California	Yes	Yes	When a quota licence becomes available, the licensing department must publish a notice of intention to receive licence applications. If the number of applicants exceeds the total number of available licences, the department will use random selection. No more than one lottery may be undertaken each year, and applicants may only participate in one lottery and must have lived in California for at least 90 days prior. To participate in the lottery, applicants pay a refundable fee of \$15,835 which is the new licence application fee. This is returned

Jurisdiction	Transfers permitted within county?	Private sales permitted?	Additional information
			to unsuccessful applicants minus \$100 dollars processing charge. The lottery is available for viewing via a live video feed.
Florida	Yes	Yes	Interested persons can submit one entry to the licence lottery per person/entity and pay a non-refundable \$100 fee. Once announced, lottery winners must either file an application for the issuance of the licence within 45 days or waive the right to apply. There are several state-imposed requirements that must be met, including payment of the required fees which vary by county. Payment of a one-time Hughes Act fee of \$10,750 is required which is ringfenced for alcohol and drug abuse education, treatment, and prevention programs. If a licence is purchased, a transfer fee applies which is the average annual gross sales of alcoholic beverages in the last 36 months multiplied by 0.004 and capped at \$5000.
<b>Purchase at fair market value</b>			
Arizona	Yes	Yes	A list of licences available for each county is published online alongside information about the type of licence and the estimated fair market value (defined as the average value of the same type of licence sold in the open market in the past 12 months or similar). Applicants can express their interest in purchasing the licence by completing an application form and paying a one-off non-refundable fee of \$100. If there is more than one applicant for the same licence, the successful applicant is decided by random selection. If otherwise eligible, the successful applicant must pay the agreed fair market value and usual licensing fees.
<b>Waiting list</b>			
Idaho (control state)	Yes	Yes	To obtain a quota licence which permits the sale of spirits by the drink, applicants must apply for a licence and join a waiting list. Licences are issued to those next on the list and waiting times can be long. When an applicant is notified that a license is available to it, that applicant must, within 10 days, accept the license. The applicant then has 180 days to fully prepare for issuance of the license, including obtaining and readying its licensed premises, with a possible 90-day extension.
<b>Decision of local licensing board</b>			
Oregon (control state)	No	No	In Oregon, distilled spirits (hard liquor) by the bottle are sold only in retail liquor stores. The State owns the distilled spirits in each store and decides when and where the new licence can be issued based on population growth.

Jurisdiction	Transfers permitted within county?	Private sales permitted?	Additional information
Utah (control state)	No	No	Applicants present their ideas to the licensing board who determines what business the licence is awarded to.
<b>Multiple approaches</b>			
South Dakota	Yes	No	Quota licences may be awarded by waiting list, lottery, or auction, depending on local laws.
<b>Apply to local licensing board</b>			
Alaska	Yes	No	-
Arkansas	Yes	No	-
Connecticut	Yes	No	-
Kentucky	Yes	No	-
Maryland (control state)	Yes	No	-
Massachusetts	Yes	No	-
Michigan (control state)	Yes	Yes	-
Minnesota	Yes	No	-
New Mexico	Yes	Yes	-
Ohio (control state)	Yes	Yes	-
Rhode Island	Yes	No	-



<b>Jurisdiction</b>	<b>Transfers permitted within county?</b>	<b>Private sales permitted?</b>	<b>Additional information</b>
Tennessee	No	No	-
Washington	No	No	-
Wisconsin	No	No	-
Wyoming (control state)	Yes	Yes	-

## Appendix 8: Implementation of Licensing Systems Literature Review Methodology

This rapid review aims to identify and synthesise qualitative evidence focused on describing, understanding, analysing or otherwise exploring the operation of alcohol licensing systems, or specific elements of such systems, in national or subnational jurisdictions. Within this, the review aims particularly to identify evidence addressing (i) the relationship and any differences between licensing legislation outlining how the licensing system should operate, guidance or policy on the operation of the licensing system, and how the system operates in practice and (ii) explanations for any differences arising. It focuses particularly on the gap between national legislation and local licensing decisions and practices in multi-level licensing systems and on systems where a licence is required to sell alcohol (as distinct from monopoly-based systems).

RQ1: How are alcohol licensing systems implemented in practice, compared to their apparent or intended operation as specified in legislation, guidance or policy?

RQ2: What explains the emergence of differences between the actual and intended operation of alcohol licensing systems?

### Methods

#### Search strategy

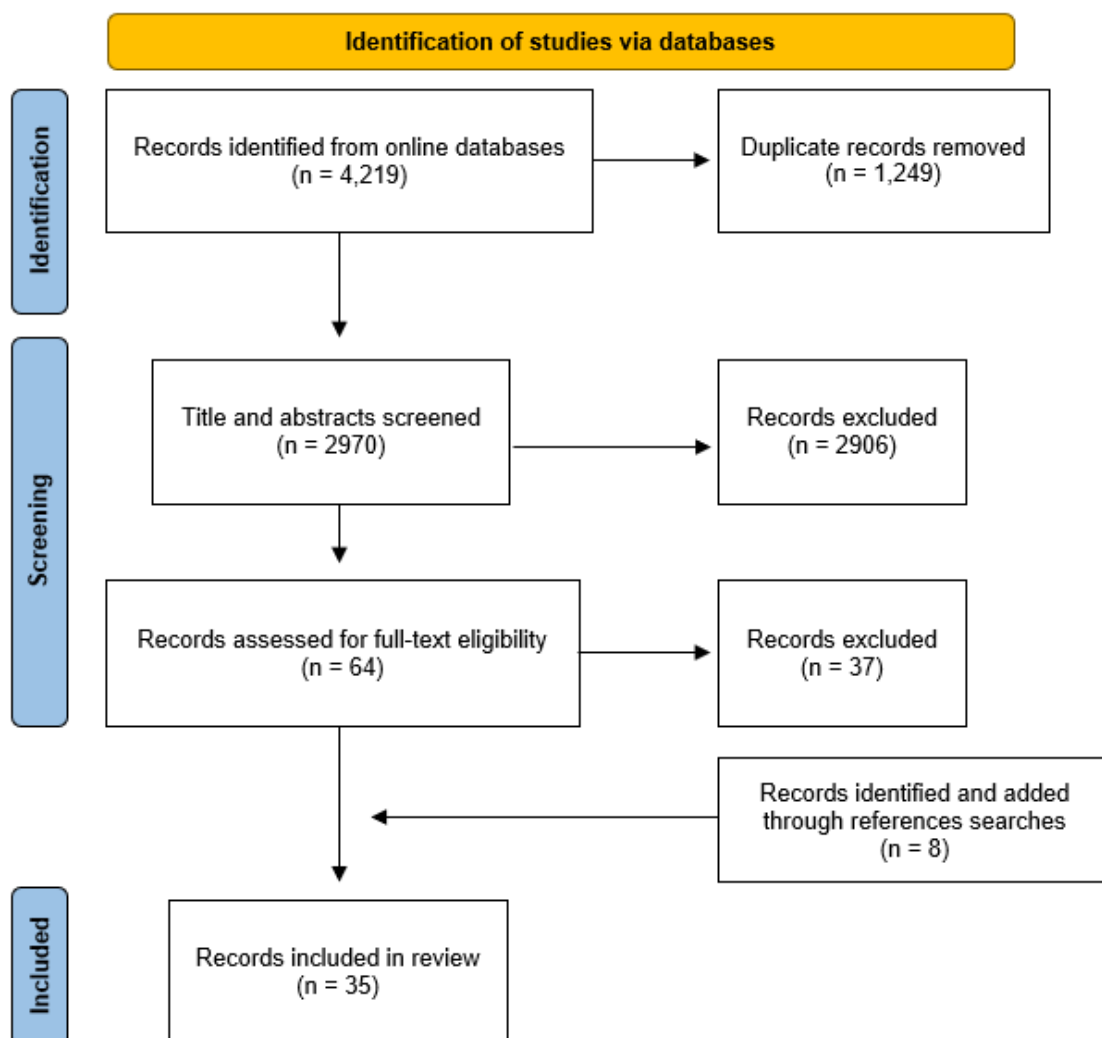
A systematic search of academic literature databases (CINAHL, Medline, APA PsycInfo, Public Affairs Index, SocINDEX, and Web of Science) using a mix of free-text and index terms for alcohol/liquor and licensing/permits was conducted by KA. This search was supplemented by systematic searches in selected academic literature databases and using Google search engine, limited to certain jurisdictions highlighted from other parts of the larger project that this work sits within. Backwards- and forwards-citation searches of relevant studies already known to us and snowballing via key authors' name searches and recommendations from our broader project's international advisory panel, and by reaching out to the wider alcohol research community via the review team's networks were also conducted. Results of the searches were de-duplicated. Titles and abstracts were then screened by MC and JM against the inclusion criteria (see Table A10). Determining inclusion concentrated on whether the paper has a focus on alcohol availability or licensing, whether the paper has a primary or substantial focus on the implementation of an alcohol licensing system and whether the paper is focused on qualitative or experiential data, including the authors own experiences. A sample of 50 articles were screened by both authors to ensure consistency in approach, any disagreements were discussed, and a third reviewer was brought in to resolve any disagreements. Potentially relevant full texts from both the searches were then downloaded and assessed against the same inclusion criteria; again, a third reviewer brought in to resolve any disagreements. See Figure A8 for a PRISMA search tree outlining this process.

Table A10. Inclusion and exclusion criteria

	<b>Include</b>	<b>Exclude</b>
<b>Intervention</b>	<p>Current or past legal systems<sup>1</sup> for the granting and management of licences for the public retail of alcohol including both 'on' and 'off' premises.</p> <p>The distinction between policy, guidance, and legislation in RQ1 recognises that what is written into law may not reflect the policy tools (e.g. rules, guidance, protocols) created or adopted by national or local actors – and then the practices that emerge under those policies may be different again.</p>	<p>State monopolies.</p> <p>Hypothetical systems.</p>
<b>Setting</b>	Any country with a licence or permit-based system set in national law, plus sub-national jurisdictions within high-income countries.	Jurisdictions without a legal basis governing alcohol retailing.
<b>Study design</b>	<p>Evidence is likely to come from qualitative and mixed methods research studies but any study analysing primary data will be included.</p> <p>Primary data</p> <p>Findings from systematic reviews with the same aim as ours will be included.</p>	Reviews that do not have the same aim as ours will be used as a citation source only.
<b>Outcomes</b>	Qualitative findings describing or evaluating the nature or implementation of an alcohol licensing system (e.g. laws, guidance, processes, practices, outcomes)	
<b>Publication type/status</b>	<p>Studies published in academic and practitioner/professional journals.</p> <p>Grey literature reports/papers with a stated aim and/or major primary focus relevant to our review.</p>	<p>Conference abstracts (insufficient detail)</p> <p>Data-rich reports will be prioritised over data-poor reports.</p>
<b>Limiters</b>	<p>English-language</p> <p>Date limits will be specified after scoping searches</p>	

<sup>1</sup> By using the term 'system', we mean any relevant laws, guidance, processes, practices or outcomes relating to a licensing or permit-based or planning system to regulate the physical or temporal availability of alcohol.

Figure A8. PRIMSA Search Tree (Page et al., 2021)



## Data extraction, Analysis and Synthesis

The following information was extracted from each article by two reviewers (MC & JM): article title, year of publication, authors, objective, study design, setting, sample size, sample characteristics, other methodological characteristics, analytical approach, description of the alcohol licensing system, and relevant findings. Extracted data was cross-checked for accuracy.

The extracted data was reviewed by two reviewers (MC & JM) initially to develop an initial coding framework in line with the research questions. This coding framework focused on the identifying whether there was a gap in policy and practice, the nature of this gap and reasons for this gap. The coding framework was discussed with the wider team and applied to all included studies. Finally, we conducted a textual narrative synthesis (Lucas et al., 2007), which began by grouping the studies and extracted data according to the licensing mechanisms examined (e.g., Cumulative Impact), then producing commentaries which summarised key aspects (e.g.,

methodological characteristics, contexts and findings) of the studies in relation to the subgroup they were included in, in this case the sub-group was the licensing mechanism examined, and finally sub-group synthesis were produced. This approach acknowledges that drawing conclusions across studies is not always possible due to heterogeneity in the data, in this instance for example varying licensing systems.

## Appendix 9. Modelling of Outcomes of Policy Options

Table A11: Estimated changes in average alcohol outlet density for pubs and off-trade outlets in Northern Ireland by deprivation quintile under modelled scenarios for licensing reform

Outlet type	NIMDM quintile	Modelled scenario						
		Pub liberalisation – 100%	Pub liberalisation – 50%	Pub liberalisation – 10%	Off-trade liberalisation – 100%	Off-trade liberalisation – 50%	Off-trade liberalisation – 10%	Recent trends continue
Pubs	NIMDM1 (most deprived)	10%	5%	1%	0%	0%	0%	0%
	NIMDM2	201%	100%	20%	0%	0%	0%	-6%
	NIMDM3	450%	225%	45%	0%	0%	0%	-3%
	NIMDM4	305%	152%	30%	0%	0%	0%	-7%
	NIMDM5 (least deprived)	407%	204%	41%	0%	0%	0%	-16%
Off-trade	NIMDM1 (most deprived)	0%	0%	0%	266%	133%	27%	2%
	NIMDM2	0%	0%	0%	491%	245%	49%	-5%
	NIMDM3	0%	0%	0%	561%	280%	56%	2%
	NIMDM4	0%	0%	0%	358%	179%	36%	3%
	NIMDM5 (least deprived)	0%	0%	0%	435%	217%	43%	-9%

## Modelling the association between outlet density and alcohol consumption

In order to estimate the association between the changes in outlet density described above and changes in alcohol consumption we performed a new analysis of data from the Health Surveys for Northern Ireland 2017/18 and 2019/20. For every individual survey respondent we added variables representing the outlet density for pubs, off-licences and all licenced outlets, based on their Super Output Area of residence. In order to maintain statistical disclosure, the values of these variables was converted by the Northern Ireland Department of Health into categorical variables taken between 18 and 32 discrete values.

For our analysis, we fitted an Ordinary Least Squares regression model to the pooled data from both surveys, with logged mean weekly alcohol consumption as the dependent variable. The categorical density variables were transformed back into continuous variables by assigning each value the mid-point of its category range. We fitted two models: one that included both logged pub and off-trade outlet density, and one with logged overall outlet density. Both models controlled for age, age squared, sex and deprivation quintile (as a categorical variable). Due to the log-log specification of these models, the coefficients on the density terms can be interpreted as ‘elasticities’ – representing the percentage change you would expect in the dependent variable (mean weekly alcohol consumption) for a 1% change in the relevant density measure. Full results for both models are presented below.

*Table A12: Regression results for model with pub and off-trade outlets. Coefficients marked in bold are significant at the 95% level*

Variable	Coefficient	Std. error	t value	Pr(> t )
<b>Intercept</b>	<b>1.1979694</b>	<b>0.3328891</b>	<b>3.599</b>	<b>0.000327</b>
<b>Age</b>	<b>0.0405019</b>	<b>0.0128536</b>	<b>3.151</b>	<b>0.001649</b>
<b>Age squared</b>	<b>-0.003761</b>	<b>0.0001223</b>	<b>-3.077</b>	<b>0.002119</b>
Male	Reference			
<b>Female</b>	<b>-1.1420993</b>	<b>0.0785902</b>	<b>-14.532</b>	<b>&lt;0.000001</b>
NIMDM1 (most deprived)	Reference			
<b>NIMDM2</b>	<b>-0.6260894</b>	<b>0.1265697</b>	<b>-4.947</b>	<b>&lt;0.000001</b>
<b>NIMDM3</b>	<b>-0.4780290</b>	<b>0.1235395</b>	<b>-3.869</b>	<b>0.000112</b>
<b>NIMDM4</b>	<b>-0.5621415</b>	<b>0.1275582</b>	<b>-4.407</b>	<b>0.0000110</b>
<b>NIMDM5 (least deprived)</b>	<b>-0.4010978</b>	<b>0.1247053</b>	<b>-3.216</b>	<b>0.001317</b>
Log Pub density	0.0064938	0.0295481	0.220	0.826070
<b>Log off-trade density</b>	<b>0.1377556</b>	<b>0.0402305</b>	<b>3.424</b>	<b>0.000628</b>

Table A13: Regression results for model with all outlets combined. Coefficients marked in bold are significant at the 95% level

Variable	Coefficient	Std. error	t value	Pr(> t )
<b>Intercept</b>	<b>1.1157623</b>	<b>0.4452631</b>	<b>2.506</b>	<b>0.01234</b>
<b>Age</b>	<b>0.0343750</b>	<b>0.0174186</b>	<b>1.973</b>	<b>0.04866</b>
<b>Age squared</b>	<b>-0.003571</b>	<b>0.0001673</b>	<b>-2.134</b>	<b>0.03302</b>
Male	Reference			
<b>Female</b>	<b>-1.1431433</b>	<b>0.1036906</b>	<b>-11.025</b>	<b>&lt;0.00001</b>
NIMDM1 (most deprived)	Reference			
NIMDM2	-0.1373902	0.1538911	-0.893	0.37215
NIMDM3	-0.2893234	0.1577748	-1.834	0.06693
NIMDM4	-0.2927397	0.1629932	-1.796	0.07273
NIMDM5 (least deprived)	-0.1553342	0.1672934	-0.929	0.35332
<b>Log overall density</b>	<b>0.1019318</b>	<b>0.0375955</b>	<b>2.711</b>	<b>0.00679</b>

## Strengths and limitations

This analysis uses the latest available data and a leading policy appraisal tool – the Sheffield Alcohol Policy Model – to estimate the potential impact of changes to the alcohol licensing system in Northern Ireland. However, there are some significant limitations to our approach. Most notably, the fact that we have taken evidence on the cross-sectional association between alcohol outlet density and alcohol consumption and assumed that this link is causal. Our analysis has controlled for important confounders, such as socioeconomic deprivation, but other confounding factors may remain. Longitudinal evidence on associations between changes in alcohol outlet density and alcohol consumption is not readily available and our approach is in line with that taken in other studies which have explored the potential public health consequences of liberalising alcohol licensing systems (Stockwell et al. 2018; Sherk et al. 2023)<sup>1</sup>. It should also be noted that, particularly in the full liberalisation scenario, the changes in alcohol outlet density that we are modelling are extremely large – more than a fivefold increase in some areas. Previous studies have found some evidence for diminishing marginal effects of increased outlet density on alcohol consumption (Stockwell et al. 2018), however exploratory analysis of HSNi data did not find evidence to support similar effects in Northern Ireland. Finally, our analysis has only considered the effects of alcohol outlet density on alcohol harms that goes through changes in alcohol consumption. We have not considered other causal pathways between outlet density and alcohol harms, for example around the clustering of outlets, that are particularly likely to be relevant for pubs, rather than off-trade outlets.

<sup>1</sup> Stockwell, T., Sherk, A., Norström, T., Angus, C., Ramstedt, M., Andréasson, S., Chikritzhs, T., Gripenberg, J., Holder, H., Holmes, J., and Mäkelä, P. (2018) Estimating the public health impact of disbanding a government alcohol monopoly: application of new methods to the case of Sweden, *BMC Public Health*, 18:1400, pp. 1-16. doi: <https://doi.org/10.1186/s12889-018-6312-x>  
 Sherk, A., Stockwell, T., Sorge, J., Churchill, S., Angus, C., Chikritzhs, T., Holmes, J., Meier, P.S., Naimi, T.S., Norström, T., Ramstedt, M. and Simpura, J. (2023) *The public-private decision for alcohol retail systems: Examining the economic, health, and social impacts of alternative systems in Finland*, *Nordic Studies on Alcohol and Drugs*. 40 (3), pp. 218-232. doi: <https://doi.org/10.1177/14550725231160335>





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