



## Quantitative controls on the number and/or location of alcohol retail outlets: an overview of approaches in the USA and Canada

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### ABSTRACT

**Background:** Regulatory approaches to alcohol availability vary widely, yet policies that control the number and/or location of alcohol retail outlets remain under-documented. This study aimed to identify and describe these approaches across jurisdictions in the USA and Canada.

**Methods:** A two-stage document analysis was conducted for all 50 states, 10 Canadian provinces, and three Canadian territories (jurisdictions). Relevant legislative documents were identified and reviewed, with data extracted on policies establishing quantitative thresholds on either total outlet numbers (including outright prohibition), outlets numbers per population, distances between alcohol retail outlets, or distances between alcohol retail outlets and sensitive locations such as schools. Data collection took place between March and May 2024.

**Results:** Among 63 jurisdictions, 56 (88.9 %) used at least one approach to limiting the number and/or location of alcohol retail outlets, with 39 (61.9 %) using two or more. The most common approach (63.5 % of jurisdictions) was limiting minimum distances between outlets and specific locations, such as schools or places-of-worship. Population-based limits on outlet density were used by 44.4 % of jurisdictions, but thresholds varied substantially, (e.g. from 1.36 to 200 outlets per 100,000 population for on-sales, and 5.00 to 200 per 100,000 population for off-sales). Nearly half of all jurisdictions (47.6 %) had at least one dry county or area, while a smaller proportion (17.5 %) set minimum distances between outlets to prevent clustering. Fixed caps on the absolute number of outlets, regardless of population size, were least common (12.7 %).

**Conclusion:** Quantitative controls on the number and/or location of alcohol retail outlets are widely used across the USA and Canada but vary significantly in structure and stringency. While some jurisdictions impose multiple controls, others apply none. Understanding these policy approaches provides insight into regulatory frameworks but does not indicate enforcement levels or public health impact. Further research could examine how these measures are implemented and whether different models influence alcohol availability.

### Introduction

Globally, alcohol consumption is a leading risk factor for ill-health, disability, and early death (Institute for Health Metrics, 2024). Alongside wider determinants such as alcohol's affordability and acceptability, alcohol consumption and harm are influenced by its availability (Babor et al., 2022; Burton et al., 2017). Communities with a higher density of alcohol outlets tend to have higher rates of alcohol consumption, violent crime, sexually transmitted infections, suicides, alcohol-related hospital admissions and deaths, and road traffic crashes (Campbell et al., 2009; Popova et al., 2009; Sherk et al., 2018).

Consequently, regulating alcohol outlet numbers is recognised by the World Health Organization (WHO) as a key component of alcohol control strategies (World Health Organization, 2010, 2017a). Since deprived communities tend to have higher levels of alcohol availability, actions to reduce the number or density of licensed outlets have the potential to reduce health inequalities (World Health Organization, 2022).

An alcohol retail licence is any licence, permit, certification, registration, or other approval legally required to sell alcoholic drinks to customers (World Health Organization, 2022). In 2019, among 128 countries that responded to the WHO's global alcohol survey that do not

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have a ban on alcohol, 71.9 % had a retail licensing system for beer (World Health Organization, 2024). Internationally, the implementation of licensing systems is highly varied, however these structures provide a foundation for availability policies and regulations.

There are four commonly used levers to regulate the physical availability of alcohol (World Health Organization, 2022). The first is banning alcohol retail outlets altogether, as seen in dry counties or municipalities where alcohol sales are prohibited. The second is volume controls, which cap the number of outlets, typically by setting limits per population size or within a particular geographic area. The third is clustering controls, which prevent outlets from being too close together by requiring minimum distances between them. Finally, proximity restrictions, set minimum distances between alcohol outlets and specific locations, such as schools, places of worship, or alcohol treatment centres. These approaches are generally used for one of two purposes: to protect specific populations, or to reduce the number or concentration of alcohol retail outlets, either generally, or in specific locations (World Health Organization, 2022).

Bans on retail outlets (dry counties/areas) are the most comprehensive sales restriction, essentially limiting the number of alcohol retail outlets to zero. Volume controls aim to limit the total supply of alcohol but do not control the spatial patterns of outlets. Clustering controls address this by limiting the minimum distance between two or more outlets, therefore reducing the chance of high local concentrations, even if the overall number of outlets is unchanged. Proximity restrictions, which are laws that specify minimum distances between outlets and specific locations such as schools or places of worship are designed to protect populations but may have little effect on overall retail availability in the absence of other controls. In practice, jurisdictions may implement more than one approach. For example, they may set a limit of the number of outlets per population, in addition to specifying minimum distances between outlets, and from specific locations. These rules may apply only to certain types of alcoholic drinks or retail settings and can vary depending on factors like population size or whether the local area is commercial or residential.

While the relationship between outlet density, alcohol consumption, and alcohol-related harm has been widely studied, the specific regulatory approaches used to establish quantitative controls on the number and/or location of outlets has received less attention, leaving open questions about how jurisdictions should establish such controls. A recent study examining alcohol outlet density restrictions in the USA found that around two-thirds of states have some form of legislative control, most commonly, population-based limits (Michel et al. 2024). However, that study excluded laws allowing localities to ban alcohol sales (i.e. dry counties/areas) and laws establishing minimum distance requirements between outlets and from specific locations. This study expands on previous work by comprehensively documenting policies to limit the number and/or location of alcohol retail outlets across the USA and Canada, capturing all major approaches set out in legislation. By systematically identifying and describing these policies, this study provides a detailed overview of the different regulatory mechanisms in place.

This approach aligns with emerging frameworks for scientific legal mapping, which emphasise transparent, systematic documentation of legal and regulatory environments (Burris 2025). These approaches extend traditional comparative legal research by creating structured, reproducible datasets that can inform empirical analysis, policymaking, and public understanding (Burris 2025; Burris et al. 2016). Recent examples in the field of substance use include mapping of cannabis delivery laws in the USA (Ebling et al. 2025), syringe service programme legislation (Fernández-Viña et al., 2020), and alcohol-related firearm laws (Silver, Bae & Macinko 2024). Together, these studies demonstrate the value of detailed legal mapping for documenting policy variation and identifying opportunities for future evaluation, while also highlighting challenges such as maintaining comparability across complex legal frameworks and ensuring that static legal snapshots are interpreted

in context. Our study follows these principles by systematically identifying and coding legislative provisions regulating the number and location of alcohol retail outlets across the USA and Canada.

## Methods

### Study design

This study provides a descriptive, cross-sectional analysis of approaches used to establish quantitative controls the number and/or location of alcohol retail outlets in the USA and Canada. We undertook a two-stage document analysis, focusing on regulatory documents for all 50 US states, 10 Canadian provinces, and three Canadian territories (herein jurisdictions).

Document analysis is a systematic approach for reviewing and synthesising information from written records, commonly used to examine regulatory and policy environments (Bowen, 2009). This method was selected to provide a structured comparison of legislative provisions governing alcohol outlet limits across jurisdictions without making inferences about enforcement or effectiveness.

The analysis was conducted in two stages:

- 1) Identification of relevant legislation: Legislative documents governing alcohol retail licensing were located for each jurisdiction using publicly available legal databases
- 2) Data extraction and categorisation: Relevant provisions were reviewed, and information was systematically extracted

### Search strategy, data extraction, and management

We included 63 jurisdictions: 50 US states, 10 Canadian provinces, and three Canadian territories. In Maryland (USA), 23 local jurisdictions have control over alcohol availability policies and regulations and we either extracted data for each county, or for brevity, present data for Anne Arundel County where the state capitol is located.

To systematically identify legislative provisions governing alcohol retail licensing, a structured search strategy was undertaken using publicly accessible legal databases. In the USA, state-level alcohol control laws were retrieved from [Justia.com](https://www.justia.com), an open-access database specialising in US legal information (Justia, 2023). For Canadian provinces and territories, legislative documents were obtained from [CanLII.org](https://www.canlii.org), which provides access to national and subnational legal materials (CanLII, 2024). These databases were chosen for their comprehensiveness and accessibility, ensuring that the most up-to-date legislative texts as of May 2024 were examined.

The data extraction process was conducted in two stages. The first stage involved identifying relevant legislative provisions within the retrieved documents. Legislation was systematically screened to determine whether it contained policies establishing quantitative controls on the number and/or location of alcohol retail outlets. This included provisions relating to dry zones where retail sales are not permitted, population-based density controls, minimum distance requirements between alcohol outlets (clustering controls), and minimum distance requirements between alcohol outlets and specific locations such as schools or places of worship (proximity restrictions). Each jurisdiction's legislation was reviewed in full, and sections relevant to these policy categories were identified for further analysis.

In the second stage, relevant legislative text was extracted and classified according to the type of restriction imposed. Where legislation specified numerical thresholds, such as maximum permitted outlets per population or minimum distances between outlets, these values were recorded in their original format. To facilitate comparability across jurisdictions, population-based limits were standardised to reflect the number of outlets per 100,000 people. The majority of legislation reported minimum distance requirements in feet, as used in the USA. To ensure comparability, Canadian measures were converted to feet where

necessary, though we also report distances in meters for international readers. Where legislation was ambiguous, or the precise meaning of statutory language was unclear, the research team discussed and resolved classification decisions to ensure consistency. In certain cases, additional sources were consulted to supplement legislative data. For example, information on dry counties in the USA was cross-referenced with materials published by the National Alcohol Control Beverage Association to confirm the presence of alcohol outlet bans at the local level (National Alcohol Control Beverage Association, 2017).

The scope of this study was limited to the 63 jurisdictions in the USA and Canada where English is the primary legislative language. This decision was made for practical reasons, reflecting both the language proficiency of the research team and the need for comparability across regulatory frameworks. Data collection and extraction were conducted between March and May 2024, ensuring that the study reflects policies in place during this period.

**Results**

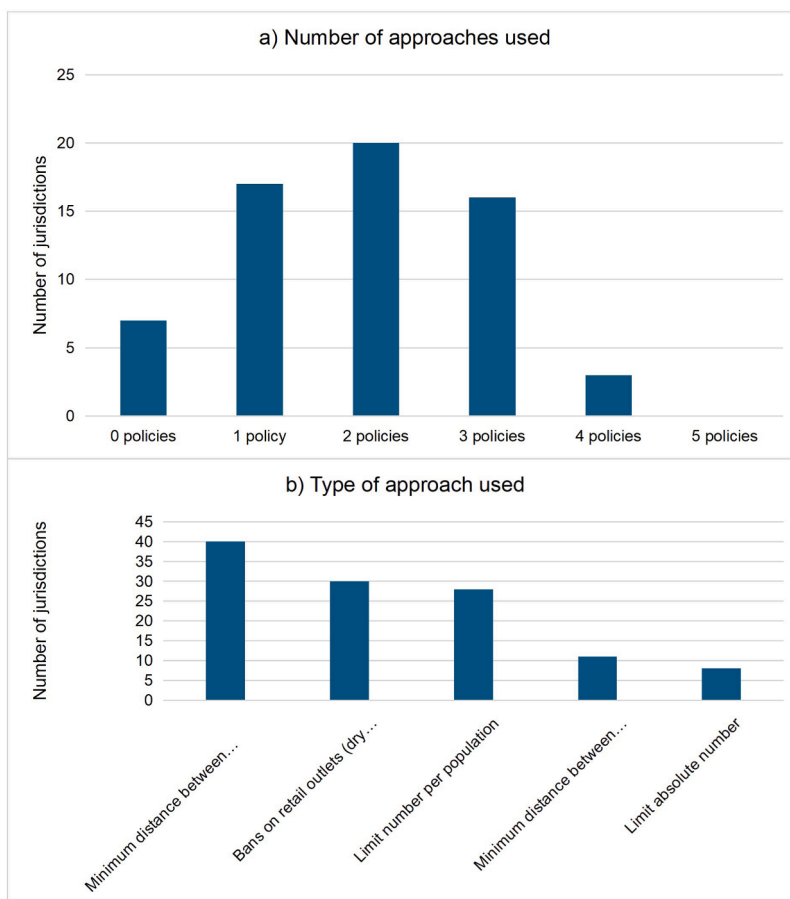
All 63 jurisdictions in the USA and Canada require alcohol retail outlets to be licensed (noting state-run stores under a retail monopoly may not require a licence but are subject to similar controls). Of the 63 jurisdictions included in this study, 88.9 % had at least one policy limiting the number and/or location of outlets, and 61.9 % used two or more approaches (Fig. 1a). The most common restriction, implemented in 63.5 % of jurisdictions, was a minimum distance requirement between alcohol outlets and sensitive locations such as schools or places of worship (Fig. 1b). Nearly half (47.6 %) had dry areas where alcohol retail sales are prohibited, while 44.4 % imposed population-based

limits on outlet numbers. Fewer jurisdictions (17.5 %) specified minimum distances between two or more outlets to prevent clustering, and only 12.7 % set fixed numerical caps on the total number of licenses, regardless of population size. Jurisdiction-specific data are available in Supplementary Material 1.

*Retail sale of alcohol prohibited (dry counties/areas)*

Dry counties or areas, where retail outlets are prohibited, represent the most restrictive form of alcohol availability control, effectively setting the number of outlets to zero. Nearly half (47.6 %) of the jurisdictions examined contained at least one county, or smaller geographical area, where retail alcohol sales are prohibited. These municipal bans often exist alongside state-level monopolies in areas of the same state that do not impose such a ban. In such systems, the state government regulates wholesale alcohol distribution and, in some cases, also controls retail sales, but no retail outlets would be permitted in municipalities with a ban (further details on control systems are provided in Supplementary Material 3 and the overlap with dry counties/areas in Supplementary Material 4).

The size and scope of dry areas vary widely. Some states, such as Arkansas, have entire counties where alcohol sales are prohibited, while others, like New Jersey and North Carolina, allow individuals cities or towns in otherwise ‘wet’ counties to remain dry (National Alcohol Control Beverage Association, 2017). In Wisconsin, the village of Ephraim is the only dry jurisdiction in the state.



**Fig. 1.** The number of jurisdictions in the USA and Canada using an approach to establish quantitative controls on the number and/or location of alcohol retail outlets by a) the number of approaches used in a single jurisdiction and b) by type of approach.

General volume controls

Volume controls aim to limit the number of alcohol retail outlets within a jurisdiction, either by capping the number of licenses per population, or by setting an absolute limit regardless of population size. Of the 63 jurisdictions examined, 27 (44.4 %) applied population-based limits, though the way these limits were structured varied. Among those using this approach, 75.0 % applied restrictions to at least one type of off-sales outlet, 47.2 % to at least one type of on-sales outlet, and 22.2 % to either the aggregate on- and off-sales outlets or outlet types that were permitted to make on- and off-sales.

Despite being commonly used, population-based limits varied substantially (Table 2). In off-sales settings, permitted outlet densities ranged from as low as 5.00 per 100,000 population in Ohio for government-controlled stores selling spirits, wine, and beer to 200 per 100,000 population in Wyoming for off-sales outlets selling spirits, wine, and beer (Fig. 2). On-sales outlets limits showed similar variation, from 1.36 per 100,000 population in Utah for taverns selling beer to 200 per 100,000 population in Montana for outlets licensed to sell wine and beer.

Some jurisdictions apply different rates based on outlet type. For example, Alaska permits one restaurant or eatery per 1500 population but allows only one on-sales outlet per 3000 population for other license types. In other cases, such as Indiana, Kentucky, and Massachusetts, density limits vary by city or town, depending on local population size. In such instances, the least restrictive (highest permitted) rate was selected for comparison.

Further complexity arises in how population thresholds are used. In some jurisdictions, a new licence may be issued each time the population increases by a specified amount. For example, if the rule allows two licenses per 2000 population, one licence may be issued at 1000 additional residents, and another at 2000. Elsewhere, licences are granted only when the full population threshold is met, meaning that under the same rule, both licenses would only be issued once the population reaches 2000. Licenses are typically not revoked if the population declines.

In addition, the scope of these limits varies. Some apply to all alcohol

types, while others differentiate by product. For example, Florida sets population-based limits for licenses covering spirits, wine, and beer, whereas Kentucky applies them only to spirits and wine, exempting beer sales. These variations are detailed in Table 1.

Policies that impose a fixed cap on the total number of alcohol retail licenses, regardless of population size, are relatively uncommon and are mostly applied to off-sales outlets (Table 3). Some jurisdictions set temporary moratoriums on new licenses, while others establish permanent numerical limits.

In British Columbia, a moratorium is in place, preventing new alcohol store licenses from being issued until 2032. In contrast, Ontario and Manitoba have permanently capped the number of certain types of alcohol retail licenses, meaning no additional licenses can be granted beyond the existing limit. Other jurisdictions take a tiered approach based on broad population bands. For example, in Maine, the maximum number of permitted retail licences increases as population size grows, with predefined thresholds determining when new licences can be issued.

Clustering controls

Clustering controls set a minimum required distance between one or more alcohol retail outlets and aim to prevent high concentrations of outlets together in a single area. This approach was relatively uncommon, with only 11 jurisdictions (17.5 %) specifying such restrictions. Where in place, the minimum permitted distance between outlets varied widely, with a median of 805 m (2640 feet), but ranging from as little as 61 m (200 feet) to as much as 15,000 m (49,212 feet) (Table 3).

Laws specifying minimum distances between outlets and specific locations

Many jurisdictions set minimum distance requirements between alcohol retail outlets and specific locations. These locations include schools and churches, or other services primarily attended by populations who might be considered to require protection from exposure to alcohol outlets, or who have specific religious beliefs about alcohol.

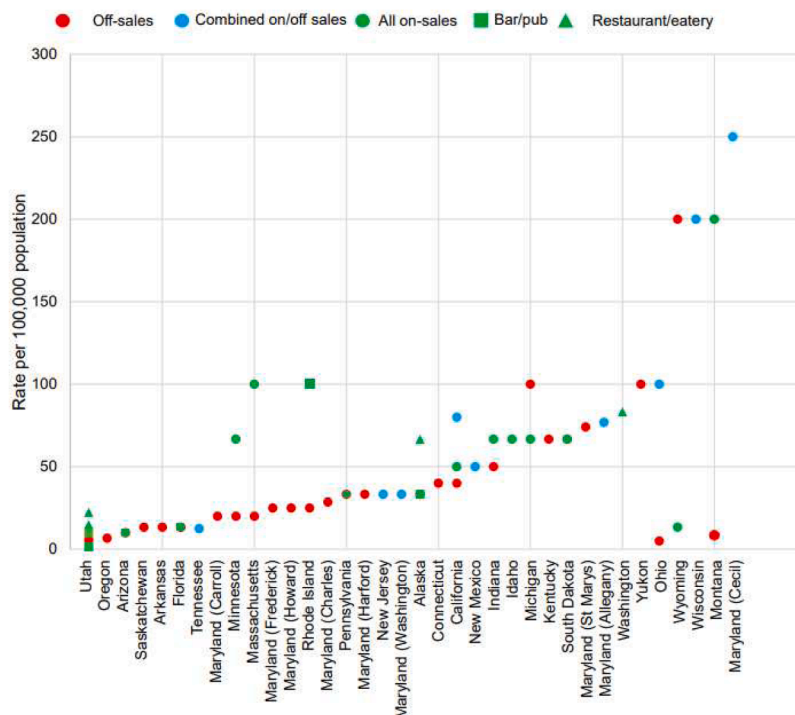


Fig. 2. The maximum permitted rate of alcohol retail outlets in on- and off-sales settings across 27 jurisdictions in the USA and Canada applying population-based limits. All rates have been converted to a rate per 100,000 population to increase comparability.

**Table 1**

An overview of approaches that apply population-based volume controls on the number of alcohol outlets in jurisdictions in the USA and Canada. References to legislation are given in Supplementary Material 5.

Jurisdiction	Setting and product with controls	Description of legislation
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 1500 population. Other on-sales licences are generally issued at a rate of 1 per 3000 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 3000 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 7500 population
California	On-sale spirits, wine, beer	On-sale general licences are limited to a rate of 1 per 2000 population
	Off-sale spirits, wine, beer	Off-sale general licences are limited to a rate of 1 per 2500 population and off-sale beer and wine licences are limited to a rate of 1 per 2500 population. Off-sale beer and wine licences in combination with off-sale general licences may not exceed a rate of 1 per 1250 population
Connecticut	Off-sale spirits, wine, beer	Package store permits are limited to a rate of 1 per 2500 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 7500 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 7500 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 1500 population. Sales of spirits by the drink are banned in Franklin and Madison counties

**Table 1 (continued)**

Jurisdiction	Setting and product with controls	Description of legislation
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 1500 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 1500 population
	On-sales beer	On-sale one-way permits (permitting the sale of beer) are limited to a rate of 1 per 1500 population
	Off-sales beer	Off-sale beer permits are limited to a rate of 1 per 2000 population in populations <15,001; in populations between 15,001–80,000 the permitted rate is 1 per 3500 population; in populations larger than 80,000 the permitted rate is 1 per 6000 population
	Off-sale spirits, wine	Off-sales liquor permits are limited to a rate of 1 per 2000 population in populations <15,001; in populations between 15,001–80,000 the permitted rate is 1 per 3500 population; in populations larger than 80,000 the permitted rate is 1 per 6000 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 1500 population. In all other cities, the permitted rate is 1 per 2300 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 1300 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 5000 population. In Charles County, off-sale licences may not exceed a rate of 1 per 3500 population. In Frederick County there may be 1 licence per 4000 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 3000 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 4000 population. In St Mary's, there can be no more than 1 Class A licence per 1350 population
	On- or off sale spirits, wine, beer	In Allegany County, Class D licences cannot exceed a rate of 1 per 1300 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

(continued on next page)

Table 1 (continued)

Jurisdiction	Setting and product with controls	Description of legislation
Massachusetts	On-sale spirits, wine, beer	restaurants and hotels). In Washington County, the permitted rate for all licence types is 1 per 3000 population On-sale licences are limited to a rate of 1 per 1000 population up to a population of 25,000 and thereafter a rate of 1 per 10,000 population
Michigan (control state)	Off-sale spirits, wine, beer On-sale spirits, wine, beer	Off-sales licences are limited to 1 per 5000 population 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 1500 of population or major fraction of 1500 population
Minnesota	Off-sale spirits, wine, beer On-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 1000 of population, or fraction of 1000 No off-sale intoxicating liquor license may be issued in any city at a rate of more than 1 per 5000 population In cities with a population <500, a maximum of three licenses; in cities with a population between 500–2500, a maximum of four licenses; in cities with a maximum population between 2500 to 5000, 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 licences. Above that, there is a rate of 1 per 1500 population up to 200 licences. Clubs, theatres, wine establishments, hotels and bowling alleys are exempt
Montana (control state)	On-sale wine, beer Off-sale spirits	In populations <500, one retail wine and beer licence is permitted. In areas with more than 500 inhabitants and not more than 2000 inhabitants, one retail beer and wine license is permitted for every 500 inhabitants. In local areas of more than 2000 inhabitants, four retail beer and wine licenses for the first 2000 inhabitants, two additional retail beer and wine licenses for the next 2000 inhabitants or major fraction of 2000 inhabitants, and one additional retail beer and wine license for each additional 2000 inhabitants 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

Table 1 (continued)

Jurisdiction	Setting and product with controls	Description of legislation
New Mexico	On- or off-sale spirits, wine, beer	be issued until the rate is fewer than 1 per 3000 population The maximum number of retail licenses to be issued is 1 per 2000 population
Ohio (control state)	On and off-sale spirits, wine, beer On-sale spirits, wine, beer Off-sale spirits, wine, beer	Class C licences (permitted to sell spirits, wine, and beer on-site but is also permitted to sell to-go) are issued at a rate of 1 per 1000 population Class D licences (permitted to sell spirits, wine, and beer in on-sales settings) are issued at a rate of 1 per 1000 population 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 Off-sale spirits, wine, beer	Generally, on-sales outlets are limited to a rate of 1 per 3000 population. This includes restaurants, bars, taverns, eating places and clubs Generally, off-sales outlets are limited to a rate of 1 per 3000 population
Rhode Island	On-sale spirits, wine, beer Off-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 1000 population 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 6000 population in populations larger than 20,000 and 1 per 4000 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; 500–1000 population: 1 store; 1001–2500 population: 2 stores; 2501–5000 population: 3 stores; 5001–10,000 population: 4 stores; 10,001–15,000 population: 5 stores; 15,001–20,000 population: 6 stores; thereafter, a maximum rate of 1 per 7500 population
South Dakota	Off-sale spirits, wine, beer On-sale spirits, wine, beer	In populations <1000 there can be a maximum of 2 licences, above which the permitted rate is 1 per 1500 population In populations <1000 there can be a maximum of 3 licences, above which the permitted rate is 1 per 1500 population
Tennessee	On- or off-sale spirits, wine, beer	No more than one licence may be issued per 8000 population
Utah (control state) <sup>a</sup>	On-sale sprits, wine, beer	Restaurant licences that can sell spirits, wine, and beer are limited to a rate of 1 per 4467 population

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Table 1 (continued)

Jurisdiction	Setting and product with controls	Description of legislation
	On-sale, wine, beer	Restaurant licences that can sell wine and beer are limited to a rate of 1 per 6817 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 1200 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 9500. Over 9500 population, the rate changes to 1 per 3000 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 7500 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 7500 population
Yukon (control state)	Off-sale spirits, wine, beer	When considering a licence application for an off-sales outlet, the board will consider density targets for each area. In guidance, the specified rate is 1 per 1000 population

<sup>a</sup> These rates are changing in 2025. The number of full-service restaurant licenses will gradually increase from one per population of 4467 to 3167 over seven years. The total increase will be about 312 additional licenses, bringing the total number of FS restaurant licenses to 1073 statewide by fiscal year 2031. The number of bar licenses will increase from one per population of 10,200 to 7246 graduated over seven years, with a total increase of about 136 additional licenses, bringing the bar license total to 469 statewide by fiscal year 2031.

Among the 40 jurisdictions limiting the proximity of licensed alcohol outlets to specific locations, the vast majority (90.5 %) required a minimum distance from schools or youth-centred facilities, while 76.2 % set similar requirements for places of worship (Table 3). It was less common for jurisdictions to specify distance requirements to health or treatment facilities (25.0 %).

Not all jurisdictions specified exact distance requirements. Of the 40 jurisdictions reporting minimum distance policies for specific places, eight (20.0 %) used vague language in their legislation such as prohibiting outlets in “the vicinity” or “immediate vicinity” of a school or in locations that could “cause inconvenience to a church, school or hospital”.

Table 2

An overview of approaches that apply population-based volume controls on the number of alcohol outlets in jurisdictions in the USA and Canada. References to legislation are given in Supplementary Material 5.

Jurisdiction	Setting and product with controls	Description of legislation
British Columbia (control state)	Off-sale, spirits, wine, beer Off-sale wine	Moratorium on new licensee retail stores until July 1 2032 Moratorium on new wine store licences (in perpetuity) meaning no new licences can be issued
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.
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 <2000 a maximum of one licence, increases to three for populations thereafter up to 5000, 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	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. 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

(continued on next page)

Table 2 (continued)

Jurisdiction	Setting and product with controls	Description of legislation
West Virginia (control state)	Off- and on-sale spirits, wine, beer	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 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

Where numerical limits were set, the most common minimum distance was 91 m (300 feet), though actual requirements ranged from 30 m (100 feet) to 457 m (1500 feet).

The method for measuring distance also varied. Some jurisdictions calculated distance as the shortest pedestrian or vehicular route (e.g., Louisiana), while others used straight-line distance (Michigan), nearest property line (Arkansas), or normal pedestrian route (New Jersey). Most laws applied only to new licences, with only five jurisdictions extending these restrictions to licence transfers when an outlet changed location.

## Discussion

Measures to restrict the physical and temporal availability of alcohol are widely recognised as effective strategies to reduce alcohol-related harm (World Health Organization, 2017b). Multiple systematic reviews have found that greater availability is generally associated with higher levels of consumption and harm, with evidence drawn from a range of international contexts (Burton et al. 2017; Babor et al. 2022; Bryden et al. 2012; Campbell et al. 2009; Middleton et al. 2010; Sherker et al. 2018). However, few studies have systematically documented approaches to establish quantitative controls on numbers and / or the location of alcohol outlets. To address this, we systematically identified and described approaches to establish quantitative limits on the number and/or location of alcohol retail outlets across the USA and Canada, providing a comprehensive overview of the key legislative approaches in use. This mapping clarifies the range of policy options currently in use and provides a basis for future evaluation of how different approaches are implemented and enforced.

Most jurisdictions applied at least one policy limiting the number or location of outlets, with many combining approaches. Proximity controls, which establish minimum distances between alcohol outlets and specific locations such as schools or places of worship, were most common. Population-based limits on outlet density were also widely used, though thresholds and scope varied substantially. A smaller number of jurisdictions imposed absolute caps on licence numbers or minimum distances between outlets to prevent clustering.

Each of these models operates through distinct pathways. Proximity controls are often justified as a way to protect specific populations, such as children or individuals in treatment for alcohol use disorder (World Health Organization, 2022), perhaps making them more politically feasible (Ackerman et al. 2017; Farley et al. 2015). While research has found that proximity to alcohol outlets can influence underage drinking (Trapp et al. 2018), the extent to which specific minimum distances impact alcohol availability remains unclear. Similar policies in tobacco control suggest that short distances, such as the most common 91 m (300 foot) alcohol restriction, may not substantially reduce retail availability, as studies indicate that even 121 m (400-foot) limits may be insufficient

to meaningfully reduce tobacco retailer density (Larsen et al. 2017; Marsh et al. 2021; Ribisl et al. 2017). Larger distance requirements, such as 305 m (1000 feet), have been associated with greater reductions in tobacco outlet density (Ribisl et al. 2017), but whether similar patterns apply to alcohol outlets is less well understood. These controls have been described by stakeholders working in alcohol licensing as a response to alcohol's visibility, viewing frequent exposure to alcohol outlets as a cue for drinking, especially for those with past dependence or children navigating daily environments (O'Donnell et al. 2024). Minimum distance requirements may have different effects depending on local context. For example, alcohol outlets tend to be more concentrated around schools in disadvantaged areas, so restrictions on minimum distances from schools may have a greater benefit in these neighbourhoods (Martín-Turrero et al., 2022; Ribisl et al. 2017). In this way, proximity controls could contribute to reducing health inequalities if well-targeted.

Population-based volume controls were also widely used, though their implementation varied. Some jurisdictions applied the same limits across all retail outlets, while others differentiated between on- and off-sales settings. Among those that set population-based limits, 72 % restricted off-sales outlets, compared to 42 % that applied limits to both on- and off-sales, and just two jurisdictions that applied restrictions only to on-sales outlets. The median threshold was one licence per 1500 people for bars and restaurants and one licence per 4000 people for off-sales outlets. More restrictive population-based limits were generally found in jurisdictions with larger urban populations (e.g., California), while those with a greater proportion of rural residents (e.g., Kentucky) tended to set higher limits. In some cases, restrictions focused specifically on outlets selling spirits, as seen in Idaho, Oregon, and Utah. These variations suggest that some jurisdictions may tailor density controls based on outlet type, beverage category, or perceived risk (The Beverage Information Group, 2024; World Health Organization, 2022; Crawford et al. 2012; Moore, Brennan & Murphy 2011; Van Amsterdam et al. 2020). However, the relationship between outlet volume and harm remains complex. Stakeholders and researchers alike struggle to identify clear mechanisms linking lower outlet volume to reduced harm (Gmel, Holmes & Studer 2016; Holmes et al. 2014; O'Donnell et al. 2024). Suggested pathways include reduced convenience and impulse purchasing, and lowered overall exposure (O'Donnell et al. 2024), but empirical evaluation is often limited and often fails to account for outlet type or social context.

Clustering controls, which specify minimum distances between two or more alcohol outlets were far less common, but where implemented, the permitted distances were generally larger than those required between outlets and specific locations such as schools. These policies aim to prevent high concentrations of alcohol outlets in a single area, which have been linked to higher rates of alcohol-related harm, particularly violence and crime (Grubestic & Pridemore 2011; Grubestic et al. 2016). Studies that disaggregate on-trade outlets suggest bars and nightclubs are more strongly associated with assaults and sexual violence, potentially due to their concentration in nighttime economy zones (Gmel, Holmes & Studer 2016; Cameron et al. 2016; Horsefield, Lightowers & Green 2023).

Clustering of alcohol outlets tend to occur in historically disadvantaged areas (Trangenstein et al. 2019; Fliss, 2021). As such, policies targeting clustering may help reduce spatial inequalities in alcohol-related harm. Jurisdictions varied in how they measured distance (e.g., Euclidian, vs road network), which might affect the impact of clustering controls. Preliminary evidence suggests that policies that use Euclidean ("as-the-crow-flies") distance may achieve larger reductions in overall outlet density (Martín-Turrero et al. 2023). When determining which type of distance to use, jurisdictions should consider the level of urbanicity, because differences between distance types are greater in dense cities (Martín-Turrero et al. 2023). Importantly, many proximity and clustering restrictions apply only to new licences, which could undermine their effectiveness, especially considering that, in

**Table 3**

An overview of restrictions limiting the proximity of licensed retail outlets to other locations or licensed outlets. All distances have been converted to feet. References to legislation are given in Supplementary Material 2.

Jurisdiction	Minimum distance in meters (feet)					How distance is measured	Applies to
	School or youth area <i>n</i> = 38	Place of worship <i>n</i> = 32	Health facility <i>n</i> = 10	Licensed outlet <i>n</i> = 11	Other <i>n</i> = 8		
	<b>American States</b>						
Alabama	NS <sup>a</sup>	-	-	-	-	Measurement not specified	New licences
Alaska	61 (200)	61 (200)	-	-	-	Shortest pedestrian route	New and transferred licences for a beverage dispensary (on) or package store (off) licence
Arizona	91 (300)	-	-	-	-	Horizontal feet	New licences (restaurants are excluded)
Arkansas	305 (1000)	305 (1000)	-	-	-	Within distance of property line	New or transferred licences
California	183 (600)	NS	NS	-	-	Immediate vicinity	New licences
Colorado	152 (500)	-	-	457 (1500)	-	Measurement not specified	New and transferred licences. In populations <10,000 the permitted distance to another licensed outlet is 3000 feet
Delaware	NS	NS	-	805 (2640)	-	By accessible public road or street. NS refers to "the vicinity"	New licences
Florida	152 (500)	-	-	-	-	Within distance of the real property	New on-sales licences only (excludes restaurants)
Georgia	61 (200)	30 (100)	-	-	-	Within stated distance	New off-sales licences
Hawaii	152 (500)	-	-	-	-	Within distance of the nearest point of the premises	New on-sales licences
Idaho	91 (300)	91 (300)	-	-	-	Within distance measured in a straight line to the nearest entrance to the licensed premises	New licences
Illinois	30 (100)	30 (100)	30 (100)	-	-	Within distance measured to the nearest part of any building	New licences
Kansas	61 (200)	61 (200)	-	-	-	Measurement not specified	New licences
Louisiana	91 (300)	91 (300)	-	-	91 (300) <sup>b</sup>	Within distance measured as a person walks using the sidewalk from the nearest point of the property line	New licences
Maine	91 (300)	91 (300)	-	-	-	Distance from the main entrance of the alcohol outlets, by the ordinary course of travel	New licences for agency off-sales stores
Maryland <sup>c</sup>	305 (1000)	305 (1000)	-	-	-	In a straight line from the entry point	New licences
Massachusetts	152 (500)	152 (500)	-	-	-	Within a radius	New licences
Michigan	152 (500)	152 (500)	-	-	-	Distance measured along the centre line of the street or streets of address between two fixed points on the centre line determined by projecting straight lines, at right angles, to the centre line from the part of the church or school nearest to the contemplated location	New or transferred licences
Minnesota	457 (1500)	-	305 (1000)	-	305 (1000) <sup>d</sup>	Within stated distance	New licences
Mississippi	122 (400)	122 (400)	-	-	122 (400) <sup>e</sup>	Measurement not specified	New licences selling wine and spirits. In a zoned-commercial or industrial area, the permitted minimum distance reduces to 100 feet
Missouri	30 (100)	30 (100)	-	-	-	Measurement not specified	New licences. Can be increased to 300 feet in cities
Montana	183 (600)	183 (600)	-	5280	-	Measured in a straight line from the centre of the nearest entrance to the nearest entrance to the licensed premise	New licences. Distance to another licensed outlet applies to off-sales spirits outlets. Other distances apply to on- or off-sales of any alcohol
Nebraska	46 (150)	46 (150)	46 (150)	-	46 (150) <sup>f</sup>	Within stated distance	New licences
New Hampshire	61 (200)	61 (200)	-	16,093 (52,800)	-	Within stated distance	New licences. Distance to another licensed premise only applies the distance between two agency spirits stores
New Jersey	61 (200)	61 (200)	-	-	-	Measured in a normal way that a pedestrian would properly walk from the nearest entrance to the nearest entrance of the premises sought to be licensed	New licences
New Mexico	91 (300)	91 (300)	-	-	-	Straight line distance from the property line of the licensed premises to the property line	New licences
New York	61 (200)	61 (200)	-	-	-	Within measured distance	New licences
North Carolina	-	-	-	NS <sup>g</sup>	NS <sup>g</sup>	Measurement not specified	New off-sales licences
Ohio	152 (500)	152 (500)	-	-	-	Within measured distance	New licences

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Table 3 (continued)

Jurisdiction	Minimum distance in meters (feet)					How distance is measured	Applies to
	School or youth area <i>n</i> = 38	Place of worship <i>n</i> = 32	Health facility <i>n</i> = 10	Licensed outlet <i>n</i> = 11	Other <i>n</i> = 8		
Pennsylvania	91 (300)	91 (300)	91 (300)	61 (200)	152 (500) <sup>h</sup>	Within a radius	New or transferred licences
Rhode Island	-	-	-	61 (200)	-	Measured by any public way Shortest route of ordinary pedestrian or vehicular travel along the public thoroughfare from the nearest point of the grounds	New off-sales licences
South Carolina	91 (300)	91 (300)	-	NS <sup>i</sup>	-		New licences
Tennessee	61 (200)	61 (200)	-	-	-	Straight line from nearest corner to nearest corner	New licences
Texas	91 (300)	91 (300)	91 (300)	-	-	Measurement not specified	New licences
Washington	NS <sup>j</sup>	NS <sup>j</sup>	-	-	-	Measurement not specified	New licences
West Virginia	NS <sup>k</sup>	NS <sup>k</sup>	-	-	-	NS refers to the “immediate vicinity”	New licences
Wisconsin	91 (300)	91 (300)	91 (300)	-	-	Measurement not specified	New licences for off-sales beer and mixed on- and off-sales spirits, wine, and beer
<b>Canadian Provinces</b>							
Alberta	-	-	-	15,000 (49,212)	-	Shortest driving distance on existing public roads from the exact physical location of the proposed general liquor store	New licences
British Columbia	-	-	-	1000 (3281)	-	Measurement not specified	New and transferred licences
Newfoundland & Labrador	NS <sup>l</sup>	NS <sup>l</sup>	NS <sup>l</sup>	-	-	Measurement not specified	New licences
Nova Scotia	NS <sup>m</sup>	NS <sup>m</sup>	NS <sup>m</sup>	-	NS <sup>m</sup>	Measurement not specified	New licences
Yukon	150 (492)	150 (492)	150 (492)	150 (492)	150 (492) <sup>n</sup>	Measurement not specified	New licences
<b>Mean distance</b>	<b>124 (408)</b>	<b>106 (348)</b>	<b>115 (377)</b>	<b>3915 (12,845)</b>	<b>144 (474)</b>		
<b>Median distance</b>	<b>91 (300)</b>	<b>91 (300)</b>	<b>91 (300)</b>	<b>805 (2640)</b>	<b>136 (446)</b>		
<b>Total number</b>	<b>38</b>	<b>32</b>	<b>10</b>	<b>11</b>	<b>8</b>		

- No requirement; NS: not specified.

<sup>a</sup> “The proximity of the business to a school or childcare facility...will [not] create a harmful environment for the children”.

<sup>b</sup> Other includes public libraries and correctional facilities that house inmates.

<sup>c</sup> Local jurisdictions (counties) have control over alcohol availability policies and regulations in Maryland. Example given is for Anne Arundel County (where the state capitol is located). Not all counties have distance requirements.

<sup>d</sup> Other includes prisons and state-owned facilities.

<sup>e</sup> Other includes funeral homes.

<sup>f</sup> Other refers to distance from home for indigent persons or veterans.

<sup>g</sup> Decisions can consider whether “the health, safety, or general welfare of the community will be adversely affected, and the proximity of the new location to existing...stores”.

<sup>h</sup> Other relates to “the welfare, health, peace and morals of the inhabitants of the neighbourhood within a radius of 500 feet of the place proposed to be licensed”.

<sup>i</sup> Issuance of new licences may also be limited if the citizens are more than adequately served because of “the location of the stores within the subdivision”.

<sup>j</sup> Before a new licence is issued, the board will give “due consideration to the location of the business...with respect to the proximity of churches, schools, and public institutions”.

<sup>k</sup> Unspecified distance refers to the “immediate vicinity”.

<sup>l</sup> The legislation states that “a licence shall not be granted if the premises “are so located as to cause inconvenience to a church, school or hospital.”.

<sup>m</sup> Licences may be granted if the Executive Director is satisfied that operating the licensed premises will not interfere with or cause inconvenience to schools, churches, hospitals, nursing homes or similar institutions.

<sup>n</sup> Other includes “areas considered to pose a potential conflict”.

many cases, the requirement can be waived by the licensing board.

The most restrictive approach to limiting the availability of licensed alcohol retail outlets include bans (or dry counties/areas). Many of the jurisdictions in the USA and Canada had at least one county or smaller geographic area with a ban on outlets, however the dry zones ranged in size and covered different sized populations, and were generally legacies from the time of prohibition, rather than newly implemented (National Alcohol Control Beverage Association, 2017). While data on the effectiveness of dry zones are more limited than the other policies included in this review, dry zones may offer protections, considering that transitioning from a dry to a wet county is associated with alcohol misuse, liver disease, and congestive heart failure (Dukes et al., 2016). This suggests a potential protective effect of maintaining bans.

Across all approaches, legislation does not always translate into effective practice. Several jurisdictions have provisions that allow existing licences to remain, even when new density limits are

introduced. For example, in New Jersey, when the law was implemented to limit restaurants or bars to one per 3000 population, preexisting licences were grandfathered, meaning that some cities have more licences than the specified rate would allow, and no more licences can be granted. This was also the case in Pennsylvania. Similar grandfathering provisions exist in Arizona and Wisconsin, where the absolute number of licenses per population differs due to preexisting outlets, but a permitted rate of change has been established for future growth. These exceptions highlight that legal limits do not necessarily translate into reductions in alcohol availability, as historical licensing decisions can shape current conditions. Consequently, researchers have found that fixed limits established in laws and regulations may not align with the actual levels of availability in seen in reality (Nakkash et al., 2018; Jennings et al., 2014). Moreover, the literature and stakeholder evidence point to important mechanisms, such as affordability, premises-type norms, and intoxication effects, are rarely addressed directly in legal availability

controls, but may be critical to how these controls influence harm (O'Donnell et al., 2024).

### Strengths and limitations

This study provides a comprehensive overview of the different approaches used to establish quantitative controls on the number and/or location of alcohol retail outlets across all 63 jurisdictions in the USA and Canada. By systematically identifying and documenting these policies, the findings help to clarify common regulatory practices and serve as a foundation for future research exploring the implications of these approaches. However, several limitations should be acknowledged.

First, the study focuses solely on jurisdictions in Canada and the USA, meaning the findings do not capture how these policies are implemented in other regions. The extent to which similar approaches exist elsewhere remains unknown. Second, the analysis is restricted to legislative provisions and does not assess how these laws are enforced in practice or whether they effectively shape alcohol availability. Third, while this study examines controls on outlet numbers and locations, alcohol retail availability is also influenced by other regulations, such as permitted hours and days of sale, which were beyond the scope of this analysis. Finally, despite efforts to ensure accuracy in data extraction and interpretation, some policies may have been overlooked, particularly where local regulations differ from jurisdiction-wide laws. Additionally, legislative updates may have occurred since data collection was completed. Given statutory updates, jurisdictions and researchers may benefit from a versioned legal map (e.g. bi-annual updates) to support implementation tracking and evaluative studies.

### Conclusion

This study highlights the wide variation in how jurisdictions across the USA and Canada regulate the number and location of alcohol retail outlets. While the establishment of quantitative limits to control the number and/or location of alcohol retail outlets, particularly population-based controls, are not unusual, their application is far from universal. Notably, two out of every five jurisdictions did not have any of the main policies examined in this study, whether in the form of outlet density limits, absolute numerical caps, or minimum distance requirements. As a result, an estimated 127 million people, 34 % of the population of the USA or Canada, live in jurisdictions without these availability restrictions.

The findings provide a foundation for further research exploring how different regulatory approaches shape alcohol availability. Future studies could examine the extent to which these policies are implemented as intended, whether they lead to variations in alcohol access and alcohol-related harms, and what insights might be relevant for jurisdictions beyond North America.

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### CRedit authorship contribution statement

**Robyn Burton:** Writing – original draft, Visualization, Validation, Methodology, Formal analysis, Data curation, Conceptualization. **Pamela Trangenstein:** Writing – review & editing, Writing – original draft, Supervision. **Megan Cook:** Writing – review & editing. **Niamh**

**Fitzgerald:** Writing – review & editing, Funding acquisition, Conceptualization. **James Nicholls:** Writing – review & editing, Supervision, Funding acquisition, Data curation, Conceptualization.

### Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Robyn Burton reports was provided by Institute of Social Marketing and Health, University of Stirling. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

### Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.drugpo.2025.105075.

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