

A rapid review of the evidence

Liquor outlet density

Evidence and Innovation: Alcohol and Drug Foundation

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Declarations

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About the Alcohol and Drug Foundation

The [Alcohol and Drug Foundation \(ADF\)](https://www.adf.org.au) is Australia's leading organisation committed to inspiring positive change and delivering evidence-based approaches to minimise alcohol and drug harm. It is the best source of up-to-date, credible information on alcohol and other drugs, the latest research, prevention and harm minimisation advice, access to support services and place-based approaches to support community wellbeing.

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Abbreviations and definitions

Abbreviation or term	
AA	Alcohol-attributable.
ADF	Alcohol and Drug Foundation.
Adjusted odds ratio (aOR)	An odds ratio that accounts for the influence of other variables, estimating the independent effect of the exposure on the outcome.
Alcohol Use Disorders Identification Test (AUDIT)	A validated, widely used tool to screen for high-risk drinking behaviours in both clinical and research settings.
AOD	Alcohol and other drugs.
Displacement	The shift of alcohol purchasing, use, or related harms from one location to another or to a different time following changes to alcohol availability, such as outlet closures or trading hour restrictions, for example shifting purchasing to neighbouring areas or earlier in the evening.
DUI	Driving under the influence.
ED	Emergency Department.
Gender-based family violence (GBFV)	Gender-based family violence, a broad concept which is intended to incorporate intimate partner violence (IPV), family and domestic violence (FDV) and child maltreatment.
Heavy episodic drinking (HED)	Consuming a large quantity of alcohol in a single drinking session. Also known as binge drinking and risky drinking.
High-risk drinking	Patterns of alcohol consumption that significantly increase the risk of harmful consequences for the person's health and wellbeing. Can be assessed using the AUDIT scale.
Outlet density (OD)	The concentration of outlets in a pre-defined area, measured via: 1) count, 2) proximity or 3) spatial access; as defined by below:¹ 1) Count: a measure of outlet density on a set of 'containers' using an existing (e.g. postal code) or user-defined boundary (buffer zone around a specific location). Count may be a raw number of outlets or divided by a measure of space or reach. 2) Proximity: a measure of outlet density between a fixed location to the closest outlet, which could be measured in road miles/kms or by a mode of transport, e.g. walking, cycling or driving distance. 3) Spatial access: a measure of outlet density that sum the raw or inverse distances from a location to a subset of alcohol outlets defined by a set number or a radius.

Odds ratio (OR)	A measure of association that compares the odds of an outcome in an exposed group to the odds in an unexposed group.
Off-premise outlets	Retail business licensed to sell packaged liquor intended for consumption elsewhere (e.g. bottle shops, supermarkets, convenience stores, petrol stations).
On-premise outlets	Retail business licensed to sell alcoholic beverages intended for consumption on-site (e.g. bars, nightclubs, restaurants).
Packaged liquor	Alcohol available for sale at off-premise outlets like bottle shops, grocery stores and convenience stores that must be taken-away and consumed elsewhere.
PICOT	Population/Patient, Intervention, Comparison/Control, Outcome, Time.
MVCs	Motor vehicle crashes.
SES	Socioeconomic status.
SVN	Single-vehicle night-time.

Summary of findings

Background

Alcohol consumption remains a major global health burden, contributing to 2.6 million deaths in 2019 and continuing to pose significant risk in Australia, where 31% of people aged 14+ drank at risky levels in 2022–2023.

Availability theory suggests that greater physical access to alcohol – shaped by outlet density, proximity, outlet type and location – reduces barriers to consumption and can increase the potential for alcohol-related harms.

In addition, social ecological and niche theories suggest that different outlet types may influence harms through distinct mechanisms, with on-premise venues concentrating drinkers in shared social spaces and increasing opportunities for intoxication, crowding and interaction, while off-premise outlets primarily shape patterns of private consumption within homes and neighbourhoods.

To understand the relationship between outlet density and alcohol consumption and related harms over time, a rapid review was undertaken of longitudinal and natural experiment designs in Australia and comparable jurisdictions.

Methods

A systematic search was conducted across four databases – ADF Library (specialist alcohol and other drugs library), Google Scholar, PubMed Central and Google – including citation searching. This resulted in 51 included studies, including cohort/longitudinal ($n = 40$), quasi-experimental ($n = 8$) and case-control ($n = 3$) studies. Data were extracted using Covidence (web-based systematic review tool) and formal appraisal of study quality carried out using JBI quality assessment tools.

Findings

Overall, the findings indicate that greater outlet density is generally associated with higher levels of adult alcohol consumption and dependence, alongside a broader range of alcohol-related harms, including health and medical consequences, violent crime, and gender-based family violence. Tables 1 and 2 summarise the direction and strength of evidence linking alcohol outlet density with key alcohol-related outcomes, by outlet type.

Differences were observed by outlet type, suggesting distinct mechanisms through which on- and off-premise outlets influence alcohol-related harms. On-premise venues were more consistently linked to violent and assaultive crime, while off-premise outlets were more consistently linked with adolescent drinking and gender-based family violence and showed generally positive evidence for health and medical outcomes. For outcomes with mixed findings, this variability likely reflects differences in study contexts, measures of outlet density, and local environmental and socioeconomic factors.

Table 1: Summary of evidence on associations between on-premise outlet density and consumption and related harms

Outcome	Summary of evidence	Confidence
Adolescent alcohol consumption	Mixed	Limited
Adult alcohol consumption and dependence	Positive	Moderate
Health and medical	Mostly positive	Moderate
Violent and assaultive crime	Mostly positive	Moderate
Gender-based family violence	Mixed	Limited
Non-violent crime	Mostly null	Limited
Road safety	Mixed	Limited
Gun-related crime	Null	Very limited

Table 2: Summary of evidence of associations between off-premise outlet density and consumption and related harms

Outcome	Summary of evidence	Confidence
Adolescent alcohol consumption	Mixed	Limited
Adult alcohol consumption and dependence	Positive	Moderate
Health and medical	Mixed	Moderate
Violent and assaultive crime	Mixed	Moderate
Gender-based family violence	Mostly positive	Limited
Non-violent crime	Mostly null	Limited
Road safety	Mixed	Limited
Gun-related crime	Mixed	Very limited

Conclusion

This review closely examined the link between higher outlet density and alcohol-related harms and provides a valuable contribution to the evidence base. Overall, the findings suggest that policies aimed at managing alcohol outlet density may be an important lever for reducing alcohol-related harms and improving population health, with differential impacts likely to occur according to outlet type.

Key messages

- Higher alcohol outlet density is linked to increased adult alcohol consumption and dependence, and with alcohol related harms, particularly violent crime.
- Impacts vary by outlet type, with on-premise outlets more consistently linked to violent and assaultive crime and off-premise outlets to adolescent alcohol consumption and gender-based family violence, with mixed but generally positive evidence for health outcomes.
- Evidence for road safety and some crime outcomes is mixed, reflecting opposing mechanisms and broader spatial and contextual factors rather than inconsistent effects.

1. Introduction

1.1 Background

Alcohol consumption remains a major contributor to the global burden of disease and injury, accounting for 2.6 million attributable deaths in 2019² and constituting a leading cause of preventable harm in Australia,³ where 31% of people aged 14 and over reported risky drinking levels in 2022-2023.⁴

Physical availability – shaped by the number, type and proximity of alcohol outlets – plays a central role in influencing alcohol consumption patterns and related harms. According to availability theory, increased access to alcohol can reduce barriers to consumption, making alcohol easier to access and more affordable, thereby increasing the potential for harms.^{5, 6}

Research on outlet density and alcohol-related harms has been ongoing since the late 1970s, with much of the earlier work relying on cross-sectional designs that establish associations,¹ but offer limited insights into causal pathways of the impacts of changes in availability over time.⁷

Over the last decade, evidence has been synthesised through an umbrella review⁸ of 15 systematic reviews (published between 2006–17), multiple systematic reviews⁹⁻¹¹ and two rapid reviews^{12, 13} conducted for policymakers. The umbrella review concluded that reducing outlet density is likely to be beneficial, but highlighted the need for more longitudinal and quasi-experimental primary research.⁸

Findings from three systematic reviews have been mixed, two of which were conducted within a broader examination of off-premise alcohol availability. One review of four USA natural experiments reported associations between higher off-premise density and increased alcohol consumption;¹⁰ while another review of five USA and Canadian studies found limited or inconsistent evidence for effects on consumption.¹¹

A comprehensive review of 65 studies, published between 2009–14, suggested off-premise density may be more strongly associated with violence than on-premise density, although substantial heterogeneity in included study designs (cross-sectional, longitudinal and natural experiments) and measures limited firm conclusions.⁹ These mixed findings may partly reflect differences in the mechanisms through which outlet types influence consumption and harms. Researchers have proposed on-premise and off-premise outlets may contribute to harm through different pathways, with on-premise outlets more directly related to acute harms like injuries and drink-driving, and off-premise outlets potentially contributing to more chronic health harms.¹⁴ For example, spatial ecology theory, which emphasises the relationship between the individual and their environment, suggests that highly dense areas of on-premise outlets can bring more intoxicated people into contact with each other and increase the likelihood of intoxication and interpersonal alcohol-related harms like assaults.¹⁵

Rapid reviews conducted for policy audiences have drawn similarly mixed conclusions. A 2017 review identified strong evidence linking outlet density with social disorder, but weaker evidence for impacts on alcohol consumption and chronic harms.¹² A 2016 rapid review found Australian studies consistently linked outlet density with violence, with most studies reporting changes in chronic health problems, while evidence for risky drinking, intimate partner violence, traffic crashes and underage drinking was less clear.¹³ Notably, this review highlighted the absence of studies directly evaluating policy-driven reductions in outlet density, with most evidence derived from studies examining incremental increases in availability or broader regulatory changes.¹³

However, attributing these harms directly to outlet density is challenging, as alcohol may also act as an aggravating, rather than causal, factor within environments already characterised by socioeconomic disadvantage, violence or crime.⁹

Importantly, alcohol outlet density is not randomly distributed across neighbourhoods. A substantial body of research demonstrates that outlets tend to concentrate in areas characterised by higher population density, greater retail activity and lower land rents, which are often in socioeconomically disadvantaged neighbourhoods. As a result, communities experiencing greater outlet exposure may also face higher levels of disadvantage, social disorganisation and environmental risk, meaning outlet density may act as a marker of, rather than solely drive, underlying patterns of harm.¹⁵⁻¹⁷

From a policy perspective, this means observed links between outlets and harms should be interpreted in light of wider neighbourhood conditions and structural inequalities. In addition, interventions targeting outlet density may have differential impacts across communities, particularly in areas already experiencing disproportionate exposure and harm.^{15, 17}

1.2 Purpose

The purpose of this rapid review is to examine whether higher densities of alcohol outlets contribute to increased alcohol consumption and alcohol-related harms. In undertaking this review, we seek to inform evidence-based decision-making.

1.3 Research question

The research question for the review was developed using the PICOT (patient, intervention, comparison, outcome, and time) framework, guided by the aims and purpose of the review, and reviewed by external experts.

The review addressed the following question: “Does higher density of on-premise and off-premise alcohol outlets contribute to increased alcohol consumption and related harms in Australia and comparable jurisdictions?”

The intent behind this research question is to synthesise evidence that captures temporal patterns and policy-driven changes in alcohol availability.

Previous systematic reviews have highlighted the importance of longitudinal and quasi-experimental designs for examining changes in alcohol consumption and related harms over time.^{9, 11, 13} Longitudinal studies can determine if gradual increases in outlet density over time are related to changes in alcohol-related harms.⁷ Also, natural experiments, such as examining secondary hospital data before and after introducing alcohol sales in supermarkets, can provide a robust source of evidence to enable inferences around causality.^{1, 7} Accordingly, this review focused on study designs that align with these recommendations, in order to better understand the relationship between outlet density and alcohol consumption and related harms.

2. Methods

The review is guided by Cochrane’s definition of a rapid review – a streamlined form of knowledge synthesis that accelerates the systematic process of reviewing evidence by simplifying or removing specific steps to produce timely, resource efficient evidence for decision makers.¹⁸ The PRISMA guidelines for systematic reviews were used to inform the structure of this report.¹⁹

2.1 Eligibility criteria

The search was limited to studies published from 2010 onwards, available in English and with original data. Consistent with Cochrane rapid review guidance,¹⁸ which permits restriction of search dates where clinical or methodological justification is provided, this timeframe was selected to prioritise evidence most relevant to contemporary alcohol policy environments, outlet licensing frameworks and analytical methods.

Studies were excluded if they lacked pre/post data e.g. cross-sectional studies; were reviews, opinion or commentary pieces, editorials, essays, book chapters, conference abstracts, theses/dissertations or policy submissions; addressed the general topic but did not align with the research question or were published in countries other than Australia, New Zealand (NZ), the United States (USA), Canada, the United Kingdom (UK), Ireland and those within the Nordic region (including Denmark, Finland, Norway and Sweden). Nordic countries were included alongside English-speaking OECD countries due to their comparable alcohol policy frameworks, public health systems, and harm-focused research. These contexts provide more meaningful policy and epidemiological parallels to Australia than other European countries (e.g. Germany), where alcohol is more culturally integrated and regulatory environments differ substantially.

2.2 Search strategy

Search terms and synonyms were developed by the authors and reviewed by external experts and key staff. Key search terms included: ‘alcohol’, ‘outlet density’, ‘availability’, ‘consumption’ and ‘harms.’ Strings were tested using several seed articles, revised and finalised by the Librarian, and then applied across four databases – the [ADF Library](#) (specialist alcohol and other drugs library), Google Scholar and Pub Med Central for peer-reviewed literature, and Google for grey literature.

2.3 Screening and selection

Searches were completed in September 2025 by the Librarian and one reviewer (NB), with the first 300 relevant results from each search string assessed according to the search strategy, duplicates removed, and all eligible publications saved and imported to [Covidence](#) for abstract and full text review.

This approach aligns with literature searching recommendations, particularly for Google Scholar and Google, as relevant literature is typically found within the first 100 – 300 results.^{20, 21} Searching beyond 300 (of 5,000+ results) yielded diminishing returns, with few additional relevant studies identified and an increasing proportion of duplicates or clearly irrelevant records.

All abstracts were single screened by NB or MS, with 20% of full texts dual screened by two of the authors (NB and MS). In addition, hand searching of references was conducted for papers that addressed the general topic but did not align with the research question. Any full text papers that were identified as ineligible for inclusion were discussed between reviewers to reach consensus. Where there was uncertainty about whether to include or exclude a study in the full text stage in Covidence, a reviewer marked the study as ‘unsure’ and discussed it with another reviewer until consensus to include or exclude the study in the review was reached. See Appendix 1 for a copy of the full search strings.

2.4 Data extraction, critical appraisal and evidence synthesis

Data extraction fields were developed and tested in Covidence, tailored to the included study designs and the research question. Critical appraisal was conducted using Joanna Briggs Institute (JBI) checklists for cohort, case-control and quasi-experimental studies.²² One reviewer (MS or SZ) completed data extraction and critical appraisal for all included studies, with a second reviewer (NB) independently assessing 20% of records for consistency. Discrepancies were resolved through discussion between the two reviewers.

While JBI tools were used to systematically identify methodological strengths and limitations, several checklist items were not well aligned with the predominately ecological, longitudinal and quasi-experimental designs included in this review (see results for more detail). Accordingly, quality appraisal results were used narratively to inform judgement about the credibility, consistency and policy relevance of findings, rather than as a basis for excluding studies.

All identified studies, irrespective of critical appraisal outcomes, were therefore included in the evidence synthesis. Study quality was explicitly considered during evidence synthesis, with greater interpretive weight given to findings from studies with more robust designs (e.g. natural experiments, well-conducted longitudinal analyses with clear exposure measurement and appropriate handling of confounding).

Findings from studies with greater methodological limitations, such as imprecise exposure measurement, limited adjustment for confounding, or weak temporal alignment between outlet density and outcomes, were interpreted more cautiously, particularly where results were isolated or inconsistent with the broader evidence base. As a result, conclusions were informed not only by the number of studies available for each outcome, but by the overall strength, consistency and methodological robustness of the evidence.

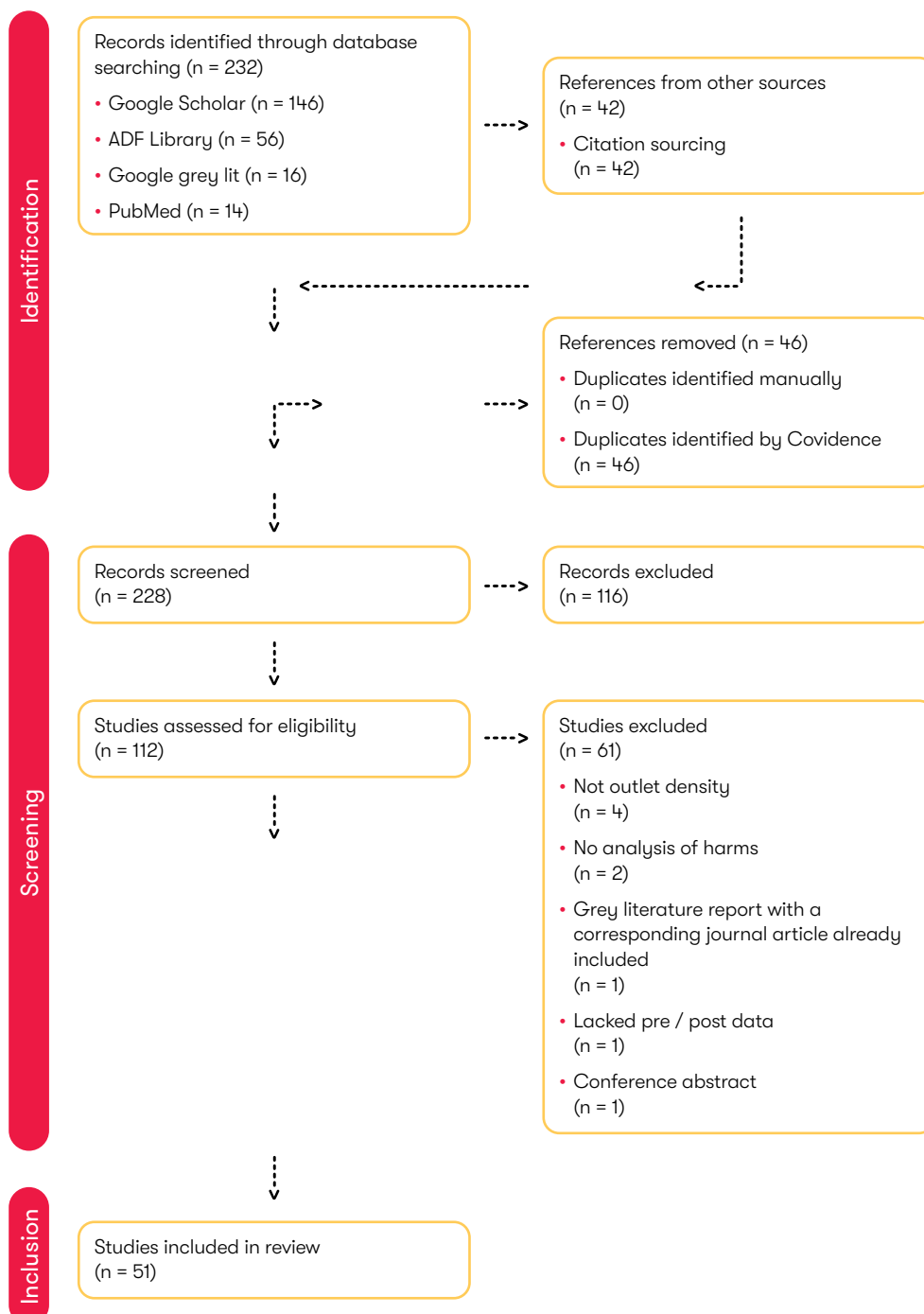
Results from the evidence synthesis were exported from Covidence, cleaned in Excel and organised into tables by MS. A narrative synthesis of the findings was then conducted by MS and NB.

3. Results

3.1 Search results and screening

Search results were assessed for eligibility and subsequently screened for full text review, as summarised in Figure 1 below.

Figure 1: PRISMA flow diagram of the literature search and selection



3.2 Characteristics of included studies

Fifty-one studies were considered eligible for inclusion in the review, see Table 8 in the Appendices for a full summary of results, from page 37.

3.2.1 Data source location

Of the 51 eligible studies, more than half were from the USA ($n = 28$, 55%), followed by Australia ($n = 9$, 18%), Canada ($n = 6$, 12%), Finland ($n = 3$, 6%), Sweden ($n = 2$, 4%), the UK ($n = 2$, 4%), and NZ ($n = 1$, 2%).

3.2.2 Study design and literature type

Most study designs were cohort or longitudinal ($n = 40$, 78%), followed by quasi-experimental ($n = 8$, 16%), and case control designs ($n = 3$, 6%). Almost all included studies were published in peer-reviewed journals ($n = 50$, 98%), with one (2%) government-commissioned grey literature study from Australia.

3.2.3 Publication year

More than half of the included studies were published in the six years between 2010–15 ($n = 28$, 55%), with the remaining studies published in the following 10-year period from 2016 to September 2025 ($n = 23$, 45%). The decline in the number of publications in the last decade may indicate a slowing of research output in this field but could also reflect changes in research priorities.

3.2.4 Research focus and type of outlet examined

Over half of the included studies examined on-premise and off-premise outlets in separate analyses ($n = 29$, 57%). Of the remaining studies, a quarter examined only off-premise outlets ($n = 13$, 25%), and about a fifth examined on-premise outlets ($n = 9$, 18%). Seven studies also examined crude or ‘total’ outlet density (14%), as a distinct category, with some including both aggregated and outlet-type specific categories.

3.2.5 Measurement of outlet density

Measurement of outlet density was coded against three primary methods - counting, proximity and spatial access (see glossary on pages 4-5 for definitions).^{1, 23} Just under two thirds of included studies measured outlet density via counting ($n = 32$, 63%), followed by spatial access ($n = 9$, 18%) and proximity measures ($n = 7$, 14%). One study used count and proximity measures, and two studies used other measures.

3.2.6 Outcomes examined

Outcomes from the included studies were organised into eight categories under three broad domains: alcohol consumption, health and medical harms and crime-related outcomes.

These included adolescent alcohol consumption ($n = 6$, 10%), adult alcohol consumption (including dependence) ($n = 9$, 16%), health and medical ($n = 9$, 16%), violent and assaultive crime ($n = 15$, 29%), gender-based family violence ($n = 6$, 10%), non-violent crime ($n = 4$, 7%), road safety ($n = 4$, 7%) and gun-related crime ($n = 3$, 5%).

In summary, violent crime and assault was the most studied outcome, followed by alcohol consumption and dependence, and health and medical-related outcomes, with non-violent crime, road safety and gun-related crime being the least studied.

3.2.7 Quality of studies

Critical appraisal of the quality of included studies was conducted using JBI checklists. To provide a transparent and consistent summary of methodology quality for the large number of studies included in the study, we applied a structured scoring method similar to Yimer et al.²⁴

Each item in JBI Critical Appraisal Checklist can be scored as ‘Yes’, ‘No’, ‘Unclear’ or ‘Not Applicable’ (NA). Each ‘Yes’ score (rather than ‘No’ or ‘Not Applicable’) was allocated one point, and these were summed up to generate an overall quality score for each study. JBI advises against using checklist scores on the

assumption that low quality studies are excluded from the review. In this review however, quality appraisal was used descriptively, and all studies meeting the inclusion criteria were retained, regardless of quality ratings, to capture as much of the evidence as possible.

Rather than exclude studies based on the quality appraisal, we took the approach of highlighting limitations, and methodological weakness and strengths across the studies that were identified by the quality appraisal. See Tables 5-7 in the Appendix for a full summary of critical appraisal results.

Cohort/longitudinal studies (n = 40)

The JBI checklist for cohort/longitudinal studies has 11 items.

Two items were excluded from the quality appraisal scoring because they were not applicable to most included studies and predominantly received 'NA' or 'No' responses, rather than reflecting poor methodological quality. These were Item 1 (*Were the two groups similar and recruited from the same population?*) and Item 6 (*Were the groups/participants free of the outcome at the start of the study (or at the moment of exposure?)*).

Two further items were also of limited relevance to many included studies but were retained in the quality appraisal score, because there were at least three 'Yes' answers. These were Item 9 (*Was follow up complete, and if not, were the reasons to loss to follow up described and explored?*) and Item 10 (*Were strategies to address incomplete follow up utilized?*).

High scoring items for cohort/longitudinal studies included Item 11 (*Was appropriate statistical analysis used?*), Item 4 (*Were confounding factors identified?*) and Item 5 (*Were strategies to deal with confounding factors stated?*).

Study quality varied, with most studies scoring a total quality score of 6 out of 9 (n = 17, 43%), with the lowest score being 1 out of 9²⁵ and the highest 7 out of 9.²⁶

The most common weakness amongst the cohort/longitudinal studies centred around the lack of a comparison group and follow-up of participants, however for many studies, these were irrelevant due to the study design (e.g. time series or panel study).

Study strengths (where critical appraisal items scored highly) included identifying and dealing with confounding (Items 4 and 5), validity of exposure outcome measures (Items 3 and 7), sufficient follow-up time (Item 8) and using appropriate statistical analyses (Item 11).

Quasi-experimental studies (n = 8)

The JBI checklist for quasi-experimental studies has nine items. Quality of studies was mixed with four studies scoring 5 or less out of 10,²⁷⁻³⁰ and four studies scoring 6 or higher.³¹⁻³⁴ Critical appraisal items that scored 100% included using appropriate statistical analyses (Item 9) and clearly distinguishing between the cause and effect under investigation (Item 1). Items with low scores included Item 3 (*Were participants included in any comparisons similar?*) and Item 8 (*Was follow-up complete and if not, were differences between groups in terms of their follow-up adequately described and analysed?*), however these items were only relevant to a small number of the included quasi-experimental studies.

Case control studies (n = 3)

The JBI checklist for case-control studies has 10 items. Study quality was high for these studies with two studies scoring 8 out of 10³⁵ and 9 out of 10,³⁶ and a third scoring 6 out of 10.³⁷ All items scored well except for Item 4 (*Was exposure measured in a standard, valid and reliable way?*) and Item 8 (*Were outcomes assessed in a standard, valid and reliable way for cases and controls?*).

4. Evidence statement (findings)

Across the 51 included studies, alcohol outlet density was examined in relation to eight outcome categories under three broad domains: alcohol consumption, health and medical outcomes and crime-related disorder outcomes. For a full summary of findings, see Table 8 in the Appendices from page 37.

4.1 Alcohol consumption outcomes

4.1.1 Adolescent alcohol consumption

Six studies (USA n = 4, Australia n = 2) examined adolescent alcohol consumption.^{38, 41, 42}

Five were cohort/longitudinal studies, and one was quasi-experimental. Studies assessed on-premise outlets (n = 1), off-premise (n = 2), and both (n = 3), using count (n = 5) and proximity (n = 1) measures.

Across studies, higher outlet density was generally associated with greater adolescent alcohol consumption, though two studies reported negative associations for specific subgroups. Some variation was observed by outlet type and age, with effects stronger for proximity to off-premise outlets during mid-adolescence.

On-premise outlets

Two studies examining on-premise outlets reported mixed associations with adolescent alcohol consumption.^{32, 39}

One USA study³⁹ investigated whether increases in adolescent alcohol use and heavy drinking over a three year period would be greater in communities with higher on-premise outlet density. The study used a fixed measure of bar density and did not examine the relationship between changing bar density over time and adolescent alcohol use. Using three waves of self-report data from adolescents across 50 Californian cities, higher bar density was significantly associated with greater adolescent alcohol use in the past year, though not past-year heavy drinking.³⁹ The effect of bar density was at least partially mediated by adolescent alcohol-related beliefs, including perceived alcohol availability and perceived parental approval of alcohol use.

The authors speculated that bar density may signal social acceptability of alcohol to adolescents. Adolescents living in cities where adults had higher levels of alcohol consumption also experienced greater increases in past-year alcohol use and heavy drinking over three years. Contrary to expectations, there was no association between enforcement of underaged drinking laws and adolescent perceived enforcement.³⁹

In a USA quasi-experimental study,³² researchers examined whether changes in the alcohol environment due to moving neighbourhoods influenced adolescent alcohol use. The study examined an intervention (Moving to Opportunity) for families living in public housing, by randomly allocating families to relocate to either: 1) any neighbourhood; 2) a neighbourhood with less than 10% poverty (intervention groups where neighbourhoods had improved socioeconomic conditions); or 3) remain in public housing.

The findings were somewhat unexpected: among girls higher on-premise outlet density (measured per square mile) was associated with a significant reduction in drinking, whereas no association was observed when outlet density was measured using raw counts.³² The intervention did not have a significant interaction with boys' drinking patterns for either measure of on-premise density used.³²

Qualitative data suggested that girls who moved to high-density outlet neighbourhoods may have been more selective in their new social networks, whereas boys reported being less selective and more likely to spend time in unsupervised public settings. The authors suggested that these gender differences may reflect unmeasured contextual or social factors.³² As with many studies in this field, outlet density may reflect broader neighbourhood conditions, making it difficult to isolate its independent effect on adolescent drinking.

Off-premise outlets

Three studies^{38, 41, 42} investigated off-premise outlets and generally reported significant associations with adolescent alcohol consumption.

In Perth, Australia, proximity to liquor stores at age 14 predicted alcohol use at age 17, but not at age 20.⁴²

Living or studying within 800 metres of a liquor store at age 14 was associated with a 49% increase in the odds of ever drinking and a 79% increase in the odds of ever engaging in heavy drinking at age 17. However, this relationship did not persist at age 20. Similarly to the Californian study of adolescent alcohol use mentioned above for on-premise outlets, this study also examined adolescent behaviour over time to a fixed measure of bar density at baseline, rather than measuring the relationship between changing availability of alcohol and behaviour.

Two USA studies reported complex longitudinal patterns of adolescent alcohol use.

In a national sample,⁴¹ students in areas with high numbers of off-premise alcohol outlets at baseline reported lower alcohol use in Year 6 compared to those in low-density areas. However, their drinking increased more sharply between Years 6 and 8, eventually matching their peers. The authors suggested this may reflect younger adolescents in low-density areas relying more on social sources of alcohol, and that as adolescents get older access to retail outlets may become more influential. In California, USA,³⁸ adolescents living in areas with higher off-premise alcohol outlet densities had higher initial levels of drinking. However, over time drinking increased more rapidly in areas with lower outlet densities. The authors suggested that young people in areas with fewer off-premise outlets may rely on social networks to access alcohol, for example, travelling with friends who have access to a car to purchase it elsewhere.

Similar patterns were observed for on-premise outlets in the same USA quasi-experimental study described earlier.³² Excessive drinking significantly decreased among girls living in areas with higher off-premise outlets for both density and count measures. The intervention was estimated to be 18% more beneficial for girls who moved to high-density neighbourhoods, compared with those who remained in public housing in high density neighbourhoods. No effects were observed for boys.³²

Total outlet density

One study examined total outlet density and reported a significant positive association with alcohol consumption.⁴⁰

Using Australian longitudinal data from Victorian high school students, a 10% increase in overall outlet density was associated with a 17% increase in the odds that an adolescent would consume alcohol in the following year.⁴⁰

However, this association was only found when outlet density was measured as an aggregate, when density measures were disaggregated by outlet type at wave one; none of the outlet types were associated with consumption at wave two. This may indicate that overall alcohol availability is more strongly related to adolescent drinking than specific outlet types in isolation, or that disaggregated analyses reduce statistical power or mask combined effects across outlet types. The authors noted that the finding was inconsistent with cross-sectional research and may reflect unexamined changes in outlet density in Victoria over time and recommended that “longitudinal growth modelling should examine how changes in different types of density are associated with adolescent consumption.”⁴⁰ (p45)

4.1.2 Adult alcohol consumption (including dependence)

Nine cohort/longitudinal studies (USA n = 4, Finland n = 3, Sweden n = 2) examined alcohol consumption and dependence.^{26, 43-49}

The three Finnish studies drew insights from the same large longitudinal dataset of public sector employees.^{26, 46, 50} No eligible Australian studies examined this outcome. Six studies examined the number of alcohol outlets^{26, 43-45, 47, 48} (two of which also included proximity measures^{26, 43}).

Overall, higher outlet density was associated with increased alcohol consumption and alcohol use disorder (AUD) though some gender- and beverage-specific differences were observed (with five studies examining gender differences^{26, 44, 46, 47, 49}). Socioeconomic effects were reported in three studies.^{44, 45, 47}

On-premise outlets

Four studies examined on-premise outlets, with all reporting significant associations with increased alcohol consumption.

In a USA cohort study⁴⁴ of participants from six sites across six different states, changes in outlet density and neighbourhood socioeconomic status over 10 years were associated with changes in alcohol use, however this was not in the expected direction for on-premise outlets. More specifically, higher bar density was linked with reductions in weekly liquor consumption for women but not for men.⁴⁴

Also in the USA, in a study across four large urbanised cities in different states, higher bar density in the immediate area surrounding the home was associated with increased alcohol consumption.⁴⁸

In Finland, living less than 1km from a bar was linked to higher odds of risky drinking behaviours compared to living further away.⁵⁰ Moving 1km closer to a bar was associated with a 17% increase in the odds of heavy alcohol use and a 3% increase in the odds of extreme drinking occasions.⁵⁰

Among a representative sample of Swedish employees, a decrease in the distance from work to the nearest bar was related to increased odds of 'problem drinking'.⁴⁹

Off-premise outlets

Five studies examined off-premise outlets. Each reported evidence of a significant positive association for alcohol consumption or dependence for at least one measured outcome, although results varied across beverage type, gender and outcome.

In a USA cohort study,⁴⁴ increases in liquor store densities over 10 years were associated with increases in weekly alcohol consumption.

For men, each additional four liquor stores per square mile were related to a 32% increase in weekly beer consumption, with no association for current or heavy daily alcohol use.⁴⁴ For women, higher liquor store density was linked with a 16% increase in weekly wine consumption.⁴⁴ The authors speculated that the "availability of alcohol purchased off-site has a stronger influence on weekly consumption than the availability of places to drink alcohol on-site."⁴⁴(p9)

A second USA study in Philadelphia, Pennsylvania,⁴³ examined changes in off-premise alcohol outlet density and alcohol use after regulatory changes increased alcohol availability, and compared this to neighbouring New Jersey and Delaware, where alcohol regulations did not change during the study period. Longitudinal analysis found that one year after the relaxation of alcohol regulations, residents of areas with higher alcohol outlet density had higher odds of drinking on more days per week, and of consuming more drinks per week.⁴³

Moving to three included Nordic studies, a Swedish study that investigated associations between a change in the distance to the nearest alcohol outlet and 'problem drinking' found that a decrease in the distance from home to the nearest liquor outlet was associated with an increased likelihood of 'problem drinking', while increased distance to the nearest beer outlet was protective.⁴⁹

Findings from two Finnish studies were mixed.

A 2014 cohort study of Finnish public servants examined the associations between the number and the change in number of alcohol outlets near home with alcohol consumption by beverage type, and found that having three or more wine outlets within 0.5 km of home was linked to higher wine consumption for both men and women.⁴⁶ Furthermore, an increase in the number of wine outlets over time was associated with increased wine consumption among women, and to a lesser extent among men, although confidence

intervals were close to null.⁴⁶ To control for the bias of participants moving closer to areas of higher alcohol availability, the authors analysed participants who did not move neighbourhoods between the surveys, and found that the associations (albeit weak) remained, suggesting that the increase in wine consumption may be due to other factors not related to moving into areas of higher availability.⁴⁶ No associations were observed for beer and liquor outlets.⁴⁶ While analyses adjusted for multiple individual level and neighbourhood level covariates (including age, SES, marital status, neighbourhood disadvantage and population density), alcohol outlet density alone provides an incomplete representation of neighbourhood environments following relocation. Participants may have moved into areas differing in social organisation, retail activity, land use mix, or local norms, which could independently influence drinking behaviours and complicate interpretation of outlet density effects.

A 2013 study²⁶ using the same Finnish Public Sector cohort examining changes in proximity between home and liquor and beer outlets found that a decrease in the distance to the nearest beer outlet increased the odds of heavy alcohol use among women, but not men. Conversely, closer proximity to beer outlets was linked with a decreased likelihood of heavy alcohol use among men.

As for the 2014 Finnish study, the authors controlled for the bias of participants moving to areas with greater alcohol availability, and found the associations remained, although all confidence intervals were close to the null.²⁶ The authors suggested these gendered differences may reflect gendered purchasing and drinking patterns; in Finland, women may purchase smaller amounts of alcohol and prefer to do so closer to home, whereas for men distance to outlets from home may be less relevant because larger quantities of beer may be purchased in a single trip.²⁶ The associations for beer outlets were stronger than those for liquor outlets, and possibly explained by the small number of liquor outlets in Finland.²⁶

It should be pointed out that all three Nordic studies used employed people (from the Swedish Longitudinal Occupational Survey of Health⁴⁹) and a section of the workforce (Finnish Public Sector Study^{26, 46}) and may be subject to the Healthy Worker Effect (which is a type of selection bias based on the premise that employed people are generally healthier than people who are not employed),⁵¹ thereby limiting the generalisability of results to other population groups.

Total outlet density

Two studies examined an aggregated outlet measure, with both reporting a significant positive association on at least one measured outcome.

A large cohort study with six USA sites found a significant association between increased outlet density (liquor stores and bars aggregated) and weekly alcohol use, with no link for current or heavy daily alcohol use.⁴⁴ In Sweden, living in a neighbourhood with at least one alcohol outlet of any type was associated with a significant increase in the likelihood of developing an AUD, though there was no link with AUD recurrence eight years later.⁴⁷

4.2 Health and medical outcomes

Nine studies^{33, 34, 52-58} (Canada n = 5, Australia n = 3, USA n = 1) examined acute and chronic health harms, including ED visits, hospitalisations and alcohol-related deaths. Seven studies were cohort/longitudinal, and two quasi-experimental. On-premise (n = 6) and off-premise outlets (n = 9) were examined using count (n = 7), spatial access (n = 1), proximity (n = 1), and other (n = 1) measures.

Most studies reported positive associations between higher outlet density and health-related harms, with off-premise alcohol availability showing more consistent effects. Regional and ownership type (private vs government stores) were occasionally reported as modifiers.

On-premise outlets

Overall, four of five studies reported a significant positive association between increased on-premise outlet densities and health and medical outcomes.

Two studies published in 2015 and 2016 investigated the effects of bar outlet density and alcohol sales on alcohol-related ED injuries in Perth, Australia, with the 2015 study also examining extended trading hours.^{52, 53}

Both studies reported a statistically significant increase in alcohol-related ED injuries associated with an increase in on-premise outlet density. The 2016 study found the association was for the inner and outer zones of metropolitan Perth.⁵³ Each additional on-premise outlet linked to a 0.8% increase in alcohol-related ED injuries for the inner zone (which has a higher mean age and higher male-to-female ratio than the middle zone) and a 2.1% increase in injuries in the outer zone (which has a higher proportion of Indigenous residents than the inner and middle zones).⁵³ The 2015 study found the positive association was for on-premise outlets with and without extended trading hours,⁴⁶ however the risk of alcohol-related ED injury was larger for outlets with extended trading hours, with each additional on-premise outlet linked to a 4.6% increase in night injuries compared with on-premise outlets with standard trading hours with a 0.6% increase in night injuries.⁴⁶

The same two studies also examined alcohol sales; the 2016 study reported a significant positive relationship between increased on-premise sales and alcohol-related ED injuries (for the outer zone of Perth metro),⁵³ while the 2015 study found no association.⁵² We are unable to explain the differences in association between the two studies regarding on-premise sales and alcohol-related ED injuries.

In Melbourne, Australia, pub/nightclub density was positively associated with rates of assault-related hospital admissions over a 12-year period.⁵⁴ The same study reported a small - but significant - relationship between chronic disease and 'on-premise licences', most of which were restaurants and cafes.

Studies conducted in the context of a rapid increase in privately owned liquor stores in British Columbia, Canada reported mixed findings by outlet type. One study found a significant positive relationship between on-premise outlet density and alcohol-related deaths,⁵⁶ with another also reporting a positive relationship between increased bar density and alcohol-related deaths.⁵⁸ In contrast, three studies found no association between restaurant density and alcohol-related deaths or alcohol-attributable hospital admissions.⁵⁶⁻⁵⁸

Overall, the evidence indicates that higher densities of bars and similar on-premise drinking establishments are associated with increased acute and chronic alcohol-related harms, whereas restaurant density appears less consistently related to adverse health outcomes.

Off-premise outlets

Seven of eight studies reported a significant positive association between off-premise outlet densities and health and medical outcomes.

More specifically, significant effects were reported on ED and outpatient visits in Ontario Canada;^{33, 55} assault hospitalisations and chronic alcohol-caused hospitalisations in Melbourne;⁵⁴ and, accidental injury hospitalisations in Washington when compared to Oregon.³⁴ These findings collectively suggest that increased off-premise availability contributes to both acute injury and longer-term health harms.

Two Perth (Australia) studies from 2015⁵² and 2016⁵³ investigated the effects of alcohol availability (through counts of licensed outlets, and volume of alcohol sales) on alcohol-related ED injuries.

Both studies reported a significant increase in the risk of alcohol-related ED injuries with higher off-premise alcohol sales, alongside a significant decrease in the risk as the number of off-premise alcohol outlets increased.^{52, 53} The authors suggested that the positive association between alcohol-related ED injuries and alcohol sales may be influenced by the affordability of off-premise alcohol prices, particularly through large retail chain stores, allowing people to purchase a greater volume of alcohol for lower prices.

Conversely, the negative association with outlet counts may reflect reduced travel time to outlets from work or home, thereby reducing risk of motor vehicle injury, or a greater tendency to consume alcohol from off-premise outlets at home, rather than drinking in on-premise venues where alcohol is more expensive.⁵²

The 2016⁵³ study also examined the effects of distance from Perth's central business district (CBD) (measured as 'inner', 'middle' and 'outer' zones) on alcohol-related ED injuries. For alcohol sales, only the middle zone was positively and significantly associated with risk of alcohol-related ED injuries, and for outlet density, the inner and outer zones were significantly but negatively associated with risk of alcohol-related ED injuries.⁵³ These findings indicate that the relationship between alcohol-related ED injuries and alcohol availability varied by proximity to the CBD. On this basis, the authors recommended that interventions to reduce risk of alcohol-related injury in the middle zone include controls over alcohol pricing, as a means of reducing overall sales volume.⁵³

In British Columbia, Canada, increased availability of private liquor stores was associated with alcohol-attributable hospital admissions⁵⁷ and alcohol-related deaths.^{56, 58} Canadian government liquor stores results were mixed; alcohol-related deaths were significantly negatively linked with government liquor stores in one study,⁵⁶ but showed a positive, albeit statistically non-significant, relationship with alcohol-related deaths in another study.⁵⁸

In summary, the evidence for off-premise outlets demonstrates a largely consistent positive association with alcohol-related morbidity and mortality, although some heterogeneity exists depending on whether density or sales volume, and ownership structure is examined.

4.3 Crime-related outcomes

4.3.1 Violent and assaultive crime

Fifteen studies (USA n = 10, Australia n = 3, UK n = 1, Canada n = 1) examined violent crime and assault.^{17, 25, 27, 28, 30, 54, 59-67} Eleven were cohort/longitudinal in design, with four quasi-experimental. Thirteen studies examined on-premise outlets and ten examined off-premise outlets, using count (n = 10), spatial access (n = 4) and other (n = 1) measures.

Several studies reported multiple violent crime outcomes; therefore, study counts in the below sub-sections reflect whether at least one outcome showed the stated association. Overall, the evidence was broadly in support of a relationship between increased outlet density and violent crime, particularly for on-premise outlets, with most reporting a significant positive association. Effects varied by neighbourhood socioeconomic factors, outlet clustering and licence type.

On-premise outlets

Overall, the evidence for on-premise outlets indicates a consistent positive association with violent crime and assault outcomes, with ten studies reporting significant positive associations.^{17, 25, 27, 54, 59, 61, 62, 64, 65, 67}

In Melbourne, higher on-premise outlet density was associated with rates of assault-related hospital admissions, a proxy indicator of alcohol-related violent harm.⁵⁴

In NSW, an increase of one alcohol outlet per local government area was associated with a 0.7% increase in assaults, and a 1.73% increase in alcohol-related assaults.⁶⁷ These effects were greater in areas with a higher proportion of Aboriginal and Torres Strait Islander peoples. When examining alcohol licence types, the same study found higher densities of hotels were significantly linked with an increase in the assault rate.⁶⁷

In Queensland, a higher density of late-closing, higher-risk venues was associated with increased assaults.⁶⁴

In California, USA,¹⁷ a 10% greater proportion of bars was related to a 7.5% increase in assaults, and a similar increase in bar density in surrounding areas was related to a 6.2% increase in assaults. The effects of increased bar density were much greater in lower-income and more densely populated areas, suggesting socioeconomic context modified the relationship.¹⁷

In inner London, each additional licensed drinking establishment was significantly associated with a 1.6% increase in alcohol-related violence.⁵⁹ The same study found a negative significant effect for increased 'other' outlets, like theatres, cinemas and cultural venues, suggesting this was protective against alcohol-related violence.⁵⁹

Three studies found a positive but non-significant relationship between violent crime and on-premise outlet density.^{25, 27, 60}

In Oakland, USA, new bar/pub openings were related to a 3.5% increase in assaults²⁷ and in the state of California, USA each 5% increase in bars and pubs corresponded to a 4% increase in the violent crime rate over a period of 12 years,⁶⁰ although these results did not reach statistical significance. In Detroit, USA, there was a non-significant relationship between increased density and various types of violent crime.²⁵

Notably in the Oakland study, researchers were able to demonstrate that new restaurants and bars/pubs tended to open in areas already characterised by high concentrations of similar venues, reflecting density-dependent 'agglomeration'. This clustering of outlets in some urban neighbourhoods may contribute to the development of localised violence 'hot-spots'.²⁷

Two studies reported no relationship between on-premise outlets and violent crime outcomes.^{27, 63}

A Canadian study⁶³ showed no evidence of a significant association for bars and restaurants and violent crimes, and another in Oakland reported no association for restaurants and assaults.²⁷ Spatial analyses suggested that patterns of co-location between bars and specific offenses like rape and murder developed over time, for example more isolated bars being co-located with murder.

Importantly, two studies examining reductions in on-premise outlet density reported consistent negative associations with violent crime.^{30, 66}

In Atlanta, USA,³⁰ a 3.2% reduction in on-premise outlet density was linked with a two-fold greater reduction in neighbourhood exposure to violent crime, relative to control areas.³⁰ While, in New Orleans a reduction in on-premise licensed outlets corresponded with decreased assaultive violence, although this finding did not reach statistical significance.⁶⁶ Taken together, these intervention and natural experiment studies strengthen the inference that a reduction in on-premise availability can contribute to reduced violent crime.

Off-premise outlets

In contrast to the relatively consistent findings for on-premise outlets, results for off-premise outlets were more mixed.

Three studies reported significant positive associations between off-premise outlet density and violent crime,^{27, 54, 62} with a fourth reporting a non-significant association.⁶⁵

In Melbourne,⁵⁴ higher densities of off-premise alcohol outlets were related to increased rates of assault-related hospital admissions.

In Oakland,²⁷ increases in off-premise outlets were significantly associated with reported assaults, although the effect size was small and confidence intervals were close to the null.

In Lubbock, Texas,⁶² there was a significant, spatially lagged effect indicating that higher outlet density was associated with higher rates of violent crime in adjacent neighbourhoods. This result is discussed below, together with another study from Lubbock Texas examining off-premise outlets.²⁷

Finally, one study reported a positive but non-significant association between the number of off-premise outlets in Norfolk, USA, and violent street crime, including homicide.⁶⁵

Two studies reported a significant reduction in assaults linked to off-premise density.^{17, 66}

In California,¹⁷ a higher proportion of off-premise outlets relative to on-premise outlets was significantly linked to fewer assault hospitalisations after adjusting for overall outlet density.

In New Orleans,⁶⁶ the implementation of a policy which increased off-premise licence fees and enhanced enforcement was related to a significant decrease in the positive relationship between off-premise outlet density and assaultive violence. Specifically, each one unit increase in off-premise density was related to a 4% smaller increase in the crime rate every two years, until the relationship stabilised in 1999.

Another California study examined trends in violent crime rates between 2005–17 and included outlet density as one of several spatially lagged correlates. The authors observed a non-significant reduction in violent crime with increasing off-premise outlet density.⁶⁰

Finally, six studies reported no association between off-premise outlets and violent crime outcomes for at least one outcome.^{27, 28, 59, 62, 63, 67}

These included findings from London, where takeaway and ‘off-sales’ licensing applications were not associated with alcohol-related crime,⁵⁹ and from NSW, Australia, where there was no association between off-premise outlet density and the rate of assault over four years.⁶⁷ See Table 4 in the Appendices for a full summary of results.

Two studies from Lubbock, Texas,^{28, 62} investigated the effects on violence after a policy change that ended the prohibition of off-premise alcohol outlets, resulting in a large and sudden increase in outlet density. Time-series analysis of city-wide violence rates before and after policy implementation found no significant association between off-premise outlet density and violent crime or assaults.²⁸

This result was consistent with a second study,⁶² which examined the same policy change at a smaller geographical level (census block groups) and similarly found no association within these areas. However, as mentioned above, spatial lag effects indicated that higher densities of off-premise outlets were related to increased violent crime in adjacent neighbourhoods.⁶²

Taken together, these findings suggest that increases in off-premise outlet density may not reduce violence overall but, instead, shift harms (displace) to neighbouring areas.

Overall, while there is evidence that higher off-premise outlet density may be associated with increased violent crime in some settings, findings are less consistent than for on-premise outlets. The heterogeneity in direction and magnitude of effects suggests that contextual factors such as neighbourhood socioeconomic composition, spatial distribution of outlets, and differences in outcome measurement may play a more substantial role in shaping off-premise effects.

4.3.2 Gender-based family violence

Six cohort/longitudinal studies (Australia $n = 3$, USA $n = 2$, UK $n = 1$), examined gender-based family violence (GBFV).⁶⁷⁻⁷² Studies used count ($n = 5$) and spatial access ($n = 1$) measures for on-premise outlets ($n = 5$) and off-premise outlets ($n = 6$).

Most studies reported significant positive associations between higher outlet density and GBFV. Some negative or null effects were observed in specific contexts, including off-premise density in higher socioeconomic contexts or during COVID-19 related closures.

On-premise outlets

Of the five studies examining on-premise outlets, four reported a positive association between outlet density and GBFV outcomes on at least one outcome, while one found no significant relationship.

In Melbourne, Australia, alcohol outlet density was significantly associated with police-reported rates of domestic violence (DV) over time, however the effect was small and non-significant for on-premise outlets.⁷²

In New South Wales, Australia, an increase in on-premise outlets (i.e. nightclubs, cafes, restaurants) was linked with an increased rate of domestic assaults.⁶⁷

In California, there was a significant increase in the risk of interpersonal violence (IPV) related ED visits with higher outlet density of pubs and bars (but not for restaurants).⁶⁸ In contrast, no association was found between IPV-related police calls and crime reports with the number of Sacramento bars or restaurants.⁶⁹

In Western Australia, a study investigated associations between substantiated child maltreatment cases, numbers of licensed outlets, and average alcohol sales volumes at the community level, and found no relationship between on-premise outlet density or on-premise alcohol sales volumes and child maltreatment substantiations.⁷⁰

Off-premise outlets

All six studies examined off-premise outlet density. Four studies reported a significant positive association with GBFV, one identifying a significant negative association and one reporting no association.

In the same Melbourne study as above, a significant increase in DV rates was observed with greater off-premise outlet density, with an increase of 0.66 DV incidents per 1,000 residents for each additional off-premise outlet.⁷²

Similarly, in Sacramento, USA, increasing off-premise outlet density was significantly associated with higher rates of IPV-related police calls.⁶⁹

In NSW, Australia, a study⁶⁷ found a significant positive association between DV and outlet densities, with higher rates of alcohol-related DV compared to alcohol-related non-domestic assaults. For each additional outlet, there was a 1.3% increase in domestic assaults and 0.7% increase in non-domestic assaults. An increase of one alcohol outlet per local government area was also linked with a 2.2% increase in alcohol-related domestic assaults and a 1.7% increase in alcohol-related non-domestic assaults.⁶⁷ The study also found effects were greater in areas with a higher proportion of Aboriginal and Torres Strait Islander peoples.⁶⁷

The same Western Australian study⁷⁰ mentioned above, investigated child maltreatment and identified an unexpected negative association between off-premise alcohol sales volumes and child maltreatment. Each additional 1,000 litres of ethanol sold per off-premise outlet was associated with a 3.7% decline in child maltreatment. The authors suggested this finding may reflect area-level affluence: “. . . may be acting as a marker of organization, with new businesses being recommended in commercially sound areas.”⁷⁰(p 50). This finding was significant even after adjusting for median household income. There was no significant association between off-premise outlet density and child maltreatment.⁷⁰

A Californian study⁶⁸ found higher off-premise outlet density was associated with a small inverse relationship with IPV-related ED visits; however this association was weak, and substantially smaller than that observed for bars (reported above). The authors cautioned that this finding was inconsistent with prior research and may reflect differences in drinking context (alcohol consumed at home) or broader unmeasured neighbourhood characteristics where off-premise outlets are located, rather than a protective effect of off-premise alcohol availability.

In NSW, no association was found for off-premise outlets and rates of domestic violence.⁶⁷

Finally, a UK study⁷¹ assessing off-premise availability during COVID-19 related on-premise closures found that while on-premise closures were associated with a three percentage points reduction in alcohol-related violent incidents, there was no significant change in the proportion of alcohol-related DV, suggesting no clear independent effect of off-premise alcohol availability in that context.

4.3.3 Non-violent crime

Four studies (USA n = 2, Canada n = 1, NZ n = 1) examined non-violent crime - including theft, motor vehicle theft, burglary, and alcohol-involved traffic incidents.^{25, 27, 63, 73} Three studies were cohort/longitudinal studies, and one was quasi-experimental. Studies used count (n = 2) and spatial access (n = 2) measures for off-premise outlets (n = 2) and on-premise outlets (n = 4). Positive associations were reported in most studies, but findings were heterogenous due to variation in crime type, outlet type and study context.

On-premise outlets

Three studies reported significant positive associations between on-premise outlet density and non-violent crime for at least one measured outcome.

In Oakland, California, burglaries increased in areas with higher densities of restaurants and bars/pubs, however this was only significant for restaurants, with a 5.3% increase in burglaries for each opening of a restaurant at the census tract level.²⁷

In Canada, following partial privatisation of off-premise sales, there was a non-significant trend for increased restaurant outlet density with decreased alcohol-involved traffic violations.⁶³

In Detroit, Michigan, a study²⁵ examining co-location of burglaries, MV theft and larceny-theft and on-premise outlets at local and wider geographical areas found all three crimes were more likely to occur where there were on-premise outlets at the local level, however burglaries were less likely to occur, and larceny-theft most likely to occur where there were bars across the wider geographical areas studied.

Off-premise outlets

Two studies reported positive associations between off-premise outlet density and non-violent crime, with one at the level of significance.

In Oakland, California, burglaries increased in areas with higher densities of off-premise outlets at the block group level, however this result was not statistically significant.²⁷

One Canadian study⁶³ examining partial privatisation of off-premise outlets found positive non-significant associations between private and government liquor store density and alcohol-involved traffic violations, though the relationship was significant for private liquor stores and non-alcohol involved traffic violations. The reason for a significant finding between non-alcohol involved traffic violations and private liquor stores and not alcohol involved traffic violations is unclear. However, the study examined the implementation of a minimum pricing policy alongside a policy relaxing outlet density restrictions, and found the effect of minimum pricing was greater than the partial privatisation of off-premise outlets on crime.⁶³ The authors also noted that in studies with greater power to detect an effect, with more time periods available for analysis, significant positive associations were found between private liquor store density and other alcohol-related harms.⁶³

Total outlet density

In Canterbury, NZ, increases in outlet densities following the 2010 earthquake were significantly associated with theft and social incivilities.⁷³ However, the same study found no association between burglary and outlet density.

4.3.4 Road safety

Four USA studies (three cohort/longitudinal, one quasi-experimental) examined road safety including motor vehicle crashes (MVCs) and driving under the influence (DUI) offences.^{31, 74-76} On- and off-premise outlets were assessed using proximity ($n = 2$) and count ($n = 1$) measures. Association with MVCs was stronger for bars than off-premise outlets, though some studies reported mixed or negative associations.

On-premise outlets

Two studies found significant increases in MVCs with increased outlet density.

A 10% increase in on-premise density was associated with a 2.4% increase in single-vehicle nighttime crashes in one multi-area USA study.⁷⁴ The authors noted the results varied on a number of factors including local traffic flow patterns and neighbourhood characteristics.

In California, a study found a 10% increase in bars was related to 1.4% more MVCs, 4.3% more crashes involving drivers who had been drinking, and 10.3% more single-vehicle nighttime crashes (SVNs).⁷⁵ In contrast, a 10% increase in restaurant density was related to a 6% decrease in SVN injury crashes.

Off-premise outlets

Two studies reported mixed findings for off-premise outlets and road safety outcomes.

A study in Lubbock, Texas, examined the effect of a change in policy that led to a large number of off-premise alcohol outlet permits in 2009 dispersed across the city.³¹ The authors reported weak effects of outlet density on total MVCs in the post policy period to 2012, but no significant effects for SVN crashes, which was used as a proxy for alcohol-related crashes.³¹ The null findings may be explained by a change in drinking behaviour, with increased off-premise availability leading to less driving after drinking, leading to fewer crashes. The study was limited by a lack of sales data and the use of a proxy measure of alcohol-involved crashes.³¹

A separate Texan study⁷⁶ investigating alcohol-related traffic accidents and DUI arrests found mixed results, with the number of expected accidents decreasing with outlets selling beer/wine, but increasing with outlets that sold all beverage types, with the effect occurring mostly from off-premise outlets that sell alcoholic beverages with a lower alcohol content.⁷⁶ The authors suggested that increased off-premise outlet density may reduce the distance driven after drinking or influence drinking patterns, while increased availability of spirits may contribute to higher DUI arrests.

Total outlet density

One study in California⁷⁵ examining total outlet density reported a significant positive association, finding that a 10% increase in all outlets across the state was related to a 2.8% increase in MVCs and a 2.5% increase in crashes involving drivers who had been drinking. In the same Texan study⁷⁶ reported above, there was a significant negative correlation between total outlet density and alcohol-related traffic accidents and DUI arrests; for one more outlet per hundred square miles, the number of expected accidents decreased by around 16%, and the number of expected DUI arrests decreased by 13%.

4.3.5 Gun-related outcomes

Three case-control USA studies examined firearm assault ($n = 2$)^{35, 36} and gun suicide ($n = 1$)³⁷ using proximity ($n = 2$) and count ($n = 1$) measures for both on- and off-premise outlets.

On-premise outlets

Two studies reported decreases in gun-related outcomes (suicide and firearm assault) with a higher density of on-premise outlets, although these associations were not significant.^{36, 37}

Off-premise outlets

Three studies examined associations between gun crime and off-premise outlet densities, with mixed findings.³⁵⁻³⁷

In California,³⁶ higher densities of both off-premise outlets and pawn firearm dealers were significantly associated with risk of firearm assault.

In Philadelphia,³⁷ higher alcohol outlet densities were associated with increased risk of gun suicide, although this association was not significant.

In another study in Philadelphia, greater proximity to liquor stores and beer stores was associated with a significant decrease in the risk of gun assault.³⁵

4.4 Strength of the evidence

Given consistent differences in the direction, strength and policy relevance of associations by outcome and outlet type, evidence strength is summarised separately for on-premise and off-premise alcohol outlets. The one outcome consistently linked to increased outlet density across all outlet types was with adult alcohol consumption and dependence, including when outlets were measured in the aggregate. Findings were more mixed for adolescent drinking and road safety, partly reflecting the small number of studies, which limits interpretability.

On-premise outlets

On-premise outlets, particularly bars and pubs, were more consistently linked to violent and assaultive crime, with more mixed evidence for non-violent crime, and road safety outcomes.

Of note, all studies reporting reductions in violence following policy-driven reductions in outlet density or availability examined on premise outlets. Associations between on premise outlet density and adult alcohol consumption and dependence were generally positive, though more variable, while evidence for adolescent alcohol consumption, non violent crime, road safety, and gun related outcomes was mixed or limited.

Off-premise outlets

Off-premise outlets showed more consistent associations with adolescent drinking, adult alcohol consumption and dependence, and GBFV with generally positive but mixed evidence for health and medical outcomes.

Evidence linking off premise outlet density with gender-based family violence was more consistent than for on premise outlets, although overall evidence strength remained limited due to the smaller number of studies. Findings for violent and assaultive crime and road safety outcomes associated with off premise outlets were mixed, with heterogeneity across study contexts and outcome measures.

Total outlet density

Although a small number of studies examined total or aggregated outlet density, these studies were limited both in number and range of outcomes assessed. In addition, total outlet density does not represent a discrete intervention target in most contemporary regulatory frameworks, and as such this evidence is not presented in a standalone summary table.

See Table 3 (on-premise outlets) and Table 4 (off-premise outlets) below for a summary of the direction and strength of evidence associated with each outcome.

Evidence strength was assessed based on the number of studies available for each outcome, the consistency and direction of reported associations across studies, and the statistical significance of findings. Outcomes with a larger number of studies and a clear majority of statistically significant associations in the same direction were classified as having stronger evidence, whereas outcomes with fewer studies or inconsistent findings were classified as having limited or mixed evidence. Classifications are based on Table 9 in the Appendices, which includes counts of significant positive, negative and non-significant associations across included studies of bars/pubs and off-premise retail outlets.

Restaurant-only analyses were excluded due to their distinct drinking context and limited relevance to density-based policy interventions.

To support interpretation of the summary tables below, direction of association reflects the balance of findings across included studies for each outcome. ‘Positive’ indicates that the majority of studies reported statistically significant positive associations between outlet density and the outcome. ‘Mostly positive’ indicates that most studies reported positive associations, but with some null or negative findings. ‘Mixed’ indicates inconsistent findings across studies, with no clear dominant direction of effect.

Table 3: Summary of associations between alcohol on-premise outlet density (bars/pubs) and consumption and related harms

Outcome	Direction of association (across included studies)	Evidence strength
Adolescent alcohol consumption (n = 6)	● Mixed	Limited
Adult alcohol consumption and dependence (n = 9)	● Positive	Moderate
Health and medical (n = 9)	● Mostly positive	Moderate
Violent and assaultive crime (n = 14)	● Mostly positive	Moderate
Gender-based family violence (n = 6)	● Mixed	Limited
Non-violent crime (n = 4)	○ Mostly null	Limited
Road safety (n = 4)	● Mixed	Limited
Gun-related crime (n = 3)	○ Null	Very limited

Legend:

- Positive – majority of associations significant and positive; ● Mostly positive – some null or negative findings;
- Mixed – conflicting directions of association or inconsistent findings; ○ Null – mostly non-significant findings

Table 4: Summary of associations between alcohol off-premise outlet density and consumption and related harms

Outcome	Direction of association (across included studies)	Evidence strength
Adolescent alcohol consumption (n = 6)	● Mixed	Limited
Adult alcohol consumption and dependence (n = 9)	● Positive	Moderate
Health and medical (n = 9)	● Mixed	Moderate
Violent and assaultive crime (n = 14)	● Mixed	Moderate
Gender-based family violence (n = 6)	● Mostly positive	Limited
Non-violent crime (n = 4)	○ Mostly null	Limited
Road safety (n = 4)	● Mixed	Limited
Gun-related crime (n = 3)	● Mixed	Very limited

Legend:

- Positive – majority of associations significant and positive; ● Mostly positive – some null or negative findings;
 ● Mixed – conflicting directions of association or inconsistent findings; ○ Null – mostly non-significant findings

5. Discussion

The aim of this rapid review was to systematically examine the evidence on the relationship between outlet density and alcohol consumption and related harms. Across Australia and comparable jurisdictions, we synthesised 51 studies across three domains – alcohol consumption, health and medical outcomes and crime-related outcomes. Overall, higher outlet densities were generally associated with increased adult alcohol consumption and dependence, health and medical harms, and GBFV.

These findings are broadly consistent with alcohol availability theory, which proposes greater physical access to alcohol reduces barriers to consumption and increases the risk of alcohol-related harms.^{5, 77} Increased outlet density not only reduces the effort and cost associated with obtaining alcohol, but can also shape the social environment in which drinking occurs, and influence broader norms around the social acceptability of alcohol. Increased outlet density can also be a marker of underlying socioeconomic conditions that can contribute to alcohol-related harms.

Importantly, our findings demonstrated different patterns of harms based on outlet type, suggesting different underlying mechanisms. In this review, on-premise outlets (bars and pubs) were most consistently linked to harms like assault, violent crime, GBFV and road safety outcomes. Spatial ecology/drinking niches theory suggests that concentrations of drinking venues can attract large numbers of patrons and increase the likelihood of intoxication, crowding and interpersonal conflict, which can lead to assaults.¹⁵ In these environments, outlet density may influence harm, not only through increased alcohol consumption, but also through the clustering of drinkers in nightlife areas and the associated negative amenity effects.⁷⁸

In contrast, off-premise outlets showed more consistent associations with adolescent drinking, and chronic health harms including morbidity and mortality. These outlets may influence harms through different mechanisms. Greater density of off-premise outlets may increase opportunities for routine purchasing and reduce barriers to underage access. Off-premise alcohol is typically less expensive, bought in larger quantities and consumed in private settings, which may contribute to heavier drinking patterns and longer-term health harms.^{5, 77, 79}

Conversely, restaurants and other outlet types, like theatres, were found to be protective across several studies. These outlets may represent drinking contexts where alcohol consumption is more strongly linked within food service or structured social activities, which may moderate heavy drinking and reduce associated harms. Studies of drinking contexts have found that, although people drink in restaurants fairly frequently, restaurants are not significantly associated with most alcohol-related harms, compared to other outlet types like bars or nightclubs.⁸⁰

Overall, findings from Australian studies were broadly consistent with international evidence, particularly regarding the association between higher on-premise outlet density and violent and assaultive crime, and between off-premise density and chronic health harms.^{17, 54, 57, 64, 67} However, Australian studies more frequently highlighted the importance of local licensing conditions, outlet mix, and precinct-level characteristics in shaping harms, whereas international studies, particularly from the USA, were more likely to examine density effects across larger geographic units or in the context of regulatory change.

For example, Australian studies from Melbourne, NSW and Queensland consistently demonstrated associations between outlet density and assault outcomes, but also showed that effects varied by outlet type, trading characteristics and neighbourhood context.^{54, 64, 67} In contrast, USA studies provided clearer evidence of population level harm reductions following explicit reductions in outlet density.^{30, 66}

Together, these findings suggest that while the direction of association is similar across jurisdictions, the mechanisms and policy levers through which outlet density influences harm may differ between Australia and other comparable countries.

Across the outcomes, evidence for adolescent alcohol consumption, violent and assaultive crime, road safety and gun-related crime was least consistent, with several studies reporting mixed results and null effects. This variability likely reflects differences in study contexts, measurement approaches and local social and spatial factors.^{7, 15} These mixed findings are consistent with prior systematic reviews emphasising the complexity of these relationships.^{9, 11} Geospatial theories of neighbourhoods and crime emphasise that crime patterns emerge through interactions between people and specific locations, including the activities that occur within and between places. These frameworks suggest that alcohol outlets may act as focal points that shape patterns of movement and social interaction, contributing to localised clusters of alcohol-related harm.¹⁶

An additional consideration when interpreting crime outcomes, is the choice of geographic unit of analysis. While earlier criminological research often favoured very small spatial units,¹⁷ empirical evidence over time suggests that alcohol outlet effects on violence are frequently spatially diffuse, extending across multiple adjacent areas rather than being confined to a single local unit. As a result, analyses using overly fine spatial scales may under capture outlet–harm relationships, particularly where offending occurs near, but not at, drinking locations.

Our findings for violent crime contrast with a previous systematic review, which suggested off-premise outlet density may be more strongly linked to violence than on-premise density.⁹ However that review included cross-sectional designs and was more cautious in determining the strength of the evidence. In contrast, the current review has focused only on studies examining changes over time.

Notably, two studies in this review reported significant reductions in violence following decreased on-premise outlet density, highlighting the emerging evidence base for policies restricting outlet numbers. Researchers have previously noted an evidence gap examining reductions in outlet density.¹³

Interpretation of the road safety literature is complicated by the weak alignment between where alcohol is consumed and where motor vehicle crashes occur. Alcohol outlets tend to be located in dense commercial or entertainment areas that also have higher traffic volumes and greater population movement – factors independently associated with crash risk. As a result, outlet density measures based on crash location may inadequately capture the pathways linking alcohol availability, drinking behaviour and road traffic injury, contributing to the mixed findings observed across studies.^{74, 75} Increased outlet density may have opposing effects on road safety. Greater availability can reduce the distance people need to travel to obtain alcohol (potentially lowering crash risk). At the same time, greater availability may increase the frequency of drinking occasions and overall exposure, increasing the risk of drink driving. Together, this tension likely contributes to the mixed and sometimes counter intuitive findings in the road safety literature.¹³

The findings also highlight several gaps in the literature. First, most studies were conducted in the USA, with relatively few from Australia and other comparable jurisdictions, limiting generalisability. Second, heterogeneity in measures of outlet density (count, proximity, spatial access), geographical unit of analysis and timeframes complicates comparison across studies. Third, few studies considered outlet characteristics such as size, sales volume, or ownership, or interactions with broader social and policy contexts. Fourthly, the least studied outcomes were non-violent crime, road safety and gun-related crime, limiting interpretability. Fifthly, some evidence suggested that socioeconomic factors may modify associations between outlet density and harms, but findings were limited and context specific. We also note that for some jurisdictions, the same group of authors appeared for two or more studies, notably in Canada and Finland (where three studies were drawn from the same dataset) which could lead to a lack of diversity of perspectives and bias in the conclusions drawn for research conducted in some jurisdictions. Finally, findings for some outcomes relied wholly on self-report, like adolescent and adult alcohol consumption, which are impacted by response and social desirability bias.

5.1 Implications and future research directions

The review suggests that reducing outlet density could mitigate alcohol-related harms, particularly for on-premise venues, and outcomes such as assault and hospitalisations. Off-premise outlets may also represent a key opportunity, given their consistent associations with adult alcohol consumption, adolescent use, and chronic health harms.

Taken together, these studies help strengthen the evidence that outlet density controls can benefit population health outcomes. Limiting outlet density may be impactful by increasing the effort involved in purchasing alcohol, limiting retail competition (e.g. reducing price competition, or limiting sales to underage customers) or reducing clustering.⁷ Policies should be tailored to local context, including population density, existing outlet distribution, and socioeconomic characteristics, to maximise public health impact.

Australian evidence would be strengthened by greater examination of under-explored outcomes like road safety, non-violent crime and evaluations of policy-driven reductions in outlet density. Future studies could focus on more distinct measurement methods based on the outcome of interest.

In this review, most studies measured outlet density via count-based methods (which assume outlets are evenly distributed¹) with no clear patterns in measurement type across outcomes. However, researchers have recommended that large count-based methods may be appropriate to measure off-premise outlet density and road safety outcomes, and spatial-access based measures may be more appropriate to understand the link between on-premise outlet density and violent crime.²³ A common limitation to all forms of outlet density measurement is that they equally weigh outlet types regardless of size, sales volume or other characteristics, which may obscure their contributions to harm.¹³ Few studies have examined the role of outlet characteristics such as size or sales volume, or how these factors interact with other social and neighbourhood factors.^{9, 13}

Evaluations using natural experiments or quasi-experimental designs remain critical to strengthen causal inference. Studies examining interactions between outlet density, social and environmental factors, and policy interventions will provide insight into mechanisms of harm and inform more targeted regulatory approaches. Future mixed-methods research could help untangle the reasons behind mixed effects that higher outlet density can have on subgroups, including across gender and differing neighbourhood conditions.

In this review, we found three studies^{44, 45, 47} that reported associations between socioeconomic factors and drinking behaviour, however, none of the studies examined the interaction between outlet density and SES. For example, in the USA,⁴⁵ socioeconomic disadvantage in Atlanta was associated with higher prevalence of heavy episodic drinking (HED), with one standard deviation improvement in economic conditions associated with a decrease in HED from 34% to 20%. In Sweden, alcohol availability was linked to higher risk of AUD onset in both highly educated individuals and residents within lower socioeconomic neighbourhoods, but not income itself, suggesting that socioeconomic factors can modify this risk in different ways.⁴⁷

These structural patterns of outlet exposure across communities also present key methodological challenges for the measurement and interpretation of outlet density effects. Alcohol outlet exposure is inherently confounded with population size and density, such that study findings may vary depending on whether outlet measures are standardised by population, land area or other denominators.^{23, 27} In addition, alcohol outlets, populations and related harms are spatially patterned and autocorrelated, meaning observations across neighbourhoods are not independent.^{15, 16} Failure to account for these spatial dependencies may bias estimated effects and contribute to heterogeneity across studies.¹⁵

The influence of SES on the relationship between alcohol availability and harms has been explored in cross-sectional research. For example in Canada, outlet density had a larger impact on ED visits in low vs high SES areas.⁶¹ Although socioeconomic determinants of exposure to alcohol outlets were not a primary focus of this review of longitudinal and quasi-experimental studies, they represent an important area of future investigation. Future longitudinal and quasi-experimental research should examine whether outlet density in low SES neighbourhoods is associated with alcohol use and related harms differently than in high SES neighbourhoods, and how population and spatial factors influence the estimate of outlet density effects.

It is also important to note that alcohol outlet density typically changes slowly over time, particularly through ownership turnover rather than net growth or loss.²⁷ As a result, studies examining short-term or year-to-year changes may struggle to detect meaningful variation in exposure, especially when using large geographic units. This highlights the importance of longer-term analyses to capture accumulated changes in availability, or alternatively, very fine-grained spatial analyses to detect small-scale shifts at the neighbourhood level.⁷⁴ Future research that better aligns analytic timeframes and spatial scale with the pace of real-world outlet change may reduce null or inconsistent findings across studies.

5.2 Strengths and limitations of this review

This review has several notable strengths.

Firstly, it employs a comprehensive and systematic search strategy, ensuring wide coverage of relevant and diverse literature, including grey literature that are typically excluded from systematic reviews. Secondly, by incorporating international studies, the review was able to draw on evidence from a variety of jurisdictions comparable to Australia. Thirdly, this analysis of outlet density and harms relies on higher quality study designs, which are particularly valuable for evaluating policy or population-level changes in which randomised controlled trials are impractical. Compared with other non-randomised designs, quasi-experiments provide stronger causal inferences while maintaining ecological validity. Fourthly, the review considered a broad range of outcome domains and segmented findings by outlet type, thereby enhancing its policy and practice relevance. Finally, selection bias in this review was reduced as all studies meeting inclusion criteria were included, regardless of the critical appraisal outcome.

As with any rapid narrative review, some methodological limitations should be noted.

Searching four databases may have excluded some relevant studies. However, this risk was mitigated through a supplementary manual search of reference lists and expanding the search from the first 100 to the first 300 results. Moreover, the use of four databases exceeds the Cochrane rapid review guidance, which recommends searching a minimum of two databases.¹⁹ Resource constraints also necessitated adding limits to jurisdictions, language and study designs, meaning some evidence (including international evidence from parts of Europe) was not included. Due to the rapid nature of data extraction, assessment of whether outlet density was measured repeatedly over time, therefore some included longitudinal studies treated outlet density as a fixed rather than time-varying exposure. Moreover, generalisability may be limited as some of the individual study findings were specific to geographical locations, and local context and policies, for example, in the USA licensing systems vary widely across different states. Data synthesis for some outcomes, like non-violent crimes was difficult due to the variations and differences in how outlet density was measured.

6. Conclusion

This rapid review synthesised evidence from 51 studies examining the relationship between alcohol outlet density and alcohol consumption and related harms.

Overall, the findings indicate that greater outlet density is generally associated with higher levels of adult alcohol consumption and dependence, as well as a range of alcohol-related harms including health and medical outcomes and crime, including GBFV. Differences were observed by outlet type, with on-premise venues more consistently linked to violent and public harms, while off-premise outlets were more consistently linked with adolescent drinking, adult alcohol consumption, and longer-term health harms. While some outcomes showed mixed evidence, these inconsistencies likely reflect differences in study contexts, measures of outlet density, and local environmental and socioeconomic factors. The findings suggest that managing alcohol outlet density may be an important lever for reducing alcohol-related harms and improving population health.

Appendices

Appendix 1: PICOT and search strings

	Key concepts	Synonyms	Subject headings
Population / problem	Adults and under 18s in Australia and comparable jurisdictions	Australia USA Canada New Zealand UK Ireland England Wales Scotland Northern Ireland British Isles Denmark Finland Iceland Norway Sweden Fareo Islands Greenland Nordic	
Intervention / program approach	Alcohol outlet density	Alcohol / liquor / wine / spirit / beverage AND Density / availability / proximity/ access / neighbourhood / community / distance / concentration / spatial AND Outlet / store / off-premise / takeaway / takeout / bottleshop / off-premise / to-go / packaged / retail / shop / off licence / supermarket / grocery store / corner store / convenience store OR On-premise / bar / club / nightclub / entertainment precinct / tavern / pub / brewery / restaurant / public house / venue	
Comparison	N/A	N/A	
Outcome	Alcohol consumption Health, social and legal harms	Risky / binge drinking / intoxication / heavy episodic / heavy consumption / harmful / hazardous / abuse / misuse / excess / problem Alcohol-related harm / injury / violence / family violence / domestic violence / assault / hospitalisations / emergency department presentations / crime / traffic crashes / road accidents / fatalities / death / disease / mortality / morbidity / ambulance	
Timeframe	N/A		

Seed articles and search terms / keywords

Article	Search terms / keywords
Final report: Association of liquor outlet density with domestic and non-domestic assault in New South Wales	'alcohol outlet density' On-premises OR bars OR hotels OR restaurants OR liquor stores OR clubs OR cafes off premises OR take-away
The effect of alcohol outlets, sales and trading hours on alcohol-related injuries presenting at emergency departments in Perth, Australia, from 2002 to 2010	Alcohol availability alcohol consumption alcohol sales alcohol-related outlet density trading hours on- and off-premises outlets harm OR injur*
The association between off-and on-premise alcohol outlet density and 100% alcohol-attributable emergency department visits by neighbourhood-level socioeconomic status in Ontario, Canada	Alcohol availability Alcohol outlet density Socioeconomic status Alcohol harms Emergency department visits

Search strings

ADF Library 22.9.25

Search terms: [\(\(\(alcohol OR liquor* OR ethanol* OR beer OR wine OR spirit*\) AND \(\(outlet* OR store* OR premise*\) AND \(densit* OR availabil* OR proximity OR access*\)\) AND \(harm* OR injur*\)\)](#)

(Search Results Display: Hide duplicates; Held By Library: Alcohol and Drug Foundation; Format: Article, Downloadable article; Publication Year: 2010 through 2025; Databases: BMJ Journals, Directory of Open Access Journals, Emerald Group Publishing Limited, Gale Health and Wellness, Informit Health Collection, Informit Indigenous Collection, Oxford Journals, ProQuest Ebook Central, PubMed Central, SAGE Journals, ScienceDirect, Taylor and Francis Journals, Wiley Online Library, WorldCat.org)

PubMed 7.10.25

[\(\(\(alcohol OR liquor* OR ethanol* OR beer OR wine OR spirit*\) AND \(\(outlet* OR store* OR premise*\) AND \(densit* OR availabil* OR proximity OR access* OR neighbourhood* OR neighborhood* OR environment* OR communit*\)\) AND \(harm* OR injur*\)\)2010 – 2025](#)

Google Scholar 23, 24.9.25, 1, 2 & 7.10.25

Search terms: [alcohol harm injury OR liquor OR ethanol OR beer OR wine OR spirits OR store OR premise OR availability OR proximity OR access OR environment OR community "outlet density" 2010 – 2025](#)

Google Grey Lit 9 & 13.10.25

[alcohol harm injury OR liquor OR ethanol OR beer OR wine OR spirits OR store OR premise OR availability OR proximity OR access OR environment OR community "outlet density" 2010 – 2025](#)

Appendix 2: Critical appraisal tables

Table 5: Summaries of JBI quality appraisal assessments – longitudinal/cohort studies (n = 40)

Item	Auchincloss et al. (2022)	Boshari et al. (2020)	Breetzke & Andersen (2018)	Brenner et al. (2015)	Caetano et al. (2021)	Chen et al. (2010)	Conrow et al. (2015)	Cooper et al. (2013)	Cunradi et al. (2011)	Cunradi et al. (2012)	Gorman et al. (2018)	Gruenewald & Johnson (2010)	Halonen et al. (2013) #232	Halonen et al. (2013) #184
1 - Were the two groups similar and recruited from the same population?	Yes	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2 - Were the exposures measured similarly to assign people to both exposed and unexposed groups?	Yes	Yes	NA	NA	NA	Yes	NA	NA	NA	NA	NA	NA	Yes	NA
3 - Was the exposure measured in a valid and reliable way?	Unclear	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4 - Were confounding factors identified?	Yes	Unclear	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Unclear	Yes	Yes	Yes	Yes
5 - Were strategies to deal with confounding factors stated?	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Yes
6 - Were the groups / participants free of the outcome at the start of the study (or at the moment of exposure)?	No	No	NA	NA	NA	No	NA	No	NA	No	No	No	NA	NA
7 - Were the outcomes measured in a valid and reliable way?	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
8 - Was the follow up time reported and sufficient to be long enough for outcomes to occur?	No	Yes	Unclear	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
9 - Was follow up complete, and if not, were the reasons to loss to follow up described and explored?	No	NA	NA	Yes	NA	No	NA	No	NA	NA	NA	NA	Unclear	Yes
10 - Were strategies to address incomplete follow up utilised?	No	NA	NA	Unclear	NA	No	NA	Unclear	NA	NA	NA	NA	Yes	Unclear
11 - Was appropriate statistical analysis used?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Overall Quality Score for items (Max = 9 items)	4/9	4/9	4/9	6/9	6/9	5/9	5/9	5/9	6/9	4/9	6/9	6/9	6/9	7/9

*Note NA = Not Applicable; Overall Quality Score does not include items 1 & 6 as they were marked as NA for most studies

Item	Hobday et al. (2015)	Hobday et al. (2016)	Huang et al. (2025)	Jiang et al. (2023)	Karriker-Jaffe et al. (2018)	Laslett et al. (2022)	Lightowlers & Bryant (2025)	Lipton et al. (2018)	Livingston et al. (2011) #115	Livingston et al. (2011) #22	Mair et al. (2013)	Myran et al. (2024)	Paschall et al. (2013)	Picon et al. (2010)
1 - Were the two groups similar and recruited from the same population?	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2 - Were the exposures measured similarly to assign people to both exposed and unexposed groups?	NA	NA	Yes	NA	NA	NA	Unclear	Yes	NA	NA	NA	Yes	Unclear	NA
3 - Was the exposure measured in a valid and reliable way?	Yes	Yes	Unclear	Yes	Yes	Unclear	Unclear	Yes	Yes	Yes	Yes	Yes	Unclear	No
4 - Were confounding factors identified?	Yes	Unclear	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
5 - Were strategies to deal with confounding factors stated?	Yes	Unclear	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
6 - Were the groups / participants free of the outcome at the start of the study (or at the moment of exposure)?	NA	No	NA	NA	No	NA	Yes	NA	No	No	NA	NA	NA	NA
7 - Were the outcomes measured in a valid and reliable way?	Yes	Yes	Unclear	Yes	Yes	Yes	Unclear	NA	Yes	Yes	Yes	Unclear	Yes	Yes
8 - Was the follow up time reported and sufficient to be long enough for outcomes to occur?	Yes	Yes	No	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	NA	Yes	Yes
9 - Was follow up complete, and if not, were the reasons to loss to follow up described and explored?	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	No	Yes
10 - Were strategies to address incomplete follow up utilised?	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Yes	No
11 - Was appropriate statistical analysis used?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Overall Quality Score for items (Max = 9 items)	6/9	4/9	2/9	6/9	6/9	5/9	4/9	5/9	6/9	6/9	6/9	4/9	6/9	6/9

*Note NA = Not Applicable; Overall Quality Score does not include items 1 & 6 as they were marked as NA for most studies

Item	Raza et al. (2023)	Rowland et al. (2016)	Shamblen et al. (2011)	Stockwell et al. (2011)	Stockwell et al. (2013)	Stockwell et al. (2015)	Tang (2013)	Taylor et al. (2021)	Trapp et al. (2018)	White et al. (2015)	Zhao et al. (2013)
1 - Were the two groups similar and recruited from the same population?	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2 - Were the exposures measured similarly to assign people to both exposed and unexposed groups?	NA	NA	NA	NA	Yes	NA	NA	NA	NA	NA	Yes
3 - Was the exposure measured in a valid and reliable way?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes
4 - Were confounding factors identified?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Unclear	Yes
5 - Were strategies to deal with confounding factors stated?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NA	Yes	Unclear	Yes
6 - Were the groups / participants free of the outcome at the start of the study (or at the moment of exposure)?	NA	NA	NA	NA	NA	NA	No	No	NA	No	NA
7 - Were the outcomes measured in a valid and reliable way?	Unclear	Yes	Yes	Yes	Unclear	Unclear	Yes	Yes	Unclear	Yes	Unclear
8 - Was the follow up time reported and sufficient to be long enough for outcomes to occur?	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
9 - Was follow up complete, and if not, were the reasons to loss to follow up described and explored?	No	No	No	NA	NA	NA	NA	NA	NA	NA	NA
10 - Were strategies to address incomplete follow up utilised?	No	No	Yes	NA	NA	NA	NA	NA	NA	NA	NA
11 - Was appropriate statistical analysis used?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Overall Quality Score for items (Max = 9 items)	5/9	5/9	6/9	6/9	5/9	5/9	6/9	4/9	4/9	3/9	5/9

*Note NA = Not Applicable; Overall Quality Score does not include items 1 & 6 as they were marked as NA for most studies

Table 6: Summaries of JBI quality appraisal assessments – quasi-experimental studies (n = 8)

Item	Gruenewald et al. (2022)	Han & Gorman (2013)	Han et al. (2015)	Joshi et al. (2022)	Myran et al. (2019)	Phillips et al. (2021)	Xu et al. (2012)	Zhang et al. (2015)
1 - Is it clear in the study what is the cause and what is the effect (i.e. there is no confusion about which variable comes first)?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2 - Was there a control group?	NA	No	Yes	Yes	Yes	Yes	No	No
3 - Were participants included in any comparisons similar?	NA	NA	Unclear	Yes	Unclear	Yes	NA	No
4 - Were the participants included in any comparisons receiving similar treatment / care, other than the exposure or intervention of interest?	NA	Yes	Unclear	Yes	Yes	Yes	Unclear	No
5 - Were there multiple measurements of the outcome, both pre and post the intervention / exposure?	Yes	No	Yes	Yes	Yes	Yes	Yes	No
6 - Were the outcomes of participants included in any comparisons measured in the same way?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
7 - Were outcomes measured in a reliable way?	Unclear	Yes	Yes	Yes	Unclear	Unclear	Yes	Yes
8 - Was follow-up complete and if not, were differences between groups in terms of their follow-up adequately described and analysed?	NA	NA	NA	Yes	NA	NA	NA	NA
9 - Was appropriate statistical analysis used?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Overall Quality Score (Max = 9)	4/9	5/9	6/9	9/9	6/9	7/9	5/9	3/9

*Note NA = Not Applicable

Table 7: Summaries of JBI quality appraisal assessments – case control studies (n = 3)

Item	Branas et al. (2011)	Morrison et al. (2017)	Pear et al. (2023)
1 - Were the groups comparable other than the presence of disease in cases or the absence of disease in controls?	Yes	Yes	Yes
2 - Were cases and controls matched appropriately?	Yes	Yes	Yes
3 - Were the same criteria used for identification of cases and controls?	No	Yes	Yes
4 - Was exposure measured in a standard, valid and reliable way?	Unclear	Yes	Unclear
5 - Was exposure measured in the same way for cases and controls?	Unclear	Yes	Yes
6 - Were confounding factors identified?	Yes	Yes	Yes
7- Were strategies to deal with confounding factors stated?	Yes	Yes	Yes
8 - Were outcomes assessed in a standard, valid and reliable way for cases and controls?	Unclear	Unclear	Yes
9 - Was the exposure period of interest long enough to be meaningful?	Yes	NA	Yes
10 - Was appropriate statistical analysis used?	Yes	Yes	Yes
Overall Quality Score (Max = 10)	6/10	8/10	9/10

*Note NA = Not Applicable

Appendix 3: Summary of findings tables

Table 8: Summary of included studies investigating relationship between outlet density (OD) and alcohol consumption and related harms (N = 51)

Author (year) Country	Aim of study	Population	Study design	OD type	OD measure	Outcome (source)	Increased or decreased harms (including relevant sub-analyses) (↑ = positive association; ↓ = negative association; * = significant at a level of $p < 0.05$)
ALCOHOL CONSUMPTION OUTCOME							
Adolescent / underage alcohol consumption (n = 6)							
Chen et al. (2010), USA ³⁸	To examine how community alcohol outlet density may be associated with drinking among adolescents using a multi-level analytical approach	1,091 adolescents aged 14-16 at baseline from 50 zip codes in California	Cohort / longitudinal study	Off-premise	Count	Past year frequency of drinking and frequency of excessive drinking (interview data)	↑* adolescent drinking and drinking to excess (with higher alcohol OD) ↓* growth in adolescent drinking and drinking to excess (with lower alcohol OD)
Joshi et al. (2022), USA ³²	To analyse data from a randomised-controlled trial to investigate whether changes in alcohol environment caused by neighbourhood relocation mediated the impact of treatment of adolescent excessive drinking	2,829 youth (aged 12-19 at follow-up) living in high poverty areas (Boston, Baltimore, Chicago, Los Angeles and New York). Control group n = 879, Treatment group = 1,950	Quasi-experimental	On-premise; off-premise	Count	Adolescent alcohol use (survey data)	Females ↓* drinking (with higher levels of off and on-premise outlet densities measured per square mile, and higher levels of off-premise outlet density based on raw counts) No interaction with intervention and on-premise outlet density (measured with raw counts) Males No interaction with intervention and off and on-premise outlet density
Paschall et al. (2014), USA ³⁹	To examine relationships between characteristics of the local alcohol environment and adolescent alcohol use and beliefs in 50 Californian cities	Random samples of 1,478 adolescents and 8,553 adults from 50 Californian cities	Cohort / longitudinal study	Bar	Count	Adolescent alcohol use & heavy drinking in the past year (survey data); Adult alcohol use in the past 28-days (survey data)	↑* adolescent past-year alcohol use (with greater bar density). Effect partially mediated by adolescent alcohol-related beliefs No significant association with adolescent past-year heavy drinking and bar density
Rowland et al. (2016), Australia ⁴⁰	To examine how outlet density was associated with adolescent alcohol consumption based on 2 waves of longitudinal survey data	2,835 Victorian school students who completed 2 waves and were on average 14 years of age at wave 2	Cohort / longitudinal study	Total outlets (on-premise; off-premise)	Count	Adolescent alcohol consumption (surveys and interviews)	↑* adolescent alcohol consumption (with increase in total OD) ↑* odds of developing early age alcohol consumption (with greater total OD)
Shamblen et al. (2011), USA ⁴¹	To examine changes in drinking behaviour as a function of alcohol outlet density in a sample of 6th graders followed across a 2-year period	5,903 USA adolescents	Cohort / longitudinal study	On-premise; off-premise	Count	Adolescent alcohol use (questionnaire)	↑ adolescent alcohol use (with high off-premise OD)

Author (year) Country	Aim of study	Population	Study design	OD type	OD measure	Outcome (source)	Increased or decreased harms (including relevant sub-analyses) (↑ = positive association; ↓ = negative association; * = significant at a level of $p < 0.05$)
Trapp et al. (2018), Australia ⁴²	To examine whether proximity to liquor stores at age 14 was associated with alcohol intake at ages 14, 17 and 20 years	999 adolescents living in Perth who reported alcohol intake at three survey waves	Cohort / longitudinal study	Off-premise	Proximity	Self-reported alcohol intake (survey)	↑* alcohol consumption (with liquor stores proximate to home or school) Some evidence suggesting that living close to a liquor store in early adolescence constituted a risk factor for alcohol consumption in middle, but not late adolescence

Adult alcohol consumption and dependence (n = 9)

Auchincloss et al. (2022), USA ⁴³	To examine whether changes in the density of neighbourhood off-premise alcohol outlets affected changes in alcohol consumption one year after regulatory changes increased alcohol availability	714 adults (aged 21-64 years) living in / around Philadelphia were included in the longitudinal analysis	Cohort / longitudinal	Off-premise	Proximity	Alcohol consumption was assessed as days per week (pw), drinks pw, high consumption (≥ 8 drinks pw), and binge drinking (survey data)	Higher off-premise outlet density: ↑* alcohol consumption (for days pw, drinks pw, high consumption [≥ 8 drinks pw]) ↑ alcohol consumption (binge drinking) Greater distance from nearest off-premise outlet: ↓* alcohol consumption (for days pw, drinks pw) ↓ alcohol consumption (for high consumption [≥ 8 drinks pw]) ↑ alcohol consumption (binge drinking)
Brenner et al. (2015), USA ⁴⁴	To examine associations of changes in neighbourhood SES and alcohol outlet density, with current, weekly, and heavy daily alcohol consumption over time, and whether these associations differed by gender, race/ethnicity, and income	6,163 USA adult residents living in six sites who provided five waves of data over a 10-year period	Cohort / longitudinal	On-premise; off-premise	Spatial access	Alcohol consumption - current, weekly, and heavy daily (self-reported survey data)	Current alcohol use: ↓* current alcohol use (with increasing neighbourhood SES) No association between current alcohol use and alcohol OD Weekly alcohol use: ↑* weekly alcohol use (increasing liquor store density) No association between weekly alcohol use and neighbourhood SES Heavy daily alcohol use: No association between neighbourhood SES or alcohol OD and heavy daily alcohol use

Author (year) Country	Aim of study	Population	Study design	OD type	OD measure	Outcome (source)	Increased or decreased harms (including relevant sub-analyses) (↑ = positive association; ↓ = negative association; * = significant at a level of $p < 0.05$)
Cooper et al. (2013), USA ⁴⁵	To test the hypothesis that improvements in socio-economic disadvantage and social disorder are inversely associated with risky substance use	162 African American adults who lived in public housing complexes targeted by Atlanta's relocations in 2007 and 2010 for at least one year	Cohort / longitudinal	Off-premise	Count	Substance dependence, illicit drug use and binge drinking in past 30 days (self-reported using TCUDS & BRFSS)	↓* illicit drug use (with decrease in economic disadvantage) ↓* binge drinking (with decrease in economic disadvantage) ↓* binge drinking (with decrease in OD) No associations with substance dependence with any measure, or for illicit drug use and binge drinking with social disorder
Halonen et al. (2013a), Finland ⁵⁰	To examine whether distance from home to the nearest bar, i.e. alcohol outlet permitting consumption on the premises, is associated with risky alcohol behaviour	Finnish Public Sector Study participants (n = 54,778) - longitudinal data only	Cohort / longitudinal	On-premise	Proximity	Heavy alcohol use and extreme drinking occasions (self-reported survey data)	↑* heavy alcohol use and extreme drinking occasions (with living closer to a bar) ↑ heavy alcohol use and extreme drinking occasions (with moving closer to a bar)
Halonen et al. (2013b), Finland ²⁶	To examine whether change in proximity to off-premise beer and liquor outlets is associated with heavy alcohol consumption	Finnish Public Sector Study participants (n = 54,778).	Cohort / longitudinal	Off-premise	Proximity	Heavy alcohol consumption (self-reported), measured in at least two survey waves between 2000 and 2009	Distance to nearest alcohol outlet: ↑* heavy alcohol use in women (with decreased distance to the nearest beer and liquor outlet) ↓* heavy alcohol use in men (with decreased distance to nearest beer outlet) No relationship between distance to nearest liquor outlet and heavy alcohol use in men Number of beer outlets: ↑* heavy alcohol use in women (with increased number of beer outlets near home) No association between heavy alcohol use in men and number of beer outlets Change in distance to nearest alcohol outlet: ↑* heavy alcohol use in women (with decreasing distance to the nearest beer outlet) No association between heavy alcohol use in men and the change in distance to the number of alcohol outlets

Author (year) Country	Aim of study	Population	Study design	OD type	OD measure	Outcome (source)	Increased or decreased harms (including relevant sub-analyses) (↑ = positive association; ↓ = negative association; * = significant at a level of $p < 0.05$)
Halonen et al. (2014), Finland ⁴⁶	To examine whether the number and change in number of beer, wine, and liquor outlets near one's home are associated with alcohol consumption by beverage type	28,074 women and 6,639 men Finnish public sector employees	Cohort / longitudinal	Off-premise	Count	Weekly consumption of all alcohol, and beer, wine, spirits (self-reported). Consumption measured at baseline 2004/2005 and follow-up 2008/2009	↑* wine consumption (with closer proximity to wine outlets) No associations between alcohol consumption and beer and liquor outlets
Karriker-Jaffe et al. (2018), Sweden ⁴⁷	To explore the association between alcohol availability with onset and recurrence of alcohol use disorder (AUD) using longitudinal population data over an 8-year period and identify groups for whom alcohol availability is particularly risky	Adults in Sweden aged 30 to 55 years of age.	Cohort / longitudinal	On-premise; off-premise	Count	Alcohol use disorder (diagnoses from Swedish medical registries; scripts for medications for AUD from prescribed drug register; convictions of drunk driving from Swedish Crime Register)	↑* AUD (with presence of an alcohol outlet in the neighbourhood) No association between greater alcohol availability and recurrence of AUD
Picone et al. (2010), USA ⁴⁸	Examine the relationship between alcohol consumption and distance between home and bars using longitudinal data	11,810 pooled sample recruited from 4 USA urban cities from three survey waves between 1985 and 1996 who had reported consuming alcohol in at least one wave	Cohort / longitudinal	On-premise	Spatial access	Alcohol consumption (drinks p/week, amount consumed per day in ml, number of beers; distilled spirits and wine per week)	↑* alcohol consumption (with increasing bar density) No association between bar density within 0.5 km of a residence and alcohol consumption (after inclusion of person-specific fixed effects)
Raza et al. (2023), Sweden ⁴⁹	To explore the association between problem drinking and living and working close to alcohol outlets using longitudinal data	13,306 Swedish employees.	Cohort / longitudinal	On-premise; off-premise	Proximity	Problem drinking (CAGE tool - indicator of alcohol dependence)	↑* problem drinking (with decreased distance from home to nearest liquor outlet) ↓* problem drinking (with increased distance from home to nearest beer outlet) ↑ problem drinking (with decreased distance from work to nearest bar) ↑* problem drinking for females (per 1km decrease in distance from home to nearest liquor outlet)

Author (year) Country	Aim of study	Population	Study design	OD type	OD measure	Outcome (source)	Increased or decreased harms (including relevant sub-analyses) (↑ = positive association; ↓ = negative association; * = significant at a level of $p < 0.05$)
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HEALTH AND MEDICAL OUTCOMES

Health and medical (n = 9)

Hobday et al. (2015) ⁵² Australia	To test whether associations: exist between alcohol-related ED injuries and alcohol sales and counts of outlets; vary between on- and off-premises outlets; and vary by trading hours conditions (extended trading permits [ETPs] versus standard hours)	936 injuries from 117 postcodes over 8 years (2002-2010) in Perth, Australia	Cohort / longitudinal	On-premise; off-premise	Count	Alcohol-related (AR) Emergency Department (ED) injuries (hospital)	Counts of outlets: ↑* AR ED injuries (with higher on-premise outlet density, with & without ETPs) ↓* AR ED injuries (with higher off-premise outlet density) Alcohol sales: ↑ AR ED injuries (with increased on-premise sales without ETPs) ↓ AR ED injuries (with increased on-premise sales with ETPs) ↑* AR ED injuries (with increased off-premise sales)
Hobday et al. (2016) ⁵³ Australia	To examine the effects of licensed outlets and sales on levels of alcohol-related injuries presenting to emergency departments (EDs) in the Inner, Middle and Outer postcode zones of Perth, Australia	Panel data from 2002 - 2010 provided by the WA Data Linkage System from Perth public hospitals	Cohort / longitudinal	On-premise; off-premise	Count	AR ED injuries (hospital)	Counts of outlet: ↑* AR ED injuries (with on-premise outlets in inner & outer zones) ↓* AR ED injuries (with off-premise outlets in inner & outer zones) Alcohol sales: ↑* AR ED injuries (with on-premise sales in outer zone) ↑* AR ED injuries (with off-premise sales in middle zone)
Livingston (2011) Australia ⁵⁴	To examine trends in hospital admission data for assault and for alcohol use disorders over a 14-year period and their relationship with the density of three kinds of alcohol outlets (general, packaged liquor, and on-premise)	Data from 186 postcodes in Melbourne over 12 years	Cohort / longitudinal	On-premise; off-premise	Count	Assault-related injuries (hospital) and chronic alcohol-caused hospitalisations (hospital)	↑* Assault-related injuries (general and packaged liquor outlets) ↓ Assault-related injuries (on-premise outlets) ↑* Chronic alcohol-caused hospitalisations (packaged liquor and on-premise outlets) ↓ Chronic alcohol-caused hospitalisations (general outlets)
Myran et al. (2019), Canada ³³	Examine the association between off-premise alcohol availability and alcohol-attributable ED visits during a period of deregulation of controls on the number of alcohol outlets	513 defined geographic regions in Ontario, called Forward Sortation Areas (FSAs). Ontario population was 13.5 million; median population for an FSA was 22,260	Quasi-experimental	Off-premise	Count & proximity	ED visits (National Ambulatory Care Reporting System Metadata)	↑* AA ED visits

Author (year) Country	Aim of study	Population	Study design	OD type	OD measure	Outcome (source)	Increased or decreased harms (including relevant sub-analyses) (↑ = positive association; ↓ = negative association; * = significant at a level of $p < 0.05$)
Myran et al. (2024), Canada ⁵⁵	To examine the association between alcohol retail access and health-care visits attributable to alcohol and whether this association differed for individuals with and without a history of health-care attributable to alcohol	All residents of Ontario, Canada aged 10-105 years with universal health coverage (n = 10,677,604 in 2013)	Cohort / longitudinal	Off-premise	Spatial access	ED visits (National Ambulatory Care Reporting System database) Outpatient visits (Ontario Health Insurance Plan Claims Database)	↑* AA ED and outpatient visits
Phillips et al. (2021), USA ³⁴	To examine the impact of a policy (which led to off-premise outlets increasing from 330 to 1,400 and trading hours lengthening) on alcohol-related adverse health outcomes	Washington (n = 39 counties) compared with Oregon (n = 36 counties)	Quasi-experimental	Off-premise	Other	Hospitalisations for alcohol-related disorders and injuries (Inpatient Database)	↑* Accidental injuries hospitalisations (in metropolitan-urban counties)
Stockwell et al. (2011), Canada ⁵⁶	To explore the relationship between alcohol-related deaths and outlet density during a period of rapid increase in privately owned stores	534 alcohol-related deaths between 2003 and 2008 across 89 local health areas in British Columbia	Cohort / longitudinal	On-premise; off-premise	Count	Alcohol-related deaths (BC Statistics Agency)	↑* AA deaths (with private liquor stores) ↑* AA deaths (with bars) ↓* AA deaths (with Government liquor stores) ↑ AA deaths (with restaurants)
Stockwell et al. (2013), Canada ⁵⁷	Investigate impacts of minimum alcohol prices and outlet densities on alcohol-attributable hospital admissions in British Columbia (BC)	Population of BC (4.6 million in 2012)	Cohort / longitudinal	Off-premise	Count	AA hospital admissions (hospitals via BC Ministry of Health)	↑* AA hospital admissions (with increased private liquor store density)
Zhao et al. (2013), Canada ⁵⁸	Investigate relationships between periodic increases in minimum alcohol prices, changing densities of liquor stores and alcohol-attributable deaths in British Columbia (BC)	Populations of 16 Health Service Delivery Areas in BC	Cohort / longitudinal	On-premise; off-premise	Count	Alcohol-attributable deaths (BC Statistics Agency)	↑* AA deaths (with private liquor stores) ↑ AA deaths (with bars) ↑ AA deaths (with Government liquor stores) ↓ AA deaths (with restaurants)

Author (year) Country	Aim of study	Population	Study design	OD type	OD measure	Outcome (source)	Increased or decreased harms (including relevant sub-analyses) (↑ = positive association; ↓ = negative association; * = significant at a level of $p < 0.05$)
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CRIME-RELATED OUTCOMES

Violent and assaultive crime (n = 15)

Caetano et al. (2021), USA ⁶⁰	To examine trends and population-level correlates of violent crime rates from 2005 to 2017 in California, including proximity to the U.S./Mexico border and alcohol outlet density	California - crime data and census data for law enforcement agencies, equalling 499 geographic units	Cohort / longitudinal study	On-premise; off-premise	Count	Violent crime data - homicide, rape, robbery, and aggravated assault (Crimes and Clearances report to the California Department of Justice from 2005-2017)	↑on-premise outlets ↓off-premise outlets
Conrow et al. (2015), USA ⁶¹	To examine the interactions between on-premise alcohol outlets and violent crime in Buffalo, New York	Buffalo, New York	Cohort / longitudinal study	On-premise	Spatial access	Violent crime geocoded locations between 2005 and 2011 (Erie Crime Analysis Center, Buffalo NY)	↓↑*Mixed findings (both directions) reported for personal crimes (violent crime - murder, rape, robbery, assault)
Gorman et al. (2018), USA ⁶²	To examine whether the introduction of a large number of off-premise alcohol outlet into Lubbock, Texas, over a brief period of time could affect rates of violent crime	Violent crime within 172 Census block groups in Lubbock, Texas, between 2006-2011	Cohort / longitudinal study	On-premise; off-premise	Count	Violent crime - murder, rape, robbery and aggravated assault (Police data)	On-premise outlets: ↑* Small positive association with violence within local area ("block group") Off-premise outlets: ↑* Spatially lagged effect found (density related to greater rates of violent crime in adjacent areas); no association with violence within local area ("block group") found
Gruenewald et al. (2022), USA ²⁷	To measure agglomeration (indicated when outlets appear in areas with greater outlet densities of the same type) and churning (indicated when new outlets opened in place of another of the same type that had closed) and the impacts of openings and closings of outlets on neighbourhood crime	Population of the City of Oakland, CA, USA	Quasi-experimental	On-premise; off-premise	Count	Crime - assaults, burglaries, and robberies (Oakland Police Department)	Outlet density & assaults: ↑* On-premise (bars/pubs) small effect (Risk Ratio: 1.0252, 95% Credible Interval: 1.0068-1.0439) On-premise (restaurants): no association found ↑* Off-premise: small effect (RR: 1.0058, 95% CI: 1.0033-1.0084)

Author (year) Country	Aim of study	Population	Study design	OD type	OD measure	Outcome (source)	Increased or decreased harms (including relevant sub-analyses) (↑ = positive association; ↓ = negative association; * = significant at a level of $p < 0.05$)
Han & Gorman (2013), USA ²⁸	To examine the effects on violence of a policy change that ended prohibition of off-premise alcohol outlets in Lubbock, Texas.	9,214 cases of violent crime within the City of Lubbock, Texas	Quasi-experimental	Off-premise	Other	Violent crime (Lubbock Police Department)	No significant association between off-premise outlets and either violent crime or total assault
Huang et al. (2025), USA ²⁵	To explore the relationship between five types of on-premise outlets and crime between 2017 and 2022.	City of Detroit, Michigan	Cohort / longitudinal study	On-premise	Spatial access	Crime - aggravated assault, burglary, larceny-theft, murder, motor vehicle theft, rape, and robbery (Detroit police data)	↑on-premise & violent crime (varied by outlet type and crime)
Jiang et al. (2023), Australia ⁶⁷	To explore the association between alcohol outlet density and rates of domestic and non-domestic assault in NSW and if it differs by SES, urban vs regional and by the proportion of Aboriginal and Torres Strait Islander residents in the community	Domestic and non-domestic assaults in NSW from 2015 - 2019	Cohort / longitudinal	On-premise; off-premise	Count	Domestic and non-domestic assault (NSW Bureau of Crime Statistics and Research)	↑* non-domestic assaults (with increase in outlet density) ↑* non-domestic assaults (with increase in on-premise outlets) No significant association between off-premise outlet density and non-domestic assault
Livingston (2011), Australia ⁵⁴	To examine trends in hospital admission data for assault and for alcohol use disorders over a 14-year period and their relationship with the density of three kinds of alcohol outlet licences (general [pubs, hotels, some nightclubs], on-premise [restaurants & bars], packaged [retail liquors stores])	Data from 186 postcodes in Melbourne over 12 years	Cohort / longitudinal study	On-premise; off-premise	Count	Rates of violence and alcohol-related chronic disease (hospital admissions data, based on ICD-9 and ICD-10 coding)	↑* violence (with general and off-premise licences) ↓ violence (with on-premise outlet licence)
Mair et al. (2013), USA ¹⁷	Panel study examining association of outlet density on hospitalisation rates	California, USA	Cohort / longitudinal study	On-premise; off-premise; bar	Count	Annual counts of hospital discharge assault injuries (California Office of Statewide Health Planning and Development hospital discharge data, 1995–2008)	Outlet density & assault: ↑* assault injuries (with on-premise bars/pubs) ↓* assault injuries (proportion of off-premise outlets relative to other outlets)

Author (year) Country	Aim of study	Population	Study design	OD type	OD measure	Outcome (source)	Increased or decreased harms (including relevant sub-analyses) (↑ = positive association; ↓ = negative association; * = significant at a level of $p < 0.05$)
Stockwell et al. (2015), Canada ⁶³	To estimate the independent effects of increases in minimum alcohol prices and densities of private liquor stores on crime outcomes in British Columbia, Canada, during a partial privatisation of off-premise liquor sales	Local health areas (LHAs) nested within 16 health service delivery areas (HSDAs) from 89 geographic regions, in British Columbia, Canada	Cohort / longitudinal study	Bar; restaurant; other	Count	Crime incidents: alcohol-involved traffic violations, non-alcohol-involved traffic violations and crimes against persons (BC Stats)	No significant association found between outlet density and crimes against the person (violent crimes)
Taylor et al. (2021), Australia ⁶⁴	To investigate whether the relationship between higher-risk outlet density and violence varied depending on precinct trading hours in night-time entertainment precincts (NEPs) in Queensland, Australia	Nine NEPs across Queensland	Cohort / longitudinal study	Bar	Count	Assaults resulting in bodily harm (Queensland Police data)	Outlet density x trading hours: ↑* assaults (with later trading venues [5am close]) ↓* assaults (with earlier trading venues [12am close])
White et al. (2015), USA ⁶⁵	Panel study examining the relationship between density and street crimes. Spatial panel models, focussing particularly on newly opened outlets	The city of Norfolk, Virginia (population of 242,803 in 2010)	Cohort / longitudinal study	Off-premise	Count	Street crimes, including homicide, aggravated assault, simple assault, rape, and robbery to individuals (Norfolk Police Department)	↑* on-premise outlet density & street crime ↑ off-premise outlet density & street crime
Xu et al. (2012), USA ⁶⁶	To evaluate the effects of changes in licensing policy at a city-level to examine if there was a relationship between outlet density and assaultive violence	New Orleans	Quasi-experimental	On-premise; off-premise	Count	Assaultive violence (New Orleans Police Dept between 1994 and 2004)	↓* Assaultive violence (with off-premise OD) ↓ Assaultive violence (with on-premise OD)
Zhang et al. (2015), USA ³⁰	To evaluate the impact of changes in alcohol outlet density on violent crime in Buckhead compared with 2 other cluster areas in Atlanta (Midtown and Downtown) with high densities of alcohol outlets, from 1997 through 2002 (pre-intervention) to 2003 through 2007 (post-intervention)	Violent crimes (188,138) between 1997- 2007 from Atlanta Police department	Quasi-experimental	On-premise	Spatial access	Violent crime (police data)	↓* Violent crime (with decreased on-premise OD)

Author (year) Country	Aim of study	Population	Study design	OD type	OD measure	Outcome (source)	Increased or decreased harms (including relevant sub-analyses) (↑ = positive association; ↓ = negative association; * = significant at a level of $p < 0.05$)
Gender-based family violence (n = 6)							
Cunradi et al. (2011), USA ⁶⁹	To investigate the association of alcohol outlet density (bars, restaurants, and off-premise outlets) with IPV-related police calls (from 2006 to 2009) and IPV-related crime reports (from 2001 to 2009) for the city of Sacramento, California	IPV-related police calls and crime reports between 2011 and 2009 in Sacramento, California	Cohort / longitudinal	Off-premise; bar; restaurant	Count	Intimate partner violence (police calls and crime reports)	Off-premise outlets: ↑* IPV-related police calls (with increase in off-premise OD) ↑ IPV crime reports (with increase in off-premise OD) Bars: No association of IPV-related police calls and crime reports with bar density Restaurants: No association of IPV-related police calls and crime reports with restaurant density
Cunradi et al. (2012), USA ⁶⁸	To examine the effects of outlet densities on IPV-related emergency department encounters throughout California between 2005-2008	State of California	Cohort / longitudinal	Off-premise; bar; restaurant	Spatial access	IPV-related ED visits (California Office of Statewide Health Planning and Development)	↑* risk of IPV-related ED visits (higher density of bars/pubs) ↓ risk of IPV-related ED visits (increasing off premise outlets) No change in risk of IPV-related ED visits and density of restaurants
Jiang et al. (2023), Australia ⁶⁷	To explore the association between alcohol outlet density and rates of domestic and non-domestic assault in NSW and if it differs by SES, urban vs regional and by the proportion of Aboriginal and Torres Strait Islander residents in the community	Domestic and non-domestic assaults in NSW from 2015 - 2019	Cohort / longitudinal	On-premise; off-premise	Count	Domestic and non-domestic assault (NSW Bureau of Crime Statistics and Research)	↑* domestic assaults (with increase in outlet density) ↑* domestic assaults (with increase in on-premise outlets) No significant association between off-premise outlet density and domestic assault
Laslett et al. (2022), Australia ⁷⁰	To investigate whether an association exists between substantiated child maltreatment cases, numbers of licensed outlets, and average alcohol sales volumes at the community level over a 13-year period across Western Australia	Annual numbers of substantiated child (0-17 yrs) maltreatment cases per postcode from 2001 to 2013, yielding 21,760 substantiations over the 13-year period	Cohort / longitudinal	On-premise; off-premise	Count	Child maltreatment, including physical, sexual, emotional abuse and neglect (Department for Child Protection and Family Support WA)	No association found between child maltreatment and outlet density ↓* child maltreatment (with off-premise outlets alcohol volumes sold (not density))

Author (year) Country	Aim of study	Population	Study design	OD type	OD measure	Outcome (source)	Increased or decreased harms (including relevant sub-analyses) (↑ = positive association; ↓ = negative association; * = significant at a level of $p < 0.05$)
Lightowlers & Bryant (2025), UK ⁷¹	To assess the impact of off-trade availability on alcohol-related violence and alcohol-related domestic violence, in the context of on-trade premise closures due to COVID-19 restrictions	35 out of 39 police force areas (PFAs) in England	Cohort / longitudinal	Off-premise	Count	Alcohol-related violent crime and domestic violence incidents (police recorded crime data - Home Office Data Hub)	No significant association between AR violent crime and domestic violence incidents with off-premise outlet density
Livingston (2011), Australia ⁷²	To examine the longitudinal relationship between alcohol availability and domestic violence rates at a neighbourhood level	Data from 186 postcodes in Melbourne between 1996 and 2005	Cohort / longitudinal	On-premise; off-premise; other	Count	Domestic violence incident data (Victorian Police Service - Law Enforcement Assistance Program database)	↑* Domestic violence (with all outlets) ↑* Domestic violence (with off-premise outlets) ↑* Domestic violence (with on-premise outlets)

Non-violent crime (n = 4)

Breetzke & Andresen (2018), NZ ⁷³	Examine the effects the Canterbury Earthquakes had on alcohol availability and crime, i.e. how alcohol outlets and crime across 6 different categories changed in magnitude and spatial distribution pre- (2009) and post- (2014) earthquake	199 census area units in Christchurch with 37,584 total offences	Cohort / longitudinal	Total outlet density	Spatial access	Crime - all crime, assault, burglary, motor vehicle (MV) theft, robbery, social incivilities, theft (police data)	↑* theft and social incivilities and alcohol outlets (i.e. there was spatial clustering between theft and social incivilities and alcohol outlets) No significant correlation between burglary and MV theft and alcohol outlets (i.e. there was no spatial clustering between burglary and MV theft and alcohol outlets)
Gruenewald et al. (2022), USA ²⁷	To measure agglomeration and churning and the impacts of openings and closings of outlets on neighbourhood crime	Population of the City of Oakland, CA, USA	Quasi-experimental	On-premise; off-premise	Count	Crime - assaults, burglaries, and robberies (Oakland Police Department)	Outlet openings and closings: ↑* burglaries (with restaurant openings – at tract level) No significant association between burglaries and openings/closings of bars/pubs (tract level) and off-premise outlets (block group level) Outlet densities: ↑* burglaries (with increased densities of bars/pubs – at tract level) No significant association between burglaries and restaurants (tract level) and off-premise outlets (block group level)

Author (year) Country	Aim of study	Population	Study design	OD type	OD measure	Outcome (source)	Increased or decreased harms (including relevant sub-analyses) (↑ = positive association; ↓ = negative association; * = significant at a level of $p < 0.05$)
Huang et al. (2025), USA ²⁵	Examine the spatial co-occurrence of bar locations and crime incidents across precise geographical locations and over time in Michigan from 2017 to 2022	City of Detroit, Michigan	Cohort / longitudinal	On-premise	Spatial access	Crime - aggravated assault, burglary, larceny-theft, murder, motor vehicle theft, rape, and robbery (Detroit Police data)	Alcohol outlets away from the Downtown area (and predominantly at the junctions of blocks), were mostly associated with all types of crimes Global Colocation Quotient analysis: Burglaries were least likely to occur, and larceny-theft most likely to occur, where there were alcohol outlets Local Colocation Quotient analysis: Motor vehicle theft, burglary and larceny-theft were co-located with alcohol outlets in Downtown Detroit.
Stockwell et al. (2015) Canada ⁶³	Estimate the effects of increases in minimum alcohol prices and densities of private liquor stores on crime outcomes in Canada, during a partial privatization of off-premise liquor sales	Local health areas (LHAs) nested within 16 health service delivery areas (HSDAs) from 89 geographic regions, in BC, Canada	Cohort / longitudinal	On-premise; other	Count	Crime incidents - alcohol-involved traffic violations, non-alcohol-involved traffic violations, and crimes against persons (BC Stats).	Alcohol-involved traffic violations: ↑ alcohol-involved traffic violations (with an increase in private liquor stores, government liquor stores, bars) ↓ alcohol-involved traffic violations (with an increase in restaurants) Non-alcohol-involved traffic violations: ↑* non-alcohol-involved traffic violations (with increase in private liquor store density) ↑ non-alcohol-involved traffic violations (with increase in government liquor store density) ↓ non-alcohol-involved traffic violations (with an increase in bars and restaurants)

Road safety (n = 4)

Gruenewald & Johnson (2010), USA ⁷⁴	Examine the influence of on-premise alcohol-outlet densities and of drinking-driver densities on rates of alcohol-related motor vehicle crashes	Motor vehicle crashes 1992 - 1996 in California and South Carolina	Cohort / longitudinal	On-premise	Count	Government database (California: Statewide Integrated Traffic Reporting System; South Carolina: Department of Public Safety)	↑* single-vehicle night-time crashes (in Downtown and rural areas threaded with highway traffic and 10% greater on-premise outlet density)
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Author (year) Country	Aim of study	Population	Study design	OD type	OD measure	Outcome (source)	Increased or decreased harms (including relevant sub-analyses) (↑ = positive association; ↓ = negative association; * = significant at a level of $p < 0.05$)
Han et al. (2015), USA ³¹	To examine the effects on motor vehicle crashes (MVC) of a policy change that led to the introduction of a very large number of off-premise alcohol outlets in Lubbock, Texas	Lubbock had an estimated population of 233,740 in 2011, plus about 31,000 students at Texas Tech University	Quasi-experimental	Off-premise	Count	Government database (State of Texas Crash Records Information System - CRIS)	Total MVC: ↓* total MVC rates (weak significant effect) for abrupt and gradual change post-policy (with increase in off-sale alcohol outlets) Single vehicle-nighttime (SVN) crashes: No significant effects were found for SVN crashes and off-sale alcohol outlets (SVN crashes act as surrogate for alcohol-induced crashes)
Lipton et al. (2018), USA ⁷⁵	To investigate the relationship between alcohol outlet densities to drinking, drunken driving, and alcohol-related motor vehicle crashes (MVCs) at 3 geographic levels	50 Californian cities	Cohort / longitudinal	Off-premise; bar; restaurant; total outlet density	Count	California Highway Patrol's (CHP) Statewide and Integrated Traffic Records System (SWITRS). Outcomes subgroups were all injury MVCs, 'had been drinking' (HBD) and single vehicle-nighttime (SVN) crashes	A 10% increase in outlets is associated with: ↑*MVC and HBD crashes (for all outlet types) ↑*MVC, HBD and SVN crashes (for bars only) ↓*SVN crashes (for restaurants only) No significant associations were found between off-premise outlets and MVCs, HBDs or SVNs
Tang (2013), USA ⁷⁶	To determine the effects of alcohol outlet density on highway safety	Alcohol-related accidents, DUI arrests and public intoxication arrests in 254 Texan counties between 1975 and 1996	Cohort / longitudinal	On-premise; off-premise; total outlet density	Count	County panel data: number of total accidents in which alcohol was a contributing factor, the number of DUI arrests	Alcohol-related accidents: ↓*alcohol-related total highway accidents (with increased outlet density for all outlet types) ↓*alcohol-related total highway accidents (with increased on- and off-premise alcohol outlet density) DUI arrests: ↓*DUI arrests (with increased outlet density for all outlet types) ↓*DUI arrests (with increased off-premise alcohol outlet density) No significant association between DUI arrests and on-premise outlet density

Author (year) Country	Aim of study	Population	Study design	OD type	OD measure	Outcome (source)	Increased or decreased harms (including relevant sub-analyses) (↑ = positive association; ↓ = negative association; * = significant at a level of $p < 0.05$)
Gun-related crime (n = 3)							
Branas et al. (2011), USA ³⁷	To aid communities in understanding relative value of different alcohol-related prevention strategies to reduce intentionally self-inflicted gun injury	3,485 (notified gun shootings) and 149 (self-inflicted gun injury cases) between 2003 and 2006 in Philadelphia	Case-control	On-premise; off-premise	Proximity	Self-inflicted gun injuries (Philadelphia Police Department data)	↑ risk of gun suicide (with high off-premise alcohol outlet availability) ↓ risk of gun suicide (with high on-premise alcohol outlet availability)
Morrison et al. (2017), USA ³⁵	To examine individuals' risk of being assaulted relative to their momentary proximity to alcohol outlets during daily activities	Case-control age matched cases of youth aged 10 - 24 years, from Philadelphia, PA	Case-control	On-premise; off-premise	Proximity	Gun assault non-gun assault (hospital records)	↓* risk of gun assault (with greater proximity to liquor stores) ↑ risk of gun assault (with greater proximity to restaurants) ↓ risk of gun assault (with greater proximity to beer stores)
Pear et al. (2023), USA ³⁶	To evaluate the effects of community firearm dealer and alcohol outlet densities on individual risk of firearm assault injury	Population of California - cases were California residents who experienced a fatal or nonfatal firearm assault injury in California	Case-Control	On-premise; off-premise	Count	Fatal or nonfatal firearm assault injury (mortality data from California Dep of Public Health's Comprehensive Death Files and ED and inpatient hospital discharge records from Dep of Health Care Access and Information)	↑* risk of firearm assault (with higher densities of pawn firearm dealers and off-premise alcohol outlets) ↓ risk of firearm assault (with higher densities of bar/pub outlets)

Table 9: Number of significant positive, significant negative, and non-significant associations by outcome and outlet type, and overall strength of evidence.

Outcome	On-premise outlets (bars/pubs/clubs) (↑ / ↓ / –)	Off-premise outlets (↑ / ↓ / –)	Total outlet density (↑ / ↓ / –)
Adolescent alcohol consumption (n = 6)	1 / 1 / 2	2 / 2 / 2	2 / 0 / 0
Adult alcohol consumption and dependence (n = 9)	4 / 0 / 0	5 / 0 / 0	2 / 0 / 0
Health and medical (n = 9)	5 / 0 / 4	10 / 3 / 1	N/A
Violent and assaultive crime (n = 14)	7 / 2 / 5 (↓2**)	4 / 1 / 7 (↓1**)	N/A
Gender-based family violence (n = 6)	3 / 0 / 1	2 / 1 / 5	2 / 0 / 1
Non-violent crime (n = 4)	1 / 0 / 3	1 / 0 / 4	2 / 0 / 2
Road safety (n = 4)	2 / 2 / 1	0 / 3 / 2	1 / 2 / 0
Gun-related crime (n = 3)	0 / 0 / 2	1 / 1 / 1	N/A

Legend:

↑ = significant positive association

↓ = significant negative association

– = non-significant association

Total outlet density refers to aggregated measures reported in some studies and is not the sum of off- and on-premise findings

On-premise results exclude restaurants

Counts represent the number of reported associations across included studies. Some studies reported multiple outlet measures

** These studies reported an association between reduced outlet density and reduced violence and assaultive crime

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