

Effectiveness of Policies Maintaining or Restricting Days of Alcohol Sales on Excessive Alcohol Consumption and Related Harms

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Abstract: Local, state, and national laws and policies that limit the days of the week on which alcoholic beverages may be sold may be a means of reducing excessive alcohol consumption and related harms. The methods of the *Guide to Community Preventive Services* were used to synthesize scientific evidence on the effectiveness for preventing excessive alcohol consumption and related harms of laws and policies maintaining or reducing the days when alcoholic beverages may be sold. Outcomes assessed in 14 studies that met qualifying criteria were excessive alcohol consumption and alcohol-related harms, including motor vehicle injuries and deaths, violence-related and other injuries, and health conditions.

Qualifying studies assessed the effects of changes in days of sale in both on-premises settings (at which alcoholic beverages are consumed where purchased) and off-premises settings (at which alcoholic beverages may not be consumed where purchased). Eleven studies assessed the effects of adding days of sale, and three studies assessed the effects of imposing a ban on sales on a given weekend day. The evidence from these studies indicated that increasing days of sale leads to increases in excessive alcohol consumption and alcohol-related harms and that reducing the number of days that alcoholic beverages are sold generally decreases alcohol-related harms. Based on these findings, when the expansion of days of sale is being considered, laws and policies maintaining the number of days of the week that alcoholic beverages are sold at on- and off-premises outlets in local, state, and national jurisdictions are effective public health strategies for preventing excessive alcohol consumption and related harms.

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Introduction

Excessive alcohol consumption in the U.S. is responsible for approximately 79,000 deaths per year, making it the third-leading cause of preventable death.¹ Approximately 15% of U.S. adults aged ≥ 18 years and approximately 29% of high school students in the U.S. report binge drinking (consuming five or more

drinks per occasion for men, and four or more drinks per occasion for women).^{2,3} The direct and indirect economic costs of excessive drinking in 1998 were \$184.6 billion.⁴ The reduction of excessive alcohol consumption is thus a matter of major public health and economic interest; this objective is a central goal in the U.S. public health agenda for the year 2010.⁵

This review examines the utility of enacting or maintaining limits on the days of the week on which alcoholic beverages may be sold (“days of sale”) as a strategy to prevent excessive alcohol consumption and related harms. The limitation of days of sale of alcoholic beverages is here defined as “applying regulatory authority to limit the days that alcoholic beverages may be sold at on- and off-premises alcoholic beverage outlets.” *Limiting* may be either maintaining existing limits (e.g., on the sale of alcoholic beverages on Sundays) or extending current limits (e.g., eliminating Sunday sales by repealing current

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authorization for such sales). Days of sale may be regulated at national, state, or local levels. *On-premises* retailing refers to the sale of alcoholic beverages for consumption at the point of sale (e.g., at bars, restaurants, or clubs); *off-premises* retailing refers to the sale (e.g., at package stores, liquor stores, grocery stores, or convenience stores) of contained alcoholic beverages for consumption elsewhere. Because most of the studies reviewed consider removing limits on days of sale (e.g., allowing sale of alcoholic beverages on Sunday when Sunday sales had previously not been allowed), the intervention of public health interest for the review is the study control condition (i.e., maintaining limits on days of sale).

In the U.S., policies restricting the days of sale currently apply to Sundays only. There are several variations on the regulation of Sunday alcohol sales in the U.S. including full bans, reduced hours relative to other days of the week, restrictions on the sale of alcoholic beverages with a high alcohol content, and the authorization of local decision making.⁶ A total of fourteen states (Alabama, Arkansas, Connecticut, Georgia, Illinois, Indiana, Kansas, Kentucky, Minnesota, Nebraska, Oklahoma, South Carolina, Tennessee, and Utah), ban alcohol sales at off-premises retail alcohol outlets on Sundays. Fourteen states (Alaska, California, Colorado, Florida, Hawaii, Idaho, Kentucky, Montana, Nevada, New Hampshire, Oregon, Vermont, Wisconsin, and Wyoming) do not restrict Sunday alcohol sales. The remaining 22 states and the District of Columbia allow Sunday sales with restrictions regarding hours and/or types of alcoholic beverages sold. Outside of the U.S., current policies restricting the days of sale may apply to days other than Sunday (e.g., some countries prohibit alcohol sales on Saturdays).

In the U.S., the control of days and hours of sale at the local level is often pre-empted by state regulations prohibiting local authorities from enacting stricter alcohol control regulations in the state in general.^{7,8} However, in some states, counties and other local jurisdictions are allowed to establish their own alcohol control policies. The nature of this authority varies by state and may allow cities or counties to have reduced hours from those stipulated by the state; have the same hours on Sunday as available during the rest of the week; or limit the sale of alcohol on Sundays to specific areas or locations. Fourteen states provide for local authority regarding days of sale, and four more allow Sunday sales in limited locations within the state.⁶ In 1995, New Mexico repealed a ban on off-premises alcohol sales on Sundays, but also allowed local jurisdictions to hold referenda to restore a local ban on Sunday sales. Alaska and Kentucky also allow counties to independently restrict alcohol sales.

This review addresses the effects on excessive alcohol consumption and related harms of maintaining or increasing restrictions on the days of sale at on- or off-premises outlets.

Findings and Recommendations from Other Reviews and Advisory Groups

Several reviews conducted in the U.S. have concluded that restricting the days of sale is an effective strategy for reducing excessive alcohol consumption and related harms. For example, a narrative review conducted by Single⁹ concluded that controlling the days (and hours) of sale may influence levels of impaired driving and other drinking problems. A systematic review published by the Substance Abuse and Mental Health Service Administration's Center for Substance Abuse Prevention¹⁰ in 1999 found substantial evidence for harms associated with expanding the days (and hours) of alcohol sales. This finding was based on previous empirical research indicating that the expansion of the days (and hours) of sale increased prevalence of excessive alcohol consumption and alcohol-related problems. Other narrative reviews^{11,12} generally concur with these findings.

Several international bodies have recommended the control of days (or hours, or both) of sale, as a means of reducing excessive alcohol consumption and related harms. The WHO has published a narrative review¹³ that identifies the limiting of days of sale as an effective method for reducing alcohol-related harms. Similarly, the Western Australian Alcohol Plan¹⁴ recommended that days and hours of sale should be considered as factors in the local regulation of alcohol availability. In Ireland, the Department of Health and Children's Strategic Task Force on Alcohol¹⁵ concluded that "restricting any further increases in the physical availability of alcohol (number of outlets and times of sales)" is among the most effective policy measures that influence alcohol consumption and related harms.

The present review updates prior syntheses using the systematic approach of the *Guide to Community Preventive Services (Community Guide)*, as described below.

Methods

The methods of the *Community Guide* were used to systematically review scientific studies that have evaluated the effectiveness of limiting or maintaining existing limits on days of sale for preventing excessive alcohol consumption and related harms. More details on the *Community Guide* review process are presented elsewhere.¹⁶ In brief, this process involves forming a systematic review development team; developing a conceptual approach to organizing, grouping, and selecting interventions; searching for and retrieving available research evidence on the effects of those interventions; assessing the quality of studies and abstracting information from

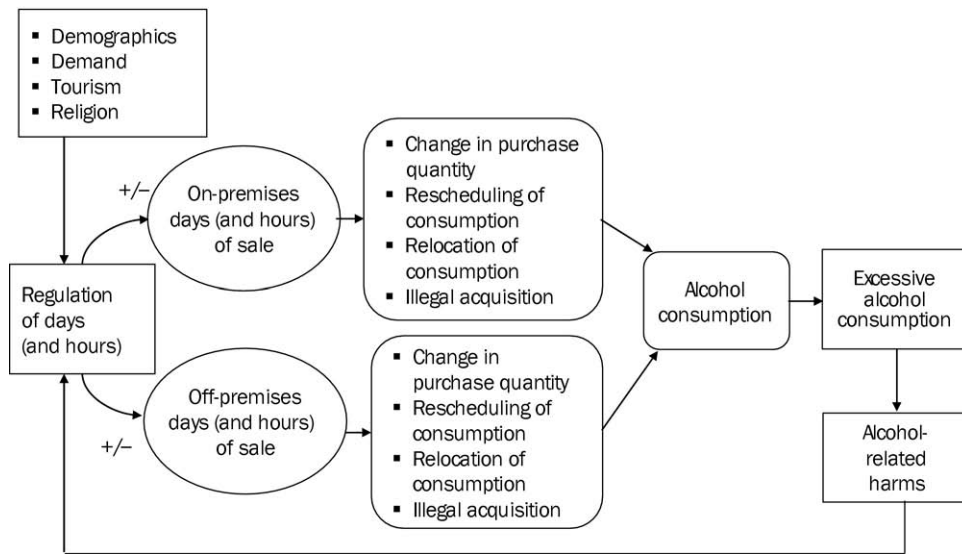


Figure 1. Effects of regulation of days (and hours) of alcohol sales on excessive alcohol consumption and related harms

each study that meets inclusion criteria; assessing the quality of and drawing conclusions about the body of evidence on intervention effectiveness; and translating the evidence on effectiveness into a recommendation or finding for each intervention reviewed. Evidence is collected and summarized on (1) the effectiveness of interventions in altering selected health-related outcomes and (2) positive or negative effects of the intervention on other health and nonhealth outcomes. To help ensure objectivity, the review process is typically led by scientists not employed by a program that might be responsible for overseeing the implementation of the reviewed intervention. When an intervention is shown to be effective, information is also analyzed on (3) the applicability of the evidence (i.e., the extent to which effectiveness data might generalize to diverse population segments and settings); (4) the economic impact of the intervention; and (5) barriers to implementation. The results of this review process are presented to the Task Force on Community Preventive Services (Task Force), a nonfederal independent scientific review board, which objectively uses specified guidelines to consider the scientific evidence on intervention effectiveness and determines whether the evidence is sufficient to warrant a recommendation.¹⁶

Conceptual Approach and Analytic Framework

Policies reducing or expanding days of sale (Figure 1) are hypothesized to affect alcohol consumption and alcohol-related harms through the

^aAndorra, Antigua and Barbuda, Aruba, Australia, Austria, The Bahamas, Bahrain, Barbados, Belgium, Bermuda, Brunei Darussalam, Canada, Cayman Islands, Channel Islands, Cyprus, Czech Republic, Denmark, Equatorial Guinea, Estonia, Faeroe Islands, Finland, France, French Polynesia, Germany, Greece, Greenland, Guam, Hong Kong (China), Hungary, Iceland, Ireland, Isle of Man, Israel, Italy, Japan, Republic of Korea, Kuwait, Liechtenstein, Luxembourg, Macao (China), Malta, Monaco, Netherlands, Netherlands Antilles, New Caledonia, New Zealand, Northern Mariana Islands, Norway, Oman, Portugal, Puerto Rico, Qatar, San Marino, Saudi Arabia, Singapore, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Trinidad and Tobago, United Arab Emirates, United Kingdom, U.S., Virgin Islands (U.S.)

following means: First, increases or decreases in the days of sale affect consumers' ability to purchase alcohol by changing its availability. Second, when access to alcoholic beverages changes, consumers may alter their purchasing habits in several ways, including changing their purchase volume per visit to the outlet, rescheduling their purchases, relocating their purchases, or obtaining alcoholic beverages illegally. Various characteristics of the affected population, including the demand for alcoholic beverages, the number of adult tourists the area attracts, and the

religious affiliation and involvement of residents, may affect the establishment of the policies regulating days of sale.

Changes in days of sale may also affect alcohol-related outcomes by other means. For example, increases in the days of sale at on-premises outlets allow more opportunities for social aggregation, which in turn may increase aggressive behaviors that are exacerbated by alcohol consumption.¹⁷ Increases or decreases in the days of sale may also alter travel patterns to areas where alcohol can be purchased, and thus influence the risk of injury or death in motor vehicle crashes that may be alcohol-related. It might be expected that added days of sale at on-premises outlets would be more likely to increase alcohol-related motor vehicle crashes than added days in off-premises facilities because patrons who have drunk at an on-premises facility may drive after excessive consumption, whereas patrons of off-premises outlets are not supposed to drink at that facility. It is also possible that when available days at on-premises facilities are reduced, motor vehicle crashes might be increased if consumers drove to more distant on-premises facilities and then returned after excessive consumption.

Inclusion and Exclusion Criteria

To be included as evidence in this review, studies had to

- evaluate long-term policy changes related to days of sale; studies that assessed short-term changes in alcohol availability (e.g., alcohol sales related to a special event) were not included;
- assess the impact of changes in days of sale alone on excessive alcohol consumption or related harm, as opposed to evaluating the effect of this change only in combination with other interventions;
- be conducted in a high-income country^{18,a};
- present primary research findings, and not just review other research findings;
- be published in English;
- have a comparison group, or at a minimum, compare outcomes of interest before and after a change in the policy related to days of sale.

Table 1. Evidence of the effects of limits of days of alcohol sale on excessive alcohol consumption and related harms

| Study Design description (suitability) Study execution (no. of limitations) | Population Study time period | Intervention comparison |
|---|---|--|
| Days of sale: On-premises | | |
| Ligon (1996) ²² Interrupted time series: before-and-after with comparison (greatest) Fair (2) | Athens GA January 1992 –December 1993 | Intervention: On 12/8/1992, Athens-Clarke County amended the Alcoholic Beverage Ordinance. Previously, Sunday sales of liquor were banned. After the change, restaurant patrons were able to purchase alcoholic beverages with food, but bars and taverns remained closed and off-premises sales were still prohibited. Comparison: Other days of the week |
| Smith (1978) ²⁸ Interrupted time series: before-and-after with comparison (greatest) Fair (2) | Perth, Western Australia 3 years before and 3 years after new law (used midpoint of June 30, 1970) | Intervention: On 7/7/1970 the sale and supply of alcoholic beverages on Sundays in the Perth Metropolitan area of Western Australia became legal. In general, two 2-hour drinking sessions were permitted. Prior to the change, alcohol sales at on-premises facilities were permitted between 10 AM and 10 PM only, Monday to Saturday. Comparison: Remainder of the state |
| Smith (1988) ³⁰ Before-and-after with comparison (greatest) Fair (2) | Brisbane, Australia Before period: April 1, 1968–March 31, 1970 After period: April 1, 1970–March 31, 1973 3-year After period: April 1, 1973–March 31, 1976 | Intervention: On April 3, 1970, Sunday alcohol sales were introduced in Brisbane, Australia. Sunday drinking was allowed from 11 AM to 1 PM and 4 PM to 6 PM Comparison: Other days of the week and the rest of Queensland |
| Smith (1987) ²⁹ Before-and-after with comparison (greatest) Fair (3) | New South Wales, Australia Before period: December 7, 1976–December 6, 1979 After period: December 7, 1979– December 6, 1981 | Intervention: In 1978, Select Committee of the New South Wales Parliament considered the issue of hotel alcohol service hours in that state. Subsequently it was recommended on December 7, 1979 that the hotel service hours of 12 NOON to 10:00 PM on Sundays be introduced. Comparison: Other days of the week and the rest of the Queensland state |
| Smith (1990) ³¹ Before-and-after with comparison (greatest) Fair (3) | Victoria, Australia Before period: January 1, 1980– December 31, 1983 After period: January 1, 1984– December 31, 1984 The following 12 months were used as the “after” period for the 8-hour Sunday drinking permit. | Intervention: Two legislative changes that increased the Sunday availability of alcoholic beverages in Victoria. Prior to July 13, 1983, on Sunday, hotels and licensed clubs in Victoria could sell alcoholic beverages for consumption only with a meal. After that date, hotels and clubs were allowed to obtain a permit that permitted them to open for two 2-hour periods on Sunday between 12 NOON and 8PM. The two drinking periods had to be at least 2 hours apart. Following an amendment to the Victorian Liquor Control Act, as of November 1984, hotels and clubs could apply for a permit that enabled them to open between 12 NOON and 8 PM on Sundays. The 1984 amendment also allowed for hotels to obtain a permit to continue Monday to Saturday ordinary bar trading from 10 PM to 12 MN. The amendment also introduced Sunday restaurant hours of 12 NOON to 11:30 PM. Previously, the Sunday restaurant opening hours were 12 NOON to 4PM and 6 to 10 PM. Comparison: Other days of the week |
| Knight (1980) ²¹ Before-and-after study design without comparison (least) Fair (4) | Four major cities and central belt of Scotland Before: March 1977 After: October 1977 | Intervention: In 1973, Scottish Licensing Law changed. The two main changes were the extension of evening hours on weekdays to 11 PM (previously 10 PM) and the provision for special licenses to allow pubs to open regularly on Sundays. Sunday licenses were not issued for approved public houses until October 1977. Comparison: No comparison group |

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Table 1. (continued)

| Analysis Outcome | Reported findings | Review Effect size |
|---|---|---|
| Chi-square DUI arrests | Following the change in law, the incidence of DUIs was lowest for Sundays. The frequency of DUI arrests made on Sundays were statistically lower than every other day of the week, except for Monday | Relative % change (95%CI): 39.8 (-21.9, 150.4) |
| Chi-square Traffic crashes: people killed in motor vehicle crashes | Significant increase in the proportion of people killed and the number of motor vehicle crashes on Sundays, compared with the other 6 days of the week in Perth. No increases in the proportions of people killed or in the number of motor vehicle crashes occurring on Sundays in comparison with the other days of the week for the rest of the state. 11% of the 453 people killed in Perth traffic crashes were killed on Sundays: after the new law, 16.9% of 486 people were killed on Sundays ($\chi^2 = 6.134$, $p > 0.02$). Rest of the state proportions were 18 and 17.4% before and after ($\chi^2 = .0318$, $p > 0.80$). Motor vehicle crashes occurring on Sundays in the Perth area increased from 12.4% of 11,598 before the new law to 14.2% of 11,870 afterward ($\chi^2 = 16.85$, $p < 0.001$). In the rest of the state the proportion of motor vehicle crashes occurring on Sunday decreased from 19.7% to 18.4% ($\chi^2 = 15.95$, $p > 0.20$) | Relative % change: People killed: 58.9; motor vehicle crashes: 22.6 |
| Chi-square Motor vehicle crashes | First follow-up period: Only the segment from 6:00 PM to 7:59 PM gave a significant result for Brisbane. In comparison to the other 6 days of the week, and after allowing for the slight change in the control data from the before to the after period, the annual increase was 129.8%. No significant differences in Brisbane motor vehicle crashes on Sundays between 8:00 PM and 10:59 AM. No significant increases in Queensland Sunday motor vehicle crashes occurred for any of the time segments. 3-year follow-up available, but data incomplete | Relative % change (95%CI): 65.0 (30.49, 108.65) |
| Chi-square Motor vehicle fatalities Traffic crashes | After the introduction of a 10-hour hotel session in New South Wales, for the 12-hour period from 12:00 NOON to 11:59 PM, there was a 22.2% increase in Sunday fatal crashes. None of the analyses for the control period of 12:00 MN to 11:59 AM gave significant results in the same direction as for motor vehicle fatalities or traffic crashes. | Relative % change (95%CI): Motor vehicle Fatalities 15.5 (-0.13, 33.59) Traffic crashes 6.7 (0.56, 13.21) |
| Chi-square Motor vehicle traffic crashes | The introduction of the two 2-hour drinking sessions on Sundays did not adversely affect the number of motor vehicle crashes, so information on 8-hour drinking not included. | Relative % change (95% CI): 9.9 (3.27, 16.98) |
| Percentage changes Consumption and patterns of consumption | Increase in consumption among men aged <45 years. Virtually no change in drinking among women. | Average change in consumption for men: 6.82 Average change in consumption for women: 1.85 |

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Table 1. Evidence of the effects of limits of days of alcohol sale on excessive alcohol consumption and related harms (*continued*)

| Study Design description (suitability) Study execution (no. of limitations) | Population Study time period | Intervention comparison |
|---|--|--|
| Days of sale; hours off-premises | | |
| McMillan (2006) ²³ McMillan (2007) ²⁴ Time-series study with prospective data collection (greatest) Fair (3) | Location: New Mexico Dates: Intervention: July 1995 Pre-period: July 1990–June 1995 Follow-up: July 1995–2000 | Intervention: Legalized Sunday off-premises sales: <ul style="list-style-type: none"> ● Between the hours of 12 NOON and 12 MN ● Alcohol was available on-premises prior to law change ● Provision for local option to reinstate ban, municipalities to bear cost of referendum and enforcement Comparison: Pre–post study, non-Sunday days serve as control. Also comparison of alcohol- and non-alcohol-related crash trends |
| Norstrom (2003) ²⁵ Norstrom (2005) ²⁶ Experimental time-series design (greatest) Good (1) | Location: Sweden Dates: Pre-intervention: January 1995–July 2000 Phase I (experimental): February 2000–June 2001 Phase II (whole country): July 2001–July 2002 | Intervention: Saturday sales allowed experimentally for six counties (Phase I) <ul style="list-style-type: none"> ● 43% of population ● Saturday sales extended to whole country (Phase II) Comparison: <ul style="list-style-type: none"> ● Seven control counties ● Middle and southern regions of Sweden ● 34% of population ● Separated from experimental regions by buffer zone ● Buffer zones 22% of population |
| Olsson (1982) ²⁷ Experimental time-series design (greatest) Fair (3) | Location: Sweden Dates Pre-period: June 1980–September 1980 Follow-up: June 1981–September 1981 Intervention: May 1981 | Intervention: Saturday closure of retail liquor stores Comparison: Non-Saturdays |
| Stehr (2007) ³² Econometric state-level time-series analysis (greatest) Fair (2) | U.S. 1990–2004 Bans were repealed in the following states: 1995: New Mexico 2002: Oregon 2003: Delaware, Kansas, Massachusetts, New York, Pennsylvania 2004: Rhode Island, Idaho, Kentucky, Ohio, Virginia 2005: Washington | Intervention: Having a Sunday ban on off-premises purchase (12 states during the study period). Specific to either beer or liquor, but wine not included. Comparison: States that did not allow sales on Sunday in each year of data collection. |
| Nordlund (1985) ³³ | Norway Before: 1983 After: 1984 | Intervention: In select villages, shops were allowed to re-open on Saturdays, in contrast to the newly instituted Saturday closing in the rest of the country. Comparison: Shops in control cities (matched by size and demographic characteristics to be similar to intervention towns). These remained open on Saturday as always. |

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Table 1. (continued)

| Analysis Outcome | Reported findings | Review Effect size |
|---|---|---|
| RR ARCs and fatalities | ARC RR (95% CI)= 1.29 (1.05, 1.58) ARC fatalities (95% CI)=1.42 (1.05, 1.93) Mean RR ARC Fatalities rest of week (95% CI)=1.07 (0.80, 1.45) Excess ARCs in study period (95%, CI)=543.1 (158.9, 927.4) Excess ARC fatalities (95% CI)=41.6 (6.6, 76.6) 2007 Study: Three counties that overturned ban repeal right away had lowest ARC RR; only one other county had RR in lowest category. | Alcohol-related Sunday crash fatalities (relative % change [95% CI]): 26.8% (3.3, 44.2) |
| ARIMA and parametric models Alcohol sales, assaults, drunken driving, and positive breath analyzer test results | Effects appear uniform across three experimental areas, tendency toward weaker effect in Northern Sweden not sign. Phase I consumption (relative % change): ● Beer (7.6%) ● Wine (2.5%) ● Spirits (3.7%) ● Total alcohol (3.7%) Phase II consumption (relative % change): ● Beer (1.8%) ● Wine (1.2%) ● Total alcohol (3.6%) | Relative % changes (95% CI): Drunk driving: 11.3% (4.2, 18.4) Alcohol sales (liters pure alcohol per capita per year): 3.6% (2.6, 4.6) Assaults, women (indoors): 0.6% (-6.5, 7.7) Assaults, total: -1.3% (-5.6, 3.0) |
| Police interventions Intoxicated people Domestic disturbances Outdoor assaults | Sales of alcohol: Slight decline could not be attributed to effects of Saturday closing. Illegal trading: (Police judgment) % of districts reporting: ● No change: 69% ● Increase: 24% ● Decrease: 7% Overall declines in: ● Drunkenness ● Domestic disturbances ● Public disturbances (not attributable to policy) ● Assaults declined | Relative % changes (95% CI): Outdoor assaults: -17.7% (-45.8, 25.0) Domestic disturbances -17.3% (-34.8, 4.8) Police interventions against intoxicated people -35.7% (-43.8, -26.4) |
| Time-series analysis of state-level variables, including Sunday bans. Controlled for pre-repeal trends | Per capita beer sales in gallons ● -2.4 relative % change due to Sunday bans controlling for pre-repeal trends ● -4.1 relative % change due to Sunday ban not controlling for pre-repeal trends Per capita spirits sales in gallons ● -3.5 relative % change due to Sunday ● -5.2 relative % change due to Sunday ban not controlling for pre-repeal trends. | Beer sales: 2.4% relative change due to repeal of bans Spirits sales: 3.5% relative change due to repeal of bans Note: Although authors coded for presence of Sunday bans, all policy changes during the study period were in the direction of repeal, so the signs have been reversed in reporting effect (above). |
| Customer calls Cash turnover Liters pure alcohol Liters total sale all outlets Arrests for drunkenness Reports of drunkenness Reports domestic trouble Reports of violence | Customers made fewer trips to vinmonopolets (i.e., state alcoholic beverage monopoly stores). Total sales at these outlets declined, but the total sales at all outlets went up slightly. Reports of drunkenness went down but not significantly, while drunkenness arrests declined significantly. Reports of domestic trouble went down a sizeable and significant 16%, whereas reports of violence went up 5%. General effects were consistent but small; ordinary drinkers consumed about the same total amount, purchased in fewer trips to the vinmonopolets with larger purchases per trip. Ultimately, the Saturday closing was repealed because of insufficient evidence of benefit. | Relative % changes: Liters pure alcohol: -3.1% Arrests for drunkenness: -5.8% Reports of drunkenness: -5.0% Reports domestic trouble: -15.9% Reports of violence: 5% |

ARC, alcohol-related crashes; ARIMA, autoregressive integrated moving average; RR, relative risk

To be included in this review, studies also had to report on outcomes related to excessive alcohol consumption or related harms. Specific types of harm that were of interest included alcohol-related medical conditions (e.g., liver cirrhosis); alcohol-impaired driving; alcohol-related crashes; unintentional or intentional injuries; and violent crime.

Outcome measures that had the strongest known association with excessive alcohol consumption included binge drinking, heavy drinking, liver cirrhosis mortality, alcohol-related medical admissions, and alcohol-related motor vehicle crashes, including single-vehicle night-time crashes (which are widely used to indicate motor vehicle crashes due to drinking and driving).¹⁹ Less-direct measures included per capita alcohol consumption, a recognized proxy for estimating the number of heavy drinkers in a population^{13,20}; unintentional injuries; suicide; and crime, such as homicide and aggravated assault. When studies assessed multiple outcomes of interest, those outcomes with the strongest known association with excessive alcohol consumption were selected.

Search for Evidence

The following databases were searched from inception to February 2008: Econlit, PsycINFO, Sociology Abstracts, MEDLINE, Embase, and EtOH. Searches also were conducted of the reference lists of papers reviewed as well as lists in review articles. Government reports were considered for review, but other unpublished papers were not. In addition, experts were consulted to identify other studies that might have been missed.

Assessing the Quality and Summarizing the Body of Evidence on Effectiveness

Each study that met the inclusion criteria was read by two reviewers who used standardized criteria (available at www.thecommunityguide.org/about/methods.html) to assess the suitability of the study design and threats to validity. Uncertainties and disagreements between the reviewers were reconciled by consensus among the team members.

Studies were evaluated based on their design and execution. The current classification of the study designs accords with *Community Guide* standards¹⁶ and may differ from the classification reported in the original studies. Those that collected data prospectively on exposed and control populations were classified as having the greatest design suitability. Those that collected data retrospectively or lacked a comparison group but that conducted multiple pre- and post-measurements on their study population(s) were rated as having moderate design suitability. Finally, cross-sectional studies, those without a comparison group, and those that involved only a single pre- and post-measurement in the intervention population were considered to have the least suitable design. Quality of execution was assessed by examining potential threats to study validity, including an inadequate description of the intervention or of the study population, poor measurement of the exposure or outcome, failure to control for potential confounders, and a high level of attrition among study participants. Based on these criteria, studies were characterized as having good quality of execution if they had at most one threat to validity, fair execution if they had two to four threats to validity, and limited quality of execution if they had five or more threats to validity. Only

studies with good or fair quality of execution were included in the body of evidence; studies with any level of design suitability were included, other than those with cross-sectional design.

We calculated effect sizes as relative percentage change in the intervention population compared with the control population using the following formulas:

- For studies with before-and-after measurements and concurrent comparison groups:

$$\text{Effect size} = [(I_{\text{post}}/C_{\text{post}})/(I_{\text{pre}}/C_{\text{pre}}) - 1] \times 100\%$$

where:

I_{post} = last reported outcome in the intervention group after the intervention;

I_{pre} = reported outcome in the intervention group before the intervention;

C_{post} = last reported outcome in the comparison group after the intervention;

C_{pre} = reported outcome in the comparison group before the intervention.

- For studies with before-and-after measurements but no concurrent comparison:

$$\text{Effect size} = [(I_{\text{post}} - I_{\text{pre}})/I_{\text{pre}}] \times 100\%$$

When there was a large enough number of studies of a single outcome, median effect size and interquartile intervals were reported.

Results

Intervention Effectiveness

Fourteen studies^{21–34} that examined the effects of changes in days of sale met the inclusion criteria for the review. These studies assessed changes that took place in cities (Athens GA [two studies] and Perth and Brisbane, Australia); states (50 U.S. states, New Mexico [two studies], and Victoria and New South Wales, Australia); and countries or large regions of countries (Norway [one study], Sweden [three studies], and Scotland [one study]). The policy changes that were assessed took place between 1967 and 2004. (For a summary of all evidence included in this review, see [Table 1](#).)

The studies used a variety of methods for estimating intervention effects, including chi-square statistics, percentage change, relative risks, and auto-regressive integrated moving average (ARIMA) time series; all except one study²¹ had comparison populations or conditions. Thirteen studies^{22–34} were of greatest design suitability and one²¹ was of least design suitability. Four studies^{25,26,32,33} were of good execution and the remainder^{21–24,27–31,34} were of fair execution. Studies assessing changes in days of sale in off-premises settings were analyzed separately from those in on-premises settings. Four studies^{28–31} were conducted by one researcher (Smith), and two studies each by Ligon and Thyer,^{22,34} McMillan and colleagues,^{23,24} and Norstrom and Skog.^{25,26}

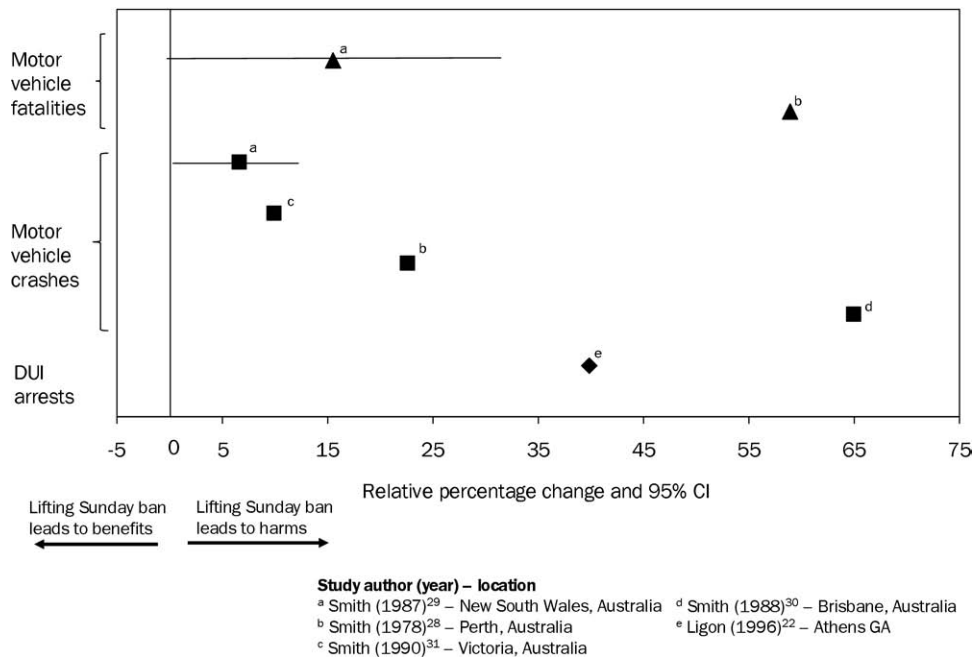


Figure 2. Relative percentage change in motor vehicle–related events after Sunday on-premises sales legalized
 DUI, driving under the influence

The Effect of Changing the Number of Days That Alcohol Was Sold at On-Premises Outlets

Seven studies^{21,22,28–31,34} assessed the effects of increasing days of sale at on-premises retail alcohol outlets. Only one study²¹ assessed changes in consumption; the remainder assessed the effects of changes in days of sale on motor vehicle–related outcomes.

Effect on excessive alcohol consumption. The findings of Knight and Wilson²¹ were reviewed in detail because only these authors examined excessive consumption among individuals (rather than per capita consumption or alcohol-related harms). This study assessed the impact on excessive alcohol consumption of a 1977 law allowing Sunday alcohol sales in the four major cities and within the central belt of Scotland. After Sunday pub sales were legalized in this area, there was a 1.3 (95% CI=−0.4, 2.8) standard unit of alcohol (a British measure equivalent to 0.6 of the U.S. standard drink) increase in the average weekly consumption by men who drank; a significant 2.4 standard unit (95% CI=0.6, 4.2) increase among men aged 18–45 years; and a nonsignificant −0.5 (95% CI=−2.6, 1.3) standard unit change in the average weekly consumption of men aged >45 years. Increases among men occurred across most levels of baseline drinking. The researchers reported a nonsignificant −0.6 standard unit change among women who drank (95% CI=−1.6, 0.5) that did not differ by age. Knight and Wilson also obtained information on the patterns of consumption

among study participants. After the change, the percentage of people who reported having 1–8 standard units on Sundays increased from 27% to 29% (7.4%, 95% CI=−11.0, 31.1), and those who reported having >8 standard units increased from 4% to 5% (25%, 95% CI=−26.5, 100.1); neither increase was significant.

Effect on alcohol-impaired driving and motor vehicle crashes.

Five studies^{22,28–31} examined the impact of allowing Sunday on-premises sales on various measures of alcohol-impaired driving (e.g., arrests for driving under the influence [DUI]) and motor vehicle crashes [Figure 2]). An additional study in Athens GA³⁴ examined the impact of a December 1992 local law that allowed Sunday sales in restaurants (but not in bars). The investigators found that this change was followed by a 39.8% increase in DUI arrests (95% CI not calculable).

Two studies^{28,30} assessed the impact of changes in days of sale in on-premises retail outlets in Perth and Brisbane, Australia, on deaths and injuries related to motor vehicle crashes; they compared outcomes on days when alcohol became newly available with outcomes on days when availability did not change. The city of Perth legalized Sunday alcohol sales in 1970, allowing two 2-hour periods when alcoholic drinks could be purchased. After this change, there was a 22.6% increase in motor vehicle crashes and a 58.9% increase in motor vehicle fatalities in Perth compared with the rest of the state. In the same year, Sunday sales were legalized in Brisbane also, resulting in an increase of 65% (95% CI not calculable) in motor vehicle crashes.

Finally, two additional studies assessed the effects on motor vehicle crashes of allowing Sunday sales in different regions of Australia. In 1979, the state of New South Wales began allowing hotels to serve alcoholic beverages between 12 NOON and 10 PM on Sundays.²⁹ This change was followed by an increase of 6.7% (95% CI=0.6%, 13.2%) in traffic crashes and an increase of 15.5% (95% CI=−0.1%, 33.6%)

in motor vehicle fatalities, compared with other days of the week in which hours did not change. Lastly, a study by Smith³¹ assessed the influence of newly legalized Sunday sales in clubs and hotels on motor vehicle injury crashes in the state of Victoria. Before the law changed in 1983, hotels and licensed clubs could sell alcoholic beverages only with a meal. After the law changed, a meal was no longer required for the consumption of alcohol, and two 2-hour drinking periods were introduced. In the following year, there was a 9.9% increase in motor vehicle crashes on Sundays compared with days of the week in which hours had not changed (95% CI=3.3%, 17.0%).

Effect of Changing the Number of Days That Alcohol Was Sold at Off-Premises Outlets

Effect of repealing bans on days of sale. Four studies^{23,25,26,32} examined the impact of increasing the days of sale at off-premises locations (Figure 3), by removing existing restrictions. Two of these studies^{25,26} examined the two-phase reinstatement of Saturday sales in Sweden between 2000 and 2003 (Sunday sales remained banned). Another study²³ examined the repeal of a ban on Sunday sales in New Mexico. Lastly, a time-series study³² examined the impact of bans across U.S. states over a period of 15 years, during which policies on off-premises Sunday sales changed in 13 states.

One study²⁵ examined the effect of removing a nearly 20-year ban on Saturday alcohol sales at off-premises locations in Sweden. Researchers collaborated with the Swedish government to implement a national experiment. In the first phase, to assess possible harms, Saturday sales were allowed only in select counties for an experimental period of 1 year. The intention was to repeal the ban on Saturday sales in the rest of the country if harms did not increase significantly when the repeal was in place in the experimental counties. To limit confounding by cross-border sales,

buffer zones were designated between the experimental areas and the control areas. The experimental areas were noncontiguous, and included several rural areas, as well as Stockholm, encompassing about 43% of the population. The control area covered seven contiguous counties and another eight counties not contiguous with those, with a total of about 34% of the population. The buffer counties had approximately 22% of the population.

During Phase I, alcohol sales in the experimental area increased 3.6% (95% CI=2.6%, 4.6%) and incidents of drunk driving arrests increased by 11.3% (95% CI=4.2%, 18.4%) compared with that in the control areas. Both findings were significant. However, the researchers noted that along with repeal of the ban, there was increased police surveillance for alcohol-related motor vehicle incidents in the experimental region, which may have contributed to the increase in the number of drunk driving incidents reported. Assaults against women indoors (a proxy for domestic violence) increased 0.6% (95% CI=-6.5%, 7.7%) and total assaults declined by 1.3% (95% CI=-5.6%, 3.0%); neither result was significant.

During Phase II, the repeal of the ban on Saturday sales was extended to the whole country.²⁶ Alcohol sales increased by 3.5% (95% CI=3.0%, 4.0%) in what had been the control and buffer regions in Phase I—an increase similar to that which had occurred in experimental counties in Phase I. The 1.7% (95% CI=-7.0%, 10.0%) in-

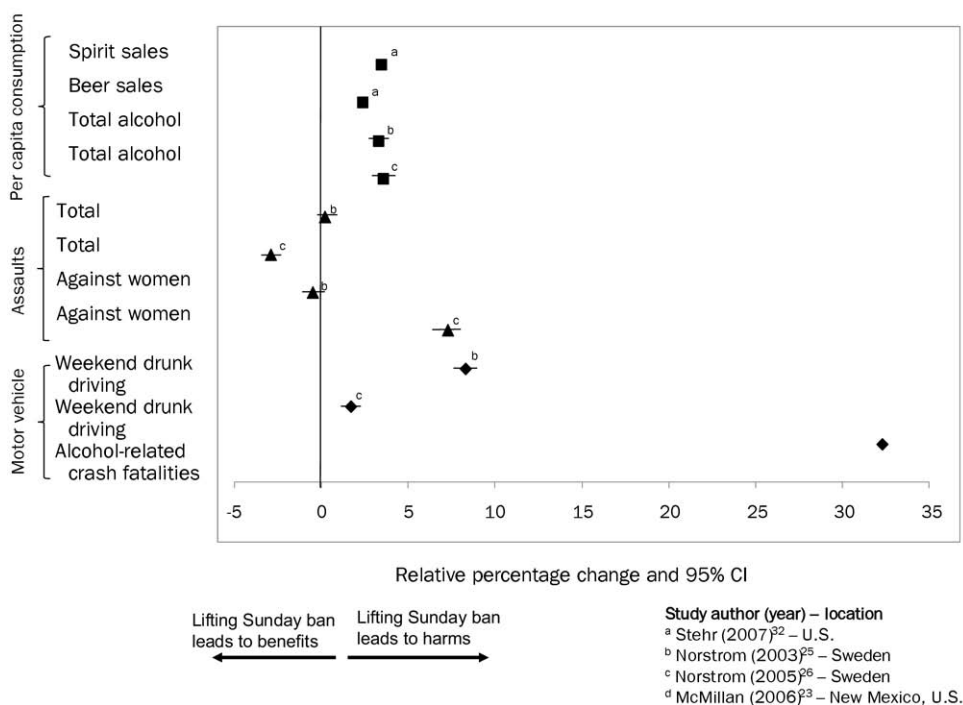


Figure 3. Relative percentage change in three categories of alcohol-linked effects attributable to an increase in days of alcohol sale in off-premises establishments

crease in drunk driving arrests in the rest of the country was not significant in Phase II (unlike in Phase I).

McMillan and others²³ examined the impact of the repeal of a ban on Sunday alcohol sales at off-premises retail outlets in New Mexico in 1995. (On-premises consumption of alcohol on Sundays was allowed already in New Mexico at that time, and was not changed by the law.) The study evaluated the impact of this change on deaths in alcohol-related motor vehicle crashes. Crashes were considered to be alcohol-related if one of the drivers involved in the crash had a blood alcohol concentration (BAC) >0.0%. To assess the impact of the repeal on alcohol-related crash fatalities, the researchers calculated the relative risk of dying in an alcohol-related crash, by day of the week, after alcohol sales were allowed on Sundays compared with the period prior to the change. They then compared the relative risk of death in an alcohol-related crash on Sundays (RR=1.4) to the mean relative risk of death in an alcohol-related crash on other days of the week (RR=1.1). Thus, the risk of death in an alcohol-related crash on Sunday increased 26.8% (95% CI=3.3%, 44.2%) relative to the risk of death in a crash on other days of the week after the ban on Sunday alcohol sales was repealed.

Finally, one study³² examined state-level U.S. data to determine the impact on beer and liquor consumption of laws repealing bans on Sunday alcohol sales in states. The authors used a time-series analysis to compare changes from 1990 to 2004 in per capita alcohol consumption in 13 states that repealed bans on Sunday alcohol sales relative to changes in consumption in other states that maintained existing state policies on Sunday sales. Controlling for other variables such as income and taxes, as well as trends in alcohol consumption in the 13 states before the bans were repealed, the researchers found that per capita spirits consumption was 3.5% higher in states that allowed Sunday sales of spirits than in states that did not. In six states that allowed Sunday sales of beer, beer consumption was 2.4% higher.

Effects of imposing bans on days of sale. Three studies^{24,27,33} examined the effect of imposing bans on days of sale of alcoholic beverages for off-premises purchase. One of these²⁷ examined the impact of the 1981 imposition of the Saturday ban on off-premises alcohol sales in Sweden that was discussed above. A second examined the impact of the 1984 imposition of a Saturday ban on alcohol sales in Norway.³³ The third examined the local referendum-based re-imposition of a previously repealed state ban on Sunday sales, described above, in several New Mexico counties.²⁴

Olsson and colleagues²⁷ compared outdoor assaults, domestic disturbances, and police interventions against

intoxicated people during the ban with the same 3-month period in the previous year when the ban was not in place. They also compared the number of these events that took place on Saturdays with the number of events that took place during the rest of the week over these two 3-month periods. During the ban, outdoor assaults on Saturdays declined by 17.7% (95% CI= -25.7%, -8.9%) relative to the rest of the week from a mean of 71.0 assaults per Saturday in the nation before the policy change to 53.2 after, compared with a mean change from 27.8 to 25.3 for the rest of the week. Domestic disturbances similarly declined by 17.3% (95% CI= -22.0%, -12.4%) relative to the rest of the week from a mean of 205.6 domestic disturbances per Saturday prior to the policy change to 154.9 per Saturday after, compared with a mean change of 104.5 to 95.3 for the rest of the week. During the ban, police interventions against intoxicated people declined by 35.7% (95% CI= -37.8%, -33.5%) relative to the rest of the week from 659.8 per Saturday before to 401.1 per Saturday after the policy change, compared with a mean change of 453.6 to 428.8 for the rest of the week.

In 1984, the Norwegian government initiated a similar experimental ban to determine whether closing state-run spirits and wine monopoly stores on Saturdays would reduce alcohol-related harms.³³ Because it was available from other sources, beer remained available on Saturdays during the experimental period. Six pairs of Norwegian communities in similar settings and with similar demographics were selected, with one community in each pair randomly selected for the intervention, and the other for the control. Nordlund evaluated changes in consumption and alcohol-related harms in October 1984, before completion of the experimental intervention year. Compared with the control communities, the consumption of ethanol (from wine and spirits) decreased by 3.1% in the experimental communities. However, the consumption of beer increased by a relative 6.4%, for a combined relative increase of total alcohol consumption of 0.7% in the experimental settings. In addition, there were relative declines of 5.8% in arrests for drunkenness and 15.9% in domestic trouble, but a relative increase of 5.0% in reports of violence in experimental communities compared with control communities. In sum, there was little net change in alcohol consumption associated with the ban and mixed results in terms of other alcohol-related outcomes. The Norwegian government concluded that the closing had little substantial effect and reverted to the prior policy allowing Saturday retail sales.

Finally, in addition to their analysis of repeal of the New Mexico ban on Sunday alcohol sales, described above, McMillan and colleagues undertook an analysis of data on the effects of local reinstatement of the ban.²⁴ The 1995 New Mexico law allowed local communities to re-

instate the Sunday sales ban following a community referendum (mounted at community expense). The towns of Gallup, Clovis, and Portales reinstated the ban within 3 months after the statewide repeal. Each of these cities is the county seat, and each comprises a sizable proportion of the total county population (70%, 27%, and 62%, respectively), such that county-level data can be taken as a gross measure of the impact of the local decision passed by these cities. Each of the three counties that rapidly reversed the state policy locally had a relative risk of Sunday alcohol-related motor vehicle crashes (comparing crash levels in each county after the policy change to levels before the change) between 1 and 1.13, the lowest reported relative risks among counties in the state. Of 33 total counties in New Mexico, only one other county had a relative risk in that range. Three other towns passed local policies somewhat later. One, Roswell, which makes up 74% of its home county, had a relative risk of <1.30. The remaining two towns had populations <2000, and would therefore not be expected to show a stable effect at the county level.

In sum, the findings from these three studies indicate that local decisions to reinstate a 1-day off-premises sales ban protected against the alcohol-related harms observed in areas that maintained the state (no ban) policy. The researchers note that these findings were based on a small number of communities and few years of data.

Conclusion

This review found that increasing days of sale by allowing previously banned alcohol sales on either Saturdays or Sundays increased excessive alcohol consumption and related harms, including motor vehicle crashes, incidents of DUI, police interventions against intoxicated people, and, in some cases, assaults and domestic disturbances. Thus, *maintaining* existing limits on Saturday or Sunday sales—the control condition in these studies—can prevent alcohol-related harms that would be associated with increased days of sale. A study of the imposition of a Saturday ban in Norway showed mixed effects, whereas one study of the imposition of a Saturday ban in Sweden and one study of the reversal of a lifted ban in New Mexico found a decrease in alcohol-related harms. Thus, some evidence suggests that *imposing* limits on the days of sale will reduce alcohol-related harms.

According to the *Community Guide* rules of evidence, there is strong evidence for the effectiveness of maintaining limits on days of sale for the reduction of alcohol-related harms. Of the qualifying studies on the *repeal of weekend-day sale bans* evaluated by *Community Guide* criteria, there were nine of greatest design suitability, three of which were of good execution and six of fair

execution; there was one study of least-suitable design and fair execution. Most findings in this body of evidence indicated harms associated with an increased day of sale; effect sizes were of public health significance.

There were three studies of greatest design suitability and fair execution that assessed the impact of *imposing bans* on weekend days of sale. Two of these studies indicated that restricting days of sale is associated with a decrease in excessive alcohol consumption and related harms, and the third did not. By *Community Guide* standards, there is not sufficient evidence on which to base a determination of effectiveness. However, these studies support the overall conclusion that increasing days of sale is directly associated with excessive alcohol consumption and related harms.

Other Harms and Benefits

In association with fewer days of sale and reduced consumption, community quality of life—evaluated through such factors as reduced levels of public drunkenness—may improve on days when alcohol outlets are closed. Although it is possible that crimes such as illicit alcohol production and sales may increase in localities in which days of sale are reduced, no evidence of such effects was found.

Applicability

The studies in this review were conducted in a variety of settings in the U.S. and in other countries and during a wide range of time periods. The association between restrictions on days of sale and excessive alcohol consumption and related harm was consistent across most geographic locations and time periods. Moreover, three of the studies of greatest design suitability were conducted in the U.S. and were published within the past 10 years. Thus, the findings of this review are relevant for examining the potential impact of current proposals to modify days of sale in the U.S.

Barriers

Reductions in days of sale and resulting reductions in excessive alcohol consumption and related harms may affect overall alcohol sales; thus those restrictions may be opposed by firms involved in manufacturing, distributing, or selling alcoholic beverages. Indeed, the alcohol industry has tended to support policies removing restrictions on days of sale,³⁵ although some industry groups or individual businesses have supported the maintenance of Sunday sales bans.³⁶

State pre-emption laws (i.e., laws that prevent the implementation and enforcement of more restrictive local alcohol sales laws) can also undermine efforts by local governments to regulate days of sale.⁷ The elimination of

pre-emption laws related to the sale of tobacco products was one of the health promotion objectives in *Healthy People 2010*⁵; however, *Healthy People 2010* had no similar objective related to eliminating pre-emption of the local regulation of alcohol sales.

Economics

We identified one study³⁷ that assessed the economic impact of reducing days of sale. This study modeled the cost effectiveness of restricting alcohol sales for a 24-hour period over the weekend in 12 global health regions, as defined by the WHO. The costs associated with this intervention included the cost of passing the legislation itself, and the cost of administering and enforcing the laws once passed. Effectiveness was assessed using Disability-Adjusted Life Years (DALYs), a standard measure of global health impact that considers the impact of an intervention on healthy years of life lost due to either death or disability. For the region most relevant to this review, the America's A region composed of the U.S., Canada, and Cuba, the estimated cost for limiting weekend days of sale was \$175,616 (converted to 2007 dollars using the Consumer Price Index) per 1 million population per year, based on a 10-year implementation period and discounted at 3%. At the same time, this restriction was estimated to prevent the loss of 250 DALYs per 1 million population per year, yielding an average cost-effectiveness ratio for this intervention of approximately \$700 per DALY averted, which is much less than the average annual income per capita in these three countries, a threshold for an intervention to be considered very cost effective that was proposed by the Commission on Macroeconomics and Health.³⁸ To obtain country-specific estimates of the DALYs saved per country as a result of this intervention, the regional analysis needs to be adjusted using country-specific data. Such estimates are limited by data available and based in part on assumptions made.

We found no study that specifically estimated the magnitude of commercial losses in sales and tax revenues resulting from a policy of restricting days of sale. Regarding the economic burden of such a policy in terms of premature mortality, the one study that examined the impact of lifting a Sunday packaged alcohol sales ban in New Mexico^{23,24} showed that this policy resulted in an estimated increase of 41.6 alcohol-related fatalities on Sundays for the 5-year period from 1995 to 2000, which translated to more than \$6 million of additional cost per year for the state when the team applied the approximate unit cost of \$745,285 (in 2007 dollars)³⁹ per motor vehicle fatality.

Research Gaps

The research on days of sale conducted in the U.S. was primarily at the state level. However, additional research is needed to assess the effectiveness of local restrictions on days of sale in preventing excessive alcohol consumption and related harms.

It would be useful to better understand the effect of differential policies regarding days of sale across neighboring jurisdictions. Does more ready access in a neighboring region lead to increased travel to this region, allowing the possibility of motor vehicle crashes, especially with intoxicated drivers?

Additional research is also needed to more fully assess the costs and benefits of restricting the number of days of sale. From a societal perspective, these should include intervention costs; loss in sales and tax revenues and employment; reductions in fatal and nonfatal injuries, crime, and violence; gains in safety and public order; and averted loss of household and workplace productivity.

Discussion

We found strong and consistent evidence that limiting alcohol availability by maintaining existing limits on the days of sale is an effective strategy for preventing excessive alcohol consumption and related harms. In addition, there is some direct evidence that the imposition of increased limits on days of sale may reduce alcohol-related harms. However, further scientific evidence is needed to fully assess the symmetry between maintaining existing limits and implementing new restrictions on days of sale, specifically as regards the impact of the latter on excessive alcohol consumption and related harms.^b

In addition to the small number of studies that assessed the effect of new restrictions on days of sale, the studies in this review had several other limitations. First, some studies did not directly assess the impact of restrictions on days of sale on excessive alcohol consumption and related harms, but rather relied on proxy measures of these out-

^bA reviewer of this manuscript indicated two studies of the effects of expanding days of sale published after the close of our reference search in February 2008: Carpenter 2009 and Stehr 2010. (Carpenter CS, Eisenberg D. Effects of Sunday sales restrictions on overall and day-specific alcohol consumption: evidence from Canada. *J Stud Alcohol Drugs* 2009;70(1):126–33; Stehr M. The effect of Sunday sales of alcohol on highway crash fatalities. *B.E. Journal of Economic Analysis & Policy* 2010;10.1.) Both studies assess the effects of expanded days of sale in off-premises facilities, for which we hypothesize smaller effects. In a cross-sectional study, Carpenter finds increased consumption on Sundays in Canadian provinces with newly allowed Sunday sales, compared with provinces which maintain Sunday sales prohibition; however, there are also reductions in consumption on other days, yielding no net effect. Stehr, who in an earlier study included in our review indicated increased consumption associated with newly allowed Sunday sales in U.S. states, in this recent study finds increases in automobile crashes in New Mexico, but not in other states. These recent studies are not entirely consistent with earlier research and suggest a need for additional research.

comes (e.g., motor vehicle crashes not specifically related to alcohol). In these cases, focus was placed on measures for which the links between proxy and health outcome have been well established. Second, these studies were often unable to control for some potential confounding factors. However, they generally assessed changes in the same geographic area and within a fairly short time period before and after the implementation of changes in days of sale. Consequently, other contextual factors that could influence alcohol sales and consumption (e.g., changes in alcohol excise taxes) at the country, state, or community levels were likely to have remained fairly constant during the study periods, thus allowing for a more valid assessment of the impact of changing days of sale on excessive alcohol consumption and related harms.

One issue not addressed in this review is the potential consequence of neighboring regions having differing policies. For example, if one community restricts access to alcohol by not allowing sales on certain days, although the neighboring community lacks these restrictions, it is possible that harms (e.g., crashes from driving, drunk or sober, over longer distances) may result when those in the restricted neighborhood travel to the other community.

The findings in this review also support the potential value of allowing local communities to maintain restrictions on days of sale independent of state policies preemptively regulating days of sale. If further research supports the effectiveness of local restrictions on days of sale, it would also argue for eliminating state pre-emption laws that prohibit local governments from enacting alcohol control policies that are more restrictive than those that exist statewide.

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