

Retail alcohol monopolies, underage drinking, and youth impaired driving deaths

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Abstract

Objective: To explore associations of state retail alcohol monopolies with underage drinking and alcohol-impaired driving deaths.

Data: Surveys on youth who drank alcohol and binge-drank recently and their beverage choices; census of motor vehicle fatalities by driver blood alcohol level.

Methods: Regressions estimated associations of monopolies with under-21 drinking, binge drinking, alcohol-impaired driving deaths, and odds a driver under 21 who died was alcohol-positive.

Results: About 93.8% of those ages 12–20 who consumed alcohol in the past month drank some wine or spirits. In states with a retail monopoly over spirits or wine and spirits, an average of 14.5% fewer high school students reported drinking alcohol in the past 30 days and 16.7% fewer reported binge drinking in the past 30 days than high school students in non-monopoly states. Monopolies over both wine and spirits were associated with larger consumption reductions than monopolies over spirits only. Lower consumption rates in monopoly states, in turn, were associated with a 9.3% lower alcohol-impaired driving death rate under age 21 in monopoly states versus non-monopoly states. Alcohol monopolies may prevent 45 impaired driving deaths annually.

Conclusions: Continuing existing retail alcohol monopolies should help control underage drinking and associated harms.

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1. Introduction

Only a few states in the United States (U.S.) maintain retail monopolies over package sales of selected alcoholic beverages (National Alcohol Beverage Control Association, 2004). Four – New Hampshire, Pennsylvania, Utah, and Washington – have monopolies over sales of both spirits and wine. Eight others – Alabama, Idaho, Maine, North Carolina, Ohio, Oregon, Virginia, and Vermont – plus Montgomery County, Maryland have monopolies on sale of spirits or spirits and fortified wines. All states with retail alcohol monopolies also have wholesale monopolies. Prior studies of seven U.S. states that abandoned alcohol monopolies and Nordic studies of expansions and contractions in authority to sell alcohol show that monopolies reduce

per capita alcohol consumption (Wagenaar and Holder, 1991, 1995; Mäkinen, 1978; Babor et al., 2003). The main impacts of a retail monopoly are to reduce alcohol outlet density (Nelson, 1990), reduce sales hours (Zardkoohi and Sheer, 1984), reduce advertising of monopoly products, and increase diligence in not selling to underage drinkers (Giesbrecht, 1995). Changing outlet density is associated with same-direction rate changes for violence, impaired driving, and arrests for public drunkenness (Gruenewald et al., 1993; Norström, 2000; Poikolainen, 1980).

The only investigation of the association of retail alcohol monopolies with underage drinking or the harms it causes examined the effects of allowing sale of 4.5% beer in Swedish grocery stores in 1964, then banning it in 1977. Underage consumption was particularly sensitive to these changes (Hibell, 1984). A time-series analysis found that motor vehicle crashes were significantly reduced among youth and two of three other age groups after the 1977 ban. Hospital admissions for alcohol-specific diagnoses also fell significantly among those under age 20, but assault, suicide and fall rates were not significantly affected (Ramstedt, 2002).

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This paper analyzes the associations of retail alcohol monopolies with underage drinking by students in grades 9–12 (labeled high school students below) and the association between underage drinking and alcohol-impaired youth driving fatalities. We began by examining underage use of wine and spirits to confirm that restrictions on sales of these beverages plausibly might impact underage drinking. We hypothesized the 12 states and one urban county with government retail alcohol monopolies would have lower underage drinking rates, presumably because they better control sales to underage drinkers. We tested the association of a retail monopoly with the percentage of youth reporting alcohol use in the past 30 days and the percentage of youth “binge drinking” (consuming five or more drinks in a drinking episode) in the past 30 days. Finally, we tested the association of underage alcohol consumption with alcohol-impaired driving deaths of drivers under age 21.

2. Consumption data

To analyze alcoholic beverage choices, we tabulated data from a national probability sample survey of children in grades 6–10, Health Behavior in School-Aged Children (HBSC), 1997–1998 ([Substance Abuse and Mental Health Data Archive, 2004](#)). No surveys were available that were nationally representative and better matched the age range in the consumption data. As a quality check, we compared HBSC and 1997 Youth Risk Behavior Survey (YRBS) estimates. The two surveys proved quite consistent for the 15–16 year old age group that they both polled comprehensively. Each survey finds 25.6% of those youth binge-drank in the past month. We used a 1998–2000 California telephone survey of randomly selected residents aged 15–20 ([Treno et al., 2003](#); [Walker et al., 2003](#)) to further confirm the HBSC findings, expand the age range of the assessment of drinking patterns, and investigate volume consumed by beverage.

The YRBS is a centrally designed survey of youth in grades 9–12 that most states administer to large representative samples of students. For almost all states, the percentage of youth who consumed alcohol in the past 30 days and the percentage who binge-drank came from the state’s YRBS (with NY and IL requiring integration of surveys of NYC and Chicago students with surveys of students in the balance of each state) or a student survey containing the YRBS questions (usually from [CDC, 2003](#), but occasionally from the internet, e.g. for NM, OR). The data usually came from a 2001 survey, but the most recent data were from 1993 for GA and from 1999 in eight states. CT used YRBS in 1997 but surveyed only grades 9 and 10 in 2000. We assumed consumption changed proportionately in the surveyed and unsurveyed grades. MD, MN, KS, PA, and VA surveyed only two grades between 9 and 12. We assumed the national 2001 YRBS consumption pattern applied for the other grades (e.g., nationally, consumption averaged across grades 10 and 12 is 1.05 times consumption averaged across grades 9 through 12). AZ, MN, and VA used a 2-week recall period for binge drinking reports. We used AZ YRBS 30-day recall data for 1997 and 2-week recall data for 2002 to estimate that the 30-day recall used in other states would yield 1.2 times as high a binge drinking percentage as the 2-week recall. The KS student survey did not

report binge drinking frequency. We used a regression on data from YRBS states to predict this frequency from the number of KS youth who drank alcohol in the past 30 days. A few of the surveys (notably, NM, OK) may not have been representative of the entire state. The sum of the population-weighted state estimates was that, nationwide, 46.8% of youth drank alcohol in the past 30 days and 29.3% binge-drank. By comparison, the 2001 YRBS national estimates derived from a national probability sample were 47.1% and 29.9%. [Table 1](#) shows the state consumption estimates.

3. Fatality data

We used 2000 Fatality Analysis Reporting System (FARS) ([NHTSA, 2001](#)) census data on U.S. highway crash fatalities. Driver blood alcohol levels on the file were either measured directly or were estimated using an algorithm developed by the National Highway Traffic Safety Administration, which collects the FARS data.

4. Statistical methods

We computed consumption mean differences, then used *t*-tests to determine their significance. We split Maryland into two observations in our analysis: Montgomery County which houses 15.5% of the state population and has a retail spirits monopoly was separated from the rest of the state, which has no monopolies. In sensitivity analysis we ran general least squares regressions that controlled for the effects of graduated licensing with a midnight driving curfew for newly licensed drivers ([National Committee, 2000](#)). The regressions did not affect the magnitude, direction, or significance of the means appreciably and are not reported below.

We examined two alcohol-impaired driving measures: (1) an impaired driving death rate computed as the number of alcohol-positive driver deaths ages 14–20 per youth ages 14–20 and (2) the odds that a driver under age 21 who was killed in the state was alcohol-impaired. We used a log-linear least squares regression with the first outcome measure and a logistic regression with the second. These regressions controlled for the presence of graduated licensing laws. We excluded Maryland from these analyses (since the state had mixed policies).

5. Results

[Table 2](#) summarizes the alcoholic beverage choices of 6th–10th graders. Seventy-four percent of those surveyed did not drink alcohol in the past 30 days. Among the 25.7% who did drink in the past month, beer only was the least common choice. Among those who drank in the past month, 65.4% drank some beer, 69.3% drank some wine, and 72.0% drank some spirits. Just 6.2% drank only beer. Among those who binge-drank, 73.0% drank some beer, 65.5% drank some wine, and 80.5% drank some spirits. Among binge drinkers, only 6.0% drank beer alone.¹

¹ Despite these estimates, in terms of number of drinks, these youth predominantly may have drunk beer.

Table 1
Youth alcohol consumption pattern by state, year of data, and type of retail sales monopoly

| State | %Drink in the past 30 days | %Binge drink in the past 30 days | Year | Government monopoly? (blank = none) |
|----------------------|----------------------------|----------------------------------|------|-------------------------------------|
| AK | 46.9 | 34.4 | 1999 | |
| AL | 42.6 | 25.0 | 2001 | Spirits |
| AR | 47.9 | 30.0 | 2001 | |
| AZ | 50.0 | 32.9 | 2002 | |
| CA | 48.8 | 30.2 | 1999 | |
| CO | 50.9 | 34.3 | 2001 | |
| CT | 52.9 | 31.4 | 1997 | |
| DC | 36.7 | 14.9 | 1999 | |
| DE | 46.4 | 27.3 | 2001 | |
| FL | 45.0 | 24.8 | 2001 | |
| GA | 44.1 | 24.8 | 1993 | |
| HI | 34.2 | 18.8 | 2001 | |
| IA | 52.3 | 37.0 | 2001 | |
| ID | 40.6 | 27.2 | 2001 | Spirits |
| IL | 42.8 | 26.8 | 2001 | |
| IN | 45.1 | 29.5 | 2001 | |
| KS | 50.6 | 32.9 | 2001 | |
| KY | 40.7 | 28.3 | 2001 | |
| LA | 50.1 | 29.3 | 2001 | |
| MA | 53.0 | 32.7 | 2001 | |
| MD ^a | 40.8 | 25.3 | 2002 | |
| Montgomery County MD | 33.3 | 20.5 | 2002 | Spirits |
| ME | 47.8 | 31.5 | 2001 | Spirits |
| MI | 46.2 | 29.3 | 2001 | |
| MN | 38.6 | 28.6 | 2001 | |
| MO | 47.6 | 34.1 | 2001 | |
| MS | 41.7 | 22.1 | 2001 | |
| MT | 54.1 | 41.4 | 2001 | |
| NC | 38.2 | 20.7 | 2001 | Spirits |
| ND | 59.2 | 41.5 | 2001 | |
| NE | 53.0 | 39.0 | 2001 | |
| NH | 52.5 | 32.1 | 2001 | Wine and spirits |
| NJ | 55.7 | 32.6 | 2001 | |
| NM | 58.8 | 43.9 | 1999 | |
| NV | 47.5 | 32.4 | 2001 | |
| NY | 49.9 | 29.0 | 2001 | |
| OH | 55.5 | 37.4 | 1999 | Spirits |
| OK | 45.8 | 27.7 | 2001 | |
| OR | 50.0 | 32.0 | 1999 | Spirits |
| PA | 40.3 | 24.4 | 2001 | Wine and spirits |
| RI | 50.3 | 30.7 | 2001 | |
| SC | 44.0 | 24.7 | 2001 | |
| SD | 50.2 | 36.5 | 2001 | |
| TN | 44.2 | 27.3 | 2001 | |
| TX | 48.6 | 31.3 | 2001 | |
| UT | 17.9 | 10.9 | 2001 | Wine and spirits |
| VA | 42.1 | 26.9 | 2000 | Spirits |
| VT | 48.1 | 29.0 | 2001 | Spirits |
| WA | 44.1 | 28.3 | 1999 | Wine and spirits |
| WI | 54.1 | 34.2 | 2001 | |
| WV | 48.6 | 35.5 | 1999 | |
| WY | 51.3 | 38.1 | 2001 | |
| USA | 47.1 | 29.9 | 2001 | |

^a Excluding Montgomery County.

Data from California confirm that most youth who drink consume some wine or spirits. In California, which is not a monopoly state, 74.1% of youth aged 15–20 who drank consumed some beer, 61.4% drank some wine (including wine coolers and hard cider), and 69.7% consumed some spirits. Among the California drinkers, 48.5% of total alcohol consumed

was beer, 33.0% was spirits, and 18.5% was wine. The percentages varied minimally by year of age.

Indeed, significantly smaller percentages of high school students drank ($p = 0.010$) and binge-drank ($p = 0.014$) in states with retail alcohol monopolies than in states without monopolies. In states with a monopoly, (population-weighted) an average of

Table 2
Alcoholic beverage consumption in the past 30 days by beverage, grades 6–10, United States, 1997–1998

| Consumption pattern | Any alcohol (%) | Five or more drinks in one episode (%) |
|-------------------------|-----------------|--|
| Did not drink this much | 74.3 | 80.0 |
| Beer only | 1.6 | 1.2 |
| Wine only | 3.9 | 1.4 |
| Spirits only | 2.4 | 1.8 |
| Beer and wine | 1.7 | 1.3 |
| Beer and spirits | 3.9 | 3.9 |
| Wine and sprits | 2.6 | 2.2 |
| Beer, wine and spirits | 9.6 | 8.2 |

Source: online tabulation of weighted health behaviors in school children data.

14.5% fewer high school students reported drinking alcohol in the past 30 days and 16.7% fewer reported binge drinking in the past 30 days. These figures equate to a 5.7% lower percentage of all high school students in monopoly states who drank alcohol and a 4.7% lower percentage who binge-drank.

The differences showed a strong negative relationship between underage consumption and the number of alcoholic beverage types controlled by retail monopolies. States with monopolies over sales of both wine and spirits had lower population-weighted levels by 29.6% for drinking and 32.3% for binge drinking ($p=0.0004, 0.004$), compared to 6.5% and 9.9% ($p=0.164, 0.128$) lower levels in states with monopolies over spirits but not wine. Interpreting the data, Utah clearly had a large effect on the findings. Repeating the analysis with Utah omitted, however, did not change the basic findings. The

population-weighted mean differences in underage drinking still were largest in states with wine and spirits monopolies and the regressions still showed significant differentials.

Tables 3 and 4 summarize the associations of youth drinking with crash deaths involving alcohol-impaired drivers under age 21. The models estimate that the 4.7% lower binge drinking rate observed in monopoly states was associated with a 9.3% ($4.7\% \times (\exp(0.02) - 1)/\exp(0.02)$) lower alcohol-positive death rate for drivers under age 21 ($p=0.002$) and with an 8.3% ($4.7\% \times 0.018/1.018$) lower odds that a driver under 21 who died in a crash was BAC-positive ($p=0.017$). Thus, the lower youth binge drinking rate in states with retail alcohol monopolies was associated with a reduction in youth impaired driving deaths. (The association with the youth 30-day drinking rate is similar, but the association with the death rate is not statistically significant.) To confirm these associations, we ran regressions that entered a retail monopoly variable directly rather than a consumption variable. These regressions revealed properly signed but insignificant results. Again, repeating the analysis with Utah omitted did not change the basic findings, although the statistical significance of the impact of binge drinking on the alcohol-involved fatal crash rate dropped to the 85% confidence level.

Graduated licensing with a midnight driving curfew was associated with a four-fold larger decline in the youth impaired driving crash fatality rate than a retail monopoly was. Not surprisingly, graduated licensing was associated with a much smaller decline in the odds that a driver under age 21 in a fatal crash was BAC-positive since graduated licensing also reduces the denominator – fatal crashes that do not involve alcohol. The

Table 3
Regressions on the impact of alcohol consumption levels of youth under age 21 and of monopoly state residence on the rate of alcohol involved fatal crashes of youth under age 21 (coefficient and in parentheses, significance level)

| | Ln (alcohol-involved fatal crash rate) ^a | | | | | |
|---------------------|---|----------------|----------------|----------------|----------------|----------------|
| | Including Utah | | | Excluding Utah | | |
| %Who drink | 0.012 (0.174) | | | 0.009 (0.441) | | |
| %Who binge | | 0.020 (0.043) | | | 0.018 (0.103) | |
| Monopoly State | | | -0.120 (0.385) | | | -0.084 (0.554) |
| Graduated licensing | -0.371 (0.003) | -0.342 (0.005) | -0.365 (0.004) | -0.375 (0.003) | -0.348 (0.005) | -0.377 (0.003) |
| R-squared | 0.192 | 0.232 | 0.173 | 0.150 | 0.223 | 0.146 |
| F | 5.50 | 6.94 | 4.82 | 5.13 | 6.46 | 5.00 |
| p(F) | 0.007 | 0.002 | 0.013 | 0.010 | 0.003 | 0.011 |

^a Estimates for the constant term are not shown.

Table 4
Regressions on the impact of alcohol consumption levels of youth under age 21 and of monopoly state residence on the odds that a driver under age 21 in a fatal crash is BAC-positive (coefficient and in parentheses, significance level)

| | Odds driver under age 21 in fatal crash is BAC-positive ^a | | | | | |
|---------------------|--|---------------|---------------|----------------|---------------|---------------|
| | Including Utah | | | Excluding Utah | | |
| %Who drink | 1.016 (0.019) | | | 1.019 (0.015) | | |
| %Who binge | | 1.018 (0.026) | | | 1.018 (0.032) | |
| Monopoly State | | | 0.873 (0.124) | | | 0.874 (0.133) |
| Graduated licensing | 0.868 (0.052) | 0.895 (0.132) | 0.871 (0.057) | 0.870 (0.056) | 0.894 (0.132) | 0.870 (0.057) |
| Chi-square | 8.95 | 8.20 | 6.07 | 9.72 | 8.39 | 6.05 |
| P | 0.011 | 0.017 | 0.048 | 0.008 | 0.015 | 0.049 |

^a Estimates for the constant term are not shown.

results indicate that graduated licensing is associated with a greater decline in alcohol-involved fatal crashes than in other fatal crashes.

6. Discussion

Drinkers under age 21 consume about one-sixth of all alcohol sold in the United States, 20 billion ounces of absolute ethanol annually (Miller et al., 2006). They caused 2239 alcohol-involved deaths in 2000, primarily homicides and impaired driving deaths. States with retail alcohol monopolies house 21% of the nation's youth aged 14–20. As the data show that most young drinkers consume wine or spirits, it is plausible that better controlling access to these beverages could reduce underage drinking and its related harms. States with existing retail alcoholic beverage monopolies annually have 200 million ounces less youth alcohol consumption and 45 fewer deaths involving alcohol-impaired drivers under age 21 than they would have if their rates were comparable to non-monopoly states. State surveys are needed exploring whether the consumption differences are concentrated in the monopoly beverages.

This study is constrained by the non-uniform dates of the available state consumption data. Also, a cross-sectional time-series model would provide better evidence, but the required data are not available. A third limitation is the lack of state consumption data for underage drinkers who have completed high school. The unchanging pattern of beverage choices from ages 12 to 20 reduces the importance of this limitation. Lastly, state and local alcohol policies and other factors missed in our analyses might influence the prevalence of underage drinking.

The greater consumption reduction with a larger number of beverage types controlled by retail monopolies suggests a dose–response relationship. It strengthens our confidence in the results, even though the significance of the differences observed for states with monopolies over spirits only is quite marginal. Future research using multi-year data is warranted to examine significance more fully.

Prior analyses of privatization examined all-age impacts. Evaluations of elimination of wine monopolies in seven states caused a 4% average rise in alcohol consumption, while elimination of a spirits monopoly in one state caused a 5% rise (Wagenaar and Holder, 1991, 1995). It is unclear if the larger percentage differences in youth consumption of 30% and 8% from our analysis suggest that retail monopolies especially reduce sales to underage drinkers. Our analysis is cross-sectional rather than time-series, so it does not establish causation. Future research should explore whether the critical determinants of the differential impact are a reduced willingness to sell to youth, higher prices, lower outlet density, reduced advertising, or other environmental changes in alcohol supply.

In summary, school-age youth drink wine and spirits regularly. Indeed these beverages account for a significant proportion of the alcohol consumed by underage youth. States with retail monopolies over sales of these beverages experience less underage drinking and binge drinking. Those consumption reductions, in turn, are associated with a lower alcohol-impaired driving

death rate of drivers under age 21. These findings suggest continuing existing retail alcohol monopolies in order to control underage drinking and associated harms.

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