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The Impact of Alcohol License Density on Alcoholic Liver Disease (ALD) Hospitalization Rates in Virginia

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Abstract

Alcohol consumption is accountable for 88,000 deaths in the United States.¹ Evidence from prior research studies suggests that alcohol consumption is associated with alcohol availability, leading some to call for policies to further limit the sale and distribution of alcohol.² This study seeks to determine the relationship between alcohol license density and the hospitalization rate for alcoholic liver disease (ALD) in the Commonwealth of Virginia to help policymakers assess the benefits of increased alcohol regulation. This study finds evidence of a positive association between the density of alcohol licenses and the hospitalization rate for alcoholic liver disease within Virginia's localities; however, additional evidence suggests that this relationship is not causal and is, perhaps, attributable instead to multiple, unobserved factors influencing both the ALD disease rate and alcohol license density.

Policy Relevance

Excessive alcohol use is one of the top five causes of preventable death in the United States.¹ To address the negative impacts of alcohol consumption on society, government regulates the production, sale, and distribution of alcohol. States often control the sale and distribution of alcohol by requiring sellers to have an alcohol license, which has the intended effect of limiting alcohol availability.

Prior research finds a connection between the availability of alcohol and alcohol consumption, suggesting that an increase in the availability of alcohol is associated with an increase in alcohol consumption. Several studies provide

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some support for regulating alcohol outlet density to reduce the negative health effects of alcohol consumption. Campbell et al. (2009), for example, state that “the regulation of alcohol outlet density may be a useful public health tool for the reduction of excessive alcohol consumption and related harms.”² Cederbaum et al. (2015) find that, in Philadelphia public housing communities, alcohol outlet density was significantly associated with alcohol use, and that, among adolescent males, alcohol outlet density predicted alcohol use.³ The authors suggest that one potential policy tool is to reduce the number of alcohol outlets near vulnerable populations or in lower income localities. Leslie et al. (2015) examine alcohol use among young men living in rural South Africa and find that symptoms of alcohol dependence and alcohol-related harms may be related to alcohol outlet density.⁴ In a study published in the *Journal of Epidemiology and Community Health*, Kuntsche, Kuendig, and Gmel (2008), report that the density of on-premise alcohol outlets is linked with adolescent alcohol use and posit that policies that focus on “reducing the number of bars, pubs, discos, and restaurants... could prove promising in terms of lowering adolescent alcohol use.”⁵ Finally, in their review of the literature, Popova et al. (2009) find that alcohol outlet density is associated with numerous alcohol-related problems, which include traffic accidents, acts of violence, and sexually transmitted diseases.⁶ Popova et al. note “many problems [related to alcohol] can be reduced, or partially avoided, through careful planning and a precautionary approach,” and they cite “price and taxation controls, controls on hours and days of sale, and controls on [alcohol outlet density] as being shown to be effective.”⁶ However, the authors caution that many studies cited in their review use cross-section models and, as such, are unable to provide a clear answer about a causal linkage.⁶

This policy brief describes research that uses Virginia data to examine the potential causal link between alcohol availability and one specific type of alcohol-related harm. The key measure of alcohol-related harm in this study is the locality-specific measure of hospitalization rate for alcoholic liver disease, defined as the number of hospitalizations for alcoholic liver disease per 1,000 residents. Alcohol availability is measured as the number of alcohol licenses per 1,000 residents in the locality. The results of this study provide new information to help decision makers evaluate policies designed to address the negative health effects of excessive alcohol consumption.

Currently, Virginia is one of 18 states in the United States to have state control over the sale of liquor.⁷ However, the Commonwealth does not regulate the sale of beer and wine, allowing these beverages to be sold in private outlets (such as grocery or convenience stores).⁷ A finding that alcohol availability has a causal effect on alcoholic liver disease might provide additional evidence for policymakers to support tightened regulations on alcohol outlet density, as suggested in the papers by Campbell et al. (2009) and Cederbaum et al. (2015).^{2, 3} States, for example, may decide to maintain state control of *all* alcoholic beverages and not just distilled spirits. In contrast, a finding that determines no causal relationship between alcohol availability and alcoholic liver disease would temper some of the support for tightening of alcohol regulation, since reducing the availability of alcohol may not reduce the prevalence of disease.^{2, 3}

Methodology

This study uses 2012-2013 data from the Virginia Health Information (VHI), the U.S. Department of Housing and Urban Development, the U.S. Census Bureau, and Virginia's Department of Alcoholic Beverage Control. Measures of alcoholic liver disease are defined from VHI's patient-level data (PLD); these data include demographic, administrative, clinical and financial information for all inpatient hospital discharges occurring at licensed Virginia hospitals in a given year.⁸ The variables of interest in the PLD data are diagnosis and procedure codes and patient race, sex, age, and zip code of residence. Cases of alcoholic liver disease hospitalizations identified in the PLD are aggregated to the locality level for analysis. Demographic information as well as industry information for Virginia localities are defined from publicly available databases obtained from the U.S. Census Bureau. Data on alcohol licenses are obtained from Virginia's Department of Alcoholic Beverage Control. For each locality, alcohol license density is measured as the number of licenses per 1,000 residents.

The data are analyzed using a multivariate regression model to measure the association of alcohol license density with the alcoholic liver disease hospitalization rate while controlling for the effects of other factors. The other factors controlled for in this analysis are the percentages of the locality's population in several racial and ethnic categories, as well as percentages of the population who are female, who live below the poverty line, and who are uninsured. The analysis also controls for financial establishment density (measured as the number of financial establishments per 1,000 residents) as well as the real estate and rental and leasing density (measured as the number of real estate and rental and leasing establishments per 1,000 residents).

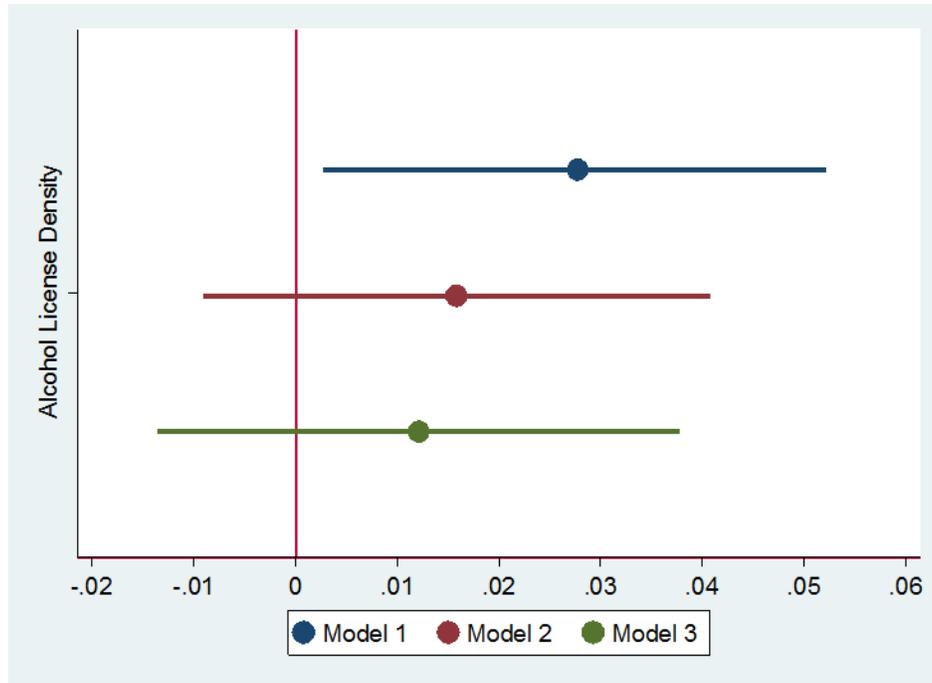
Results

This study yields two main results. First, this study finds a positive relationship between alcohol license density and the alcoholic liver disease hospitalization rate across Virginia localities. The initial regression model controls for the race, sex, poverty, and insurance variables, but does not control for financial establishment density or real estate and rental and leasing density. In this model, the adjusted association of alcohol license density with the ALD rate is positive and statistically significant. Specifically, the model suggests that a 10% increase from the mean alcohol license density across Virginia is associated with a 0.028 unit increase (or a less than 2% increase) in the alcoholic liver disease hospitalization rate, on average.

Second, this study finds that although alcohol license density is associated with the alcoholic liver disease hospitalization rate, this relationship is not causal. This result emerges after estimating more sophisticated models of the alcoholic liver disease rate that adjust for two additional factors: 1) financial establishment density and 2) real estate and rental and leasing density. These controls are added to account for other factors, such as urbanization, that may be related to both alcohol license density and alcoholic liver disease rates. After adding controls for financial establishment density and

real estate and rental and leasing density, the magnitude of the coefficient for alcohol license density decreases by approximately 43% and is no longer statistically significant.

Adjusted Associations of Alcohol License Density with the ALD Rate



The two findings are illustrated in the figure above. This figure displays the increase in alcoholic liver disease hospitalization rate that is associated with a 10% increase in alcohol license density (the shaded circle) and the 95% confidence interval for this increase (shown as lines extending from the circle) from three different regression models of alcoholic liver disease that all adjust for population demographic and economic traits. Model 1 does not contain the controls for financial establishment density and real estate and rental and leasing density. In that model, the adjusted association between a 10% increase in mean alcohol license density and the alcoholic liver disease hospitalization rate is statistically significant from zero (as depicted in blue). In Model 2, which includes the same controls as Model 1 but also controls for financial establishment density, the adjusted association between a 10% increase in alcohol license density and the alcoholic liver disease hospitalization rate is no longer statistically significant, as shown by the fact that the confidence interval includes the value of 0 (depicted in red). Likewise, after further controlling for real estate and rental and leasing density in Model 3, the size of the adjusted association between a 10% increase in alcohol license density and the alcoholic liver disease hospitalization rate decreases further, and again is not statistically different from zero.

This pattern of findings suggests that *the observed association between alcohol license density and alcoholic liver disease hospitalization rates is not causal, but instead driven by a third factor, such as urbanization or commercial development*. Since the addition of the controls for financial establishment density and real estate and rental and leasing density reduces the strength and significance of the association between alcohol license density and alcoholic liver disease hospitalization rate, this suggests that alcohol availability does not cause a higher liver disease rate in the county. Rather, the two are correlated and there is likely a third, unobserved factor causing an increase in disease rate.

Conclusion

Medical studies have established that alcohol consumption is one of the primary causes of alcoholic liver disease.⁹ It is reasonable, then, to assume that a countywide increase in alcohol consumption would lead to an increase in the alcoholic liver disease rate within that particular county. Other previous research suggests that a link exists between alcohol availability and alcohol consumption.^{2, 4, 6, 7} Given these results, one would expect that a countywide increase in alcohol availability would lead to an increase in the alcoholic liver disease rate in that county since an increase in alcohol availability would lead to an increase in alcohol consumption. This study finds evidence of such an association; however, this relationship is found to be correlational and not causal in nature. Since a causal relationship between alcohol license density and alcoholic liver disease rates is lacking, policies that restrict the number of alcohol licenses would not be expected to reduce rates of alcoholic liver disease. Further research should seek to identify the various factors that have a causal relationship with alcoholic liver disease. Only then can decision makers effectively design policies that are able to reduce the prevalence of alcoholic liver disease by alleviating some of the pressures that cause the disease.

SOURCES

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⁷ Alcohol Policy Information System. (2015). Maps and Charts. Available at http://alcoholpolicy.niaaa.nih.gov/Maps_and_Charts.html.

⁸ Virginia Health Information (VHI) has provided non-confidential patient level information used in this report which it has compiled in accordance with Virginia law but which it has no authority to independently verify. By using this report, the user agrees to assume all risks that may be associated with or arise from the use of inaccurate data. VHI cannot and does not represent that the use of VHI's data was appropriate for this report or endorse or support any conclusions of inferences that may be drawn from the use of VHI's data.

⁹ O'Shea, R.S., Dasarathy, S., and McCullough, A.J. (2010). Alcoholic liver disease. *Hepatology*, 51(1): 307-328.

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