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Impact of Alcohol Tax Increase on Maryland College Students' Alcohol-Related Outcomes

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Abstract

Objective: This study A) assessed whether levels of alcohol-related disciplinary actions on college campuses changed among MD college students after the 2011 Maryland (MD) state alcohol tax increase from 6% to 9%, and B) determined which school-level factors impacted the magnitude of changes detected.

Method: A quasi-experimental interrupted time series (ITS) analysis of panel data containing alcohol-related disciplinary actions on 33 MD college campuses in years 2006-2013. Negative binomial regression models were used to examine whether there was a statistically significant difference in counts of alcohol-related disciplinary actions comparing time before and after the tax increase.

Results: The ITS analysis showed an insignificant relationship between alcohol-related disciplinary actions and tax implementation ($\beta = -.27$; $p = .257$) but indicated that alcohol-related disciplinary actions decreased significantly over the time under study ($\beta = -.05$; $p = .022$).

Discussion: Alcohol related disciplinary actions did decrease over time in the years of study, and this relationship was correlated with several school-level characteristics, including school price, school funding type, types of degrees awarded, and specialty. School price may serve as a proxy mediator or confounder of the effect of time on disciplinary actions.

Keywords

tax; alcohol; college; campus; students; disciplinary action

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Introduction

Raising alcohol prices via alcohol tax increase is associated with decreased excessive alcohol consumption and several related harms among the general adult population in the United States (Elder, et al., 2010; Wagenaar, et al., 2010). The existing literature on alcohol pricing and its impact suggests that the price of alcoholic beverages does affect the quantity of alcohol that consumers purchase (Babor, 2010).

In 2009, Wagenaar and colleagues' meta-analysis found a consistent inverse relationship with the price of alcoholic beverages and alcohol consumption across 112 studies (Wagenaar, 2009). In 2010, another meta-analysis by Wagenaar revealed that there was also an association between alcohol prices and alcohol-related harms, including injuries, sexually transmitted diseases, drug use, and crime (Wagenaar et al., 2010).

Price can be regulated, in part, through taxation of alcoholic beverages. The Centers for Disease Control (CDC) conducted a review to examine the effectiveness of manipulating alcohol taxes in efforts to reduce excessive alcohol consumption and related harms—the results lead the U.S. Community Preventive Services Task Force to recommend increasing alcohol taxes as a primary measure for reducing the harmful consequences related to excessive alcohol consumption (Task Force on Community Preventive Services, 2010).

In collaboration with the Task Force on Community Preventive Services, Elder and colleagues completed a meta-analysis involving studies restricted to underage populations. The results were similar to prior meta-analyses, albeit less strong—more than half of the studies found that increased taxes were significantly associated with reduced consumption and alcohol-related harms (Elder, et. al., 2010). In their summary, Elder and his colleagues noted that legislators should expect that the impact of a tax increase will be proportional not only to its magnitude, but also to such factors as disposable income and demand for alcohol (Elder, et. al, 2010). The study did not address the impact on college students in particular, but it did indicate mixed results (with some evidence of potentially inverse relationships) between price increases and drinking among young adults.

With the apparent purpose of decreasing alcohol consumption, on July 1, 2011 Maryland's state legislators increased the Maryland state alcohol sales tax by 50%, from 6% to 9%. In anticipation of the tax increase, the Abell Foundation conducted a projection analysis. The results indicated that a 50% alcohol tax increase in MD would save 33 lives, prevent 370 violent acts, and prevent 13,301 cases of alcohol dependence or abuse in the state every year (Jernigan and Waters, 2009). According to study findings by Esser et al., 2016, increased alcohol sales taxes in Maryland were effective in reducing alcohol consumption (Esser et al., 2016). In addition, an analysis of sexually transmitted infection rates in Maryland found a 24% decrease in gonorrhea after the 2011 tax increase (Staras et al., 2014).

The present study sought to determine if the 2011 policy change to increase alcohol taxes in Maryland achieved the intended effect for Maryland's college students. Because college students are a critical sub-population of young adults developing drinking trajectories—effectiveness in reducing heavy alcohol consumption and alcohol-related harms in this group is key. If the legislation was effective, we would expect a reduction in alcohol-related

disciplinary actions following the tax increase. This study evaluated whether levels of alcohol-related disciplinary actions on college campuses changed after the 2011 Maryland (MD) state alcohol tax increase from 6% to 9%, and explored which school-level factors were correlated with that relationship.

Method

The Campus Safety and Security Data Analysis Cutting Tool is a free online, publicly accessible database containing crimes in and around colleges and universities in the United States (OPE, 2013). A federal mandate (the Jeanne Clery Disclosure of Campus Security Policy and Campus Crime Statistics Act), requires that these data be submitted annually via a web-collection tool by all postsecondary institutions receiving federal student aid funding (OPE, 2013). The data are collected and maintained by the Office of Postsecondary Education (OPE) of the U.S. Department of Education. The data are colloquially referred to as “Clery data” because campus police or law enforcement report it in accordance with the Clery Act. The disciplinary actions data were retrieved using queries in the Clery data Cutting Tool. Alcohol-related disciplinary actions as defined by the OPE are: “the referral of any person to any official who initiates a disciplinary action of which a record is kept and which might or might not result in the imposition of a sanction.” (Office of Post Secondary Education, 2013). Thus, disciplinary actions range in terms of severity such that underage drinking and/or more serious events like alcohol-related violence, sexual assault and so on are included.

Schools were selected using the United States Department of Education’s National Center for Education Statistics “College Navigator”, a free, public search engine designed to provide relevant information about postsecondary education options to prospective students (NCES, 2014). Querying College Navigator for two- or four-year institutions offering Associates or Bachelor’s degrees in Maryland yielded 62 institutions fitting the inclusion criteria. Data from College Navigator were merged with Clery data. Three schools (U.S. Naval Academy, Bais HaMedrash, and ITT Hanover) were missing two or more school characteristics variables (e.g. graduation rate, price, population, etc.), and were dropped, leaving 59 schools for analysis. Panel data were constructed, clustered by school for eight years: 2006 through 2013. These years were selected so there could be sufficient time before and after the tax increase to detect a change. Twenty-six of the 59 colleges reported zero alcohol-related disciplinary actions for all eight years and could not be included in a time-series analysis. Thirty-three schools were left for the analytical sample for a total of 264 (33 schools $\times$ 8 years) observations.

The Alcohol Policy Information System (APIS) is an online resource maintained by the National Institutes of Health (NIH) National Institute of Alcohol Abuse and Alcoholism (NIAAA). The APIS website (www.alcoholpolicy.niaaa.nih.gov) details the history of alcohol policies across the United States, including alcohol tax policies for all 50 states. According to APIS, on July 1, 2011, Maryland adjusted its retail alcohol tax rate from 0% to 9% (NIAAA, 2015). In addition, the sales tax rate in Maryland that had previously applied to alcoholic beverages was unapplied, such that consumers no longer pay sales tax for alcohol. As a result, consumers now pay what is referred to as a “sales tax adjusted retail ad

valorem excise tax” which includes the previous sales tax of 6% plus the new retail on-premises ad valorem excise tax of 3%. In total, consumers now pay 9% tax on alcohol purchases. A consumer who made an alcohol purchase on June 30, 2011 paid 6% sales tax, and then on July 1, 2011 paid 9% sales tax adjusted retail ad valorem excise tax, an increase of 50%.

To model time, a variable “time” was created to represent years, with a value of 0 assigned to 2006, 1 assigned to 2007, and so forth. The interaction between “time” and “tax” was used to model the effect of the tax on alcohol-related disciplinary actions on college campuses. The variable “tax” was created with a value of 0 for each of the years 2006-2010 and a value of 1 for 2011-2013.

The data obtained on school characteristics included private for profit, private non-profit, or public type institutions, the highest degree offered: associate’s, bachelor’s, master’s, etc., whether on-campus housing was available, the total student population, percentage of undergrads out of the total student population, the reported annual graduation rate, the net price for full time students for the 2010-2011 academic year, and specialty (a summary variable calculated using the sum of single sex, historically black colleges and universities and religious affiliation). Altogether, seven characteristics of Maryland colleges and universities were explored for potential impact on the relationship between the tax increase and alcohol - related disciplinary actions.

The dataset was panel in nature, with each school having counts of alcohol-related disciplinary actions on campus for each of the eight years under study. The outcome variable was a count; its distribution was truncated, right-skewed and over-dispersed. These characteristics indicated that fixed effects negative binomial regression analysis was most appropriate. Data were analyzed using Stata statistical software version 13.1 (StataCorp, 2013). A .05 alpha level was the threshold for statistical significance, and beta coefficients were produced to determine the strength of the associations. Independent effects of the predictors were explored in several steps.

A preliminary multivariate model was run with both predictor variables, and with all school characteristic predictors. The multivariate model was tested for collinearity and three collinear pairs emerged: 1) campus housing and highest degree offered; 2) percent undergraduates and funding type; and 3) graduation rate and price. The collinearity test yielded the highest value for campus housing, indicating that it was possibly collinear with more than one variable, thus the decision was made to drop campus housing from the model. Percent undergraduate was insignificant and showed a weak effect size, so it was dropped in favor of funding type, which showed a relatively strong effect and statistical significance. Similarly, graduation rate was insignificant and weak, and was dropped in favor of the stronger, significant price variable.

One at a time, the five school characteristics were removed from the final model to determine whether any of the variables mediated the relationship between the tax and disciplinary actions. The final model included five remaining school characteristics (type, degree, population, specialty and price), time, tax, and the time*tax interaction. As UMCP

and Loyola were potentially high-leverage, the final model was rerun first with UMCP removed, and then again with UMCP and Loyola removed. Neither of these alternative analysis scenarios yielded notable changes in effect size, effect direction, or statistical significance.

Results

The descriptive statistics of the counts of alcohol related disciplinary actions across the years under study, and pre- and post-tax increase implementation, are described in Table 1 for the total sample and the analytic sample. In 2006, the mean number of alcohol-related disciplinary actions was 73, and in 2013, the mean was 61. Two schools emerged as outliers warranting further investigation. The alcohol-related disciplinary actions at University of Maryland College Park (UMCP), alone, represented 26% of the total number of such actions at all campuses in 2011. Second highest was Loyola University, where disciplinary actions represented 9%.

The characteristics of the postsecondary institutions in the analytic sample are shown in Table 2. The institutions are mostly public schools (60.6%). Most of the schools offer on campus housing (75.8%). The populations of the schools have a wide range (mean=8,100, s.d.=8,956). 81% of the students are undergraduates and 42% of the schools offer doctoral degrees as the highest available degree. On average, 47% of the students successfully graduated within 1.5 times the expected number of years to graduation. 66.7% of the schools are priced more than \$20,000 per year. Less than 25% of the schools target a specialty interest.

The results of the negative binomial regression models are displayed in Table 3 with beta coefficients and *p*-values. We used a standard full Bayesian estimation procedure to interpret the coefficients (Wang et al., 2013). The coefficient for “Time measured annually” established that alcohol-related law violations decreased without accounting for the tax increase ($\beta = -.05$; $p = .022$). The coefficient for “Interaction between time and tax” estimated that there was no significant change in the intercept resulting from the tax increase ($\beta = -.27$; $p = .257$).

As compared to schools awarding only Associate’s degrees, counts of disciplinary actions related to alcohol on college campuses were higher at those schools offering Master’s and doctoral degrees. Public schools experienced higher counts of alcohol related disciplinary actions than private nonprofit institutions ($\beta = 2.01$; $p < .001$). Specialty schools experienced slightly fewer alcohol-related law violations ($\beta = -.98$; $p = .006$). More expensive schools charging \$20,000 annual tuition were much more likely to have alcohol-related disciplinary actions occur on campus ($\beta = 3.14$; $p < .001$). The third and fourth columns of Table 3 show that the estimates for the time, tax, and interaction coefficients reversed in direction and changed in magnitude once school price was removed from the model.

Discussion

This study explored whether students in Maryland colleges experienced lower levels of alcohol-related disciplinary actions after the 50% alcohol tax increase was implemented in

July, 2011. This research contributes to a small but growing body of literature clarifying the impact of alcohol tax interventions on alcohol related problems among young adults. The findings of this study show that after the 2011 tax was implemented, there was an overall decrease in alcohol related law violations on college campuses, but that decrease could not be attributed to the tax increase.

These results do corroborate other studies that found that state-level strategies that work for the general adult population may be less effective in the subset of young adults (Elder, 2010). These results do not corroborate other studies on the impact of the 2011 Maryland State alcohol tax increase. Findings from Esser et al., 2016 and Staras et al., 2014 showed that alcohol consumption decreased and gonorrhea rates decreased after the implementation of the tax.

The coefficient for tax (representing the intercept) became significant when school price was removed from the model ($\beta = -.52$; $p = .045$) which indicates that the price of the school changes the impact of tax on the alcohol-related disciplinary actions at the school. Because higher priced schools logically have more financial resources, the monitoring, detection, and reporting may be consequentially better at those schools. This would cause a confounding effect. While it appears that tax is not working to reduced alcohol related disciplinary actions, it may be the case that monitoring and reporting at high resourced schools are confounding the effect.

Alternatively, price might be a mediator serving as a proxy for average student financial resources. Given that financial resources are a part of the equation for tax impact on alcohol-related outcomes (Elder, et al., 2010), this raises questions about whether the effect of raising taxes on alcohol problems is more impactful for students with less financial resources. In this scenario, while it appears that tax is not working to reduce alcohol-related disciplinary actions among college students, it may be the case that students' financial resources are mediating the effect.

Clery Data is the best, most comprehensive data of this kind. It is the most accurate representation of the outcomes related to alcohol among college students. It encompasses the use of violations to both states and local ordinances such as unlawful sale, purchase, provision and possession of alcohol (Office of Post Secondary Education, 2013). The efforts across US colleges and universities to collect and report Clery data, along with the subsequent publication of those data has been an enormous and expensive undertaking. The criticisms that Clery data are underreported and thus lack utility may be false considering this analysis. Using results from analysis of Clery data is an important contribution to the field of higher education environment and safety surveillance.

This research met several important standards of research quality. First, the conceptual framing of this study was grounded in the ecological model, a long-accepted framework for behavior theories, including those related to alcohol consumption. Second, this study design was deliberately transparent. Upon the completion of this work, other researchers should be able to access the same publically available data, run the analyses described herein, and replicate these results. In the future, these methods can be repeated to include additional

years of data as those data become available, and if any future national college related drinking data are collected, these methods are easily modified and transferrable for other outcomes. Third, the data and analyses selected are appropriate for the question—there is no need to re-establish accepted causal linkages between alcohol legislation and alcohol problems in the general population. This research attempts to answer questions about the utility of a heralded alcohol legislation for preventing alcohol problems in college students, who make up a sub-population experiencing an alarming epidemic of alcohol problems. Lastly, this study uses several years of data and evaluates pre-and post-intervention periods to maximize internal validity.

The primary critique against the utility of Clery data is that there may be reporting bias (Maryland Collaborative to Reduce College Drinking and Related Problems, 2013). Theoretically, selection bias doesn't exist in Clery data—these are surveillance data with mandatory reporting. However, if the alcohol data are incomplete because of reporting bias, resulting estimates would likely err on the side of deflating detected associations. If any schools have administrative staff that are hypervigilant about reporting alcohol-related incidents (potentially reporting incidents that are not law violations), resulting estimates would be inflated. While the presence of campus housing may be a correlate of the volume of alcohol related infractions, housing in of itself does not produce higher counts of infractions so much as the monitoring of campus housing. Here again, varied levels of vigilance campus housing would produce varied counts.

In completing the analysis, school price may have mediated or confounded the relationship between the MD tax and alcohol related disciplinary actions on campus. This may be indicative of a differential relationship to reporting by school resources. Although potential reporting differences were not explored in this research, it is plausible that a more well-resourced school has greater capacity to direct staff efforts towards monitoring and reporting infractions.

In addition, there are likely other unmeasured or unseen confounding, mediating or moderating variables not considered in these analyses. This research design assumes relative homogeneity of the college campuses that are included in the analyses—that the “culture” of drinking or not drinking is consistent from school to school, across groups within each school, and that each individual student within a school experiences similar exposure to alcohol.

National trends around underage alcohol use and its consequences are encouraging with the exception of underage drinking in the college setting (Harding, et.al., 2016). This implies that insight and interventions around and within college environments are critical. Additional years of post-intervention data and an analysis of national trends around in alcohol violations on college campuses would strengthen the research. Future research is needed to determine whether these results based on Maryland schools are generalizable to other states. Further analysis of reporting differences by financial correlates (e.g. percentage of students receiving financial aid) is warranted as well, to elucidate whether a higher level of monitoring and reporting happens at wealthier schools, and whether varied enforcement is related to any effects from the tax increase. Finally, future research in this area should

include other environmental level interventions (e.g. Sunday sale bans, Happy hour and Keg registration laws), which may potentially impact the relationships detected in this research.

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Table 1.

Descriptive Statistics for Alcohol-related Disciplinary Actions on MD College Campuses

	Total sample (n=59)			Analytic sample (n=33)		
	(min, max)	mean	s.d.	(min, max)	mean	s.d.
2006	(0, 849)	73	(165)	(0, 849)	124	(201)
2007	(0, 987)	75	(170)	(0, 987)	123	(204)
2008	(0, 958)	72	(166)	(0, 958)	118	(200)
2009	(0, 943)	67	(170)	(0, 943)	111	(210)
2010	(0, 1062)	65	(170)	(0, 1062)	112	(212)
2011	(0, 1057)	69	(165)	(0, 1057)	121	(205)
2012	(0, 742)	58	(128)	(0, 742)	101	(156)
2013	(0, 647)	61	(141)	(0, 647)	102	(170)

Table 2.

Descriptive Statistics of Higher Education Institutions Characteristics Used as Predictor Variables

Characteristics		Total sample (n=59)	Analytic sample (n=33)
Profit Status Type			
	Private for profit	10 (17.0%)	0 (0.0%)
	Private nonprofit	20 (33.9%)	13 (39.4%)
	Public	29 (49.1%)	20 (60.6%)
Degrees Awarded			
	Associate's	21 (35.6%)	9 (27.3%)
	Bachelor's	4 (6.8%)	0 (0.0%)
	Master's	15 (25.4%)	10 (30.3%)
	Doctor's	19 (32.2%)	14 (42.4%)
Geographic Setting			
	City	19 (32.2%)	11 (33.3%)
	Suburb	32 (54.2%)	17 (51.5%)
	Rural	8 (13.6%)	5 (15.2%)
Campus Housing			
	No	28 (47.5%)	8 (21.2%)
	Yes	31 (52.5%)	25 (75.8%)
Population	Mean (sd)	6432 (8994)	8100 (8956)
Percent Undergraduates	Mean (sd)	.83 (.23)	.81 (.19)
Graduation Rate	Mean (sd)	.42 (.27)	.47 (.26)
Price >\$20,000	No	35 (59.3%)	22 (66.7%)
	Yes	24 (40.7%)	11 (33.3%)
Specialty			
	No	56 (94.9%)	25 (75.8%)
	Yes	3 (5.1%)	8 (24.2%)

Table 3.

Negative Binomial Regression Analysis of Tax, Time and College Characteristics on Alcohol-Related Disciplinary Actions

Variable	Fully adjusted		Fully adjusted; excluding price	
	β	<i>p</i>	β	<i>p</i>
Time, measured annually 2006-2013	-.05	.022	-.02	.305
Tax, pre- versus post- 2011 tax implementation	-.27	.257	-.52	.045
Interaction between time and tax	.06	.107	.07	.044
Population	.00	.004	.00	.001
Highest Degree				
Associate	Ref.	—	—	—
Master	1.65	.021	3.41	<.001
Doctor	2.06	.004	1.88	.018
Funding Type				
Private nonprofit	Ref.	—	—	—
Public	2.01	<.001	.96	.014
Specialty (HBCU, religion or gender specific)	-.98	.006	-1.35	.018
Annual Tuition Price				
<\$20,000	Ref.	—	n.a.	n.a.
\$20,000	3.14	<.001	n.a.	n.a.