Published in final edited form as:

Alcohol Clin Exp Res. 2014 January ; 38(1): 241–248. doi:10.1111/acer.12226.

INCREASED CIGARETTE TAX IS ASSOCIATED WITH REDUCTIONS IN ALCOHOL CONSUMPTION IN A LONGITUDINAL U.S. SAMPLE

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Abstract

Background—Cigarette taxation has been recognized as one of the most significant policy instruments to reduce smoking. Smoking and drinking are highly comorbid behaviors, and the public health benefits of cigarette taxation may extend beyond smoking-related outcomes to impact alcohol consumption. The current study is the first to test whether increases in cigarette taxes are associated with reductions in alcohol consumption among smokers using a large, prospective U.S. sample.

Method—Our sample included 21,473 alcohol consumers from the National Epidemiological Survey on Alcohol and Related Conditions (NESARC). Multiple linear regression analyses were conducted to evaluate whether increases in cigarette taxes between Waves I (2001–2002) and II (2004–2005) were associated with reductions in quantity and frequency of alcohol consumption, adjusting for demographics, baseline alcohol consumption, and alcohol price. Stratified analyses were conducted by sex, hazardous drinking status, and age and income group.

Results—Increases in cigarette taxes were associated with modest reductions in typical quantity of alcohol consumption and frequency of binge drinking among smokers. Cigarette taxation was not associated with changes in alcohol consumption among non-smokers. In analyses stratified by sex, the inverse associations of cigarette taxes with typical quantity and binge drinking frequency were found only for male smokers. Further, the inverse association of cigarette taxation and alcohol consumption was stronger among hazardous drinkers (translating into approximately 1/2 a drink less alcohol consumption per episode), young adult smokers, and smokers in the lowest income category.

Conclusions—Findings from this longitudinal, epidemiological study suggest increases in cigarette taxes are associated with modest to moderate reductions in alcohol consumption among vulnerable groups. Additional research is needed to further quantify the public health benefits of cigarette taxation on alcohol consumption and to evaluate the potential broader crossover effects of cigarette taxation on other health behaviors.

Keywords

cigarette tax; alcohol; longitudinal; smokers; hazardous drinking; sex

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The authors have no competing interests.

Introduction

Tobacco use is the leading cause of preventable death and disability in the U.S (Centers for Disease Control and Prevention [CDC], 2008; Mokdad et al., 2004) and much effort has gone into identifying population-level interventions to reduce the use and abuse of tobacco. In particular, cigarette taxation has been recognized as one of the most significant policy instruments to reduce smoking (World Health Organization, 2008) and extensive resources have been allocated to understanding the direct effect of taxes on reducing cigarette use. A large body of evidence indicates that increases in cigarette taxes lead to reductions in cigarette consumption, with the resulting outcomes of decreased initiation, increased quit behavior, and reductions in premature death (Chaloupka et al., 2012; Chaloupka and Warner, 2000; Glantz and Gonzalez, 2012; Levy et al., 2000; Sung et al., 2005; Wilson and Thomson, 2005). Studies estimate that a 10% increase in cigarette taxes equates to a 3–5% decrease in cigarette consumption in adults (Chaloupka et al., 2012; Evans and Farrelly, 1998), and even stronger effects are seen among adolescents and low SES populations (CDC, 1998; Ding, 2005).

Heavy drinking is common and costly in the U.S. (Substance Abuse and Mental Health Services Administration, 2011), ranking as the third leading cause of preventable death (CDC, 2004). Excessive drinking impacts risk for cardiovascular disease, gastrointestinal bleeding, cirrhosis of the liver, cancer, unintentional injuries, and violence (CDC, 2004; United States Department of Health and Human Services, 2005), and contributes an estimated yearly economic burden of \$234 billion (Rehm et al., 2009). Laboratory studies and naturalistic observations have demonstrated that smoking and alcohol consumption are highly comorbid behaviors (Barrett et al., 2006; Harrison and McKee, 2008a; Lasser et al., 2000; McKee et al., 2006), and smokers are substantially more likely than non-smokers to meet the criteria for an alcohol use disorder (alcohol abuse or dependence) (McKee et al., 2007). Alcohol-tobacco comorbidity is particularly concerning given that the health risks of combined versus singular abuse of alcohol and tobacco are multiplicative (McKee & Weinberger, 2013). Economic investigations have generally found that the cross-price elasticity between alcohol and tobacco is negative, suggesting that the two behaviors function as complements rather than substitutes (e.g., Aristei and Pieroni, 2010; Bask and Melkersson, 2004; Cameron and Williams, 2001; Fanelli and Mazzocchi, 2008; Jones, 1989; Pierani and Tiezzi, 2009), although some studies indicate that higher cigarette prices are associated with increased alcohol consumption (Decker and Schwartz, 2000; Goel and Morey, 1995; Yu and Abler, 2010), or find that the association varies by age group (McLellan et al., 2012).

Given the high co-occurrence of tobacco and alcohol use, researchers have hypothesized that the public health benefits of tobacco-related policies may extend beyond smoking-related outcomes to impact drinking behaviors. For example, several recent studies demonstrated that smoking bans in public places are associated with reductions in alcohol consumption and a reduced likelihood of alcohol use disorders over time (Kasza et al., 2012; McKee et al., 2009; Young-Wolff et al., 2013). It is possible that eliminating opportunities to drink and smoke concurrently in public places accounted for the beneficial public health influence of smoking bans on drinking behaviors. Although cigarette taxation is less directly associated with drinking behaviors compared to tobacco legislation enacted in drinking venues, the success of cigarette taxation as a tobacco control strategy, and the degree of association between alcohol and tobacco use, suggest that the public health benefits of cigarette taxation may also extend beyond smoking to alcohol-related outcomes. However, surprisingly little attention has been allocated to the impact of cigarette taxation on drinking behaviors, and extant evidence indicates that increases in cigarette taxes are associated with reductions in

drinking. In an adult sample, Lee and colleagues found that alcohol use consistently decreased as a function of increasing cigarette taxation in Taiwan (Lee, 2007; Lee et al., 2010). In an adolescent sample, Dee (1999) demonstrated a negative (but non-significant) relationship between higher cigarette taxes and reductions in alcohol consumption. To our knowledge, no prior study has considered the potential for crossover association of cigarette taxation on drinking outcomes using a longitudinal, epidemiological US sample.

The current study was conducted to address this gap in the literature. Using data from a prospective, longitudinal survey of US adults, we aimed to: a) test whether increases in cigarette taxes are associated with reductions in alcohol consumption over time, and b) evaluate whether the association between cigarette taxation and drinking outcomes is modified by smoking status, key demographic variables, and hazardous drinking. Past research has shown that the impact of tobacco-related policies on drinking behaviors are stronger among heavy drinkers and smokers (Kasza et al., 2012; McKee et al., 2009) and we hypothesize that the influence of cigarette taxation on alcohol consumption will also be stronger among these subgroups. Further, young adults, individuals with low SES, and men are particularly responsive to cigarette taxes (Chaloupka & Pacula, 1999; Chaloupka et al., 2012), and available evidence suggests that smoke-free policies may be more strongly protective against alcohol use disorders in men versus women (Young-Wolff et al., 2013). Thus, we also conducted stratified analyses to investigate whether the association between increases in cigarette taxes and changes in alcohol consumption vary among these subgroups.

Materials and Methods

Participants

The present study included data from U.S. civilian, non-institutionalized adults (>18 years of age), who completed two Waves of computer assisted personal interviews from the National Epidemiological Survey on Alcohol and Related Conditions (NESARC), a prospective survey conducted by the National Institute on Alcohol Abuse and Alcoholism (NIAAA) (Wave I, 2001–2002, $n = 43,093$, 81% of those eligible; Wave II 2004–2005, $n = 34,653$, 86.7% of wave I participants) (Dawson et al., 2007; Grant et al., 2003a; 2005). The NESARC is one of the largest, nationally representative epidemiologic surveys to date, representing residents from all 50 states and the District of Columbia using sampling frames derived from the U.S. Census. Adults aged 18–24, Hispanics, and African Americans were oversampled. All participants provided informed consent and NESARC procedures were reviewed and approved by the U.S. Census Bureau and the U.S. Office of Management and Budget.

The current sample included 10,936 participants from 31 states that increased cigarette taxes between Wave I and Wave II, and 10,537 participants from 15 states in which cigarette taxes remained the same between waves (The Tax Burden on Tobacco, 2009). Four states (Vermont, Rhode Island, Maine, and New Hampshire) were excluded from the analysis as alcohol price data were unavailable (American Chamber Commerce Researchers Association (ACCRA), 2007) across the two waves. The current sample was limited to participants who reported any past-year alcohol use at Wave I.

Measures

Frequency of alcohol consumption, amount of alcohol typically consumed, and frequency of binge drinking were assessed during Waves I and II with the NIAAA Alcohol Use Disorders and Associated Disabilities Interview Schedule- version for DSM IV (AUDADIS-IV), a well-established and valid measure of drinking outcomes (Grant et al., 1995; 2001; 2003a;

2003b). Changes in alcohol consumption between Waves I and II were calculated by subtracting the consumption measure in Wave 1 from the consumption measure in Wave II.

Frequency of alcohol consumption was assessed with the question, “During the last 12 months, about how often did you drink any alcoholic beverage?” Response options included 10 categories ranging from “every day” to “1 to 2 times in the last year”. Frequency of alcohol consumption was treated as continuous using the mid-point of each category. Results are presented in number of days/week units.

Amount of alcohol typically consumed was assessed using the following question: “Counting all types of alcohol combined, how many drinks did you usually have on days when you drank during the last 12 months?” Results are presented in drinks/typical day units.

Frequency of binge drinking was assessed with the item: “During the last 12 months, about how often did you drink [5 (male)/4 (female)] or more drinks in a single day?” Response options included 11 categories ranging from “every day” to “never in the last year”. Frequency of binge drinking was treated as continuous using the midpoints of each category. Results are presented in number of days/week units. Additionally, respondents were classified as hazardous drinkers if they consumed more than 14 (men)/7 (women) drinks/week (as calculated by frequency of consumption $\times$ amount typically consumed), or if they reported at least one binge drinking episode during the past year, per NIAAA guidelines (US Department of Health and Human Services, 2007).

Basic smoking status was assessed using the question, “*Did you smoke in the past 12 months?*” For the purposes of the current study, participants were considered smokers if they reported current daily smoking in the past 12 months at wave 1.

Cigarette taxation policy data were obtained from The Tax Burden on Tobacco (2009). State excise tax on cigarettes was determined for the state of residence of each participant at 2002 and 2005. Changes in cigarette taxes between Waves I and II were calculated by subtracting the tax measure in Wave 1 from the tax measure in Wave II and dichotomized (increase vs. no change).

We examined several covariates that could alter the associations between changes in cigarette taxation and changes in alcohol consumption, including age, race/ethnicity (Non-Hispanic White, Non-Hispanic Black, Hispanic, and other), education (< high school graduate, high school graduate, some college), personal income (\$0–19,999, \$20,000–34,999, \$35,000–69,999, \$70,000+), marital status (single, married), smoking status (current daily smoker vs. other), baseline alcohol consumption, current nicotine dependence, defined using the AUDADIS-IV (Grant et al., 2001), and change in alcohol price obtained from ACCRA (2007). The ACCRA provides cost of living adjusted, consumption weighted, total price per ounce of ethanol averaged across cities (weighted by city population) in a given state (ACCRA, 2007).

Data Analysis

We conducted a series of stratified linear regression analyses to investigate the influence of cigarette taxation on drinking outcomes separately by smoking status, sex, and, after finding significant associations among the subgroup of smokers, hazardous drinking status at Wave I among smokers. We also conducted stratified analyses by age group and income category, stratified by smoking status. Depending on the analysis, we adjusted for a number of covariates (see Table 1), including demographic variables (sex, race, education, marital

status, age), smoking status, nicotine dependence, baseline cigarette tax, corresponding baseline alcohol consumption, and change in alcohol price.

Analyses were conducted using Stata Version 11 (StataCorp, 2009). Multilevel mixed-effects regression analyses were used to account for the nesting of individuals within states. Including state as a fixed effect helps to account for potential confounding by unmeasured state-level variables that may be correlated with our key variables of interest. While NESARC sampling weights have been constructed to provide nationally representative sample estimates, they were not necessary to utilize in the current study because the analyses were concerned with relative effect sizes, and not making population-level estimates of the number of people affected (Korn et al., 1991).

Results

Demographic characteristics and alcohol consumption measures among past year drinkers, stratified by smoking status and hazardous drinking status among smokers, are presented in Table 1. Smokers were more likely to be male, tended to be younger, less educated, had lower income, and were less likely to be married compared to non-smokers. Smokers also drank more heavily and frequently compared with non-smokers. Among smokers, those who were hazardous drinkers were more likely to be male, tended to be younger, and were less likely to be married, compared to those who were not hazardous drinkers. Approximately half the sample (51%) lived in the 31 states that experienced an increase in state excise cigarette tax between Waves I and II, ranging from 7 cents to 160 cents (mean = 61 cents, SD = 42 cents, median = 40 cents).

Table 2 provides the mean change in alcohol consumption outcomes as a function of change in cigarette tax (i.e., no increase vs. increase) among smokers and non-smokers and by sex. Significantly greater reductions in typical quantity of alcohol consumption and frequency of binge drinking were seen in smokers who lived in states where cigarette taxes increased compared with those in states without tax increases. Increases in cigarette taxes were not significantly associated with changes in frequency of alcohol consumption. In analyses stratified by sex, the associations of cigarette taxation and typical quantity and binge drinking frequency were found only for male smokers. In the subset of non-smokers, changes in alcohol consumption did not vary as a function of change in cigarette tax overall, nor for subgroups of men or women.

Table 3 presents change in alcohol consumption as a function of change in cigarette tax among smokers, stratified by hazardous drinking status at baseline. Similar to Table 2, the coefficients in Table 3 represent the differences in the mean change values between tax change groups. Regardless of tax group, hazardous drinking smokers at baseline typically reduced their alcohol consumption, while those who were not hazardous drinkers maintained or increased their consumption. In the subset of hazardous drinking smokers, males who experienced increases in cigarette taxes had greater reductions in typical quantity of alcohol consumption than those without tax increases. Among male smokers who did not drink hazardously at Wave I, those who experienced cigarette tax increases experienced smaller increases in quantity of alcohol consumption than did those who were not exposed to cigarette tax increases. Regardless of hazardous drinking status, increases in cigarette taxes were not significantly associated with changes in frequency of alcohol consumption or binge drinking among male smokers, nor with changes in any drinking outcomes among female smokers.

Subgroup analyses by age group and income group, stratified by smoking status (results not shown), indicated that increases in cigarette taxes were significantly associated with

reductions in typical quantity of alcohol consumption among smokers aged 50 and older ($b = -0.23$, $p = 0.04$) and smokers in the lowest annual income group ($\$0 - \$19,999$; $b = -.24$, $p = 0.04$). Further, increases in cigarette taxes were significantly associated with reductions in frequency of binge drinking among young adult smokers aged 18–29 ($b = -0.19$, $p = 0.02$). Cigarette tax increases were not associated with changes in typical quantity of alcohol consumption nor frequency of binge drinking in non-smokers regardless of demographic subgroup, nor with changes in frequency of alcohol consumption regardless of smoking status or demographic subgroup.

Supplementary analyses with the full sample that included past-year alcohol abstainers were conducted and the overall pattern and significance of effects were virtually unchanged, indicating that excluding past-year abstainers did not affect our results. Further, we ran analyses to test whether the magnitude of changes in cigarette tax was related to changes in alcohol consumption. Absolute magnitude of increases in cigarette taxes were in the direction expected (greater increases in tax were associated with less heavy and less frequent drinking), however, the pattern of results was unchanged.

Discussion

Cigarette taxes are vital for tobacco control, and available evidence indicates that alcohol and tobacco tend to operate as complements rather than substitutes. However, in contrast to studies that examine the effects of overall tobacco price, few studies have extended cross-price elasticity analyses to examine the specific association of cigarette taxes and alcohol consumption. Extant studies using an adult sample from Taiwan and an adolescent sample from the U.S. provide initial evidence that the public health benefits of cigarette taxation may extend beyond smoking-related outcomes to impact alcohol consumption (Dee, 1999; Lee, 2007; Lee et al., 2010). The current study is the first to utilize data from a large, prospective, population-based sample of U.S. adults to study the association of increases in cigarette taxes with drinking outcomes.

Our findings indicated that increases in statewide cigarette taxes were associated with reductions in quantity of alcohol consumption and frequency of binge drinking among male smokers. These associations were generally modest to moderate, such that when cigarette taxes increased, male smokers drank approximately 1/3 of a drink less per episode (a 11% reduction), and binged approximately 7 fewer times per year (a 22% reduction), compared to male smokers who did not experience tax change. Similar to prior research indicating that the impact of smoke-free policies on drinking behaviors are stronger among heavy drinkers (Kasza et al., 2012; McKee et al., 2009), the association of cigarette tax with quantity of alcohol consumption was also found for male smokers who were hazardous drinkers at baseline, translating into just under 1/2 a drink less alcohol consumption per episode (a 10% reduction). In contrast to results for male smokers, increases in statewide cigarette taxes were not associated with changes in drinking among non-smoking men, nor among women regardless of smoking status. This sex difference may be particularly important from a prevention perspective, given that compared to women, men drink more, are at greater risk for alcohol use disorders, and are more responsive to changes in cigarette taxes (Chaloupka et al., 2012; Grant, 1997).

In addition to sex differences in the association between changes in cigarette taxes and drinking outcomes, increases in statewide cigarette taxes were associated with reductions in quantity of alcohol consumption among adult smokers aged 50 and older and smokers in the lowest annual income group ($\$0 - \$19,999$). Further, increases in statewide cigarette taxes were associated with greater reductions in frequency of binge drinking among young adult smokers, such that when cigarette taxes increased, young adult smokers binged

approximately 10 fewer times per year (a 24% reduction). These findings are consistent with existing knowledge that young adults and individuals with low SES are especially responsive to cigarette taxes (Chaloupka et al., 2012), and is consistent with the recent findings that smoke-free policies in drinking venues afford protection against the onset of alcohol use disorders among young adult drinkers (Young-Wolff et al., 2013). Given evidence that alcohol-tobacco comorbidity is greatest among young adults and decreases with increasing age (Falk et al., 2006), these results have potential implications for prevention among vulnerable groups. While the associations of cigarette taxes and weekly alcohol consumption are modest to moderate, the impact of cigarette taxation may translate into clinically relevant differences if reductions in drinking are maintained and accumulated over time.

A number of mechanisms may contribute to the inverse association between cigarette taxes and alcohol consumption. Cigarette taxation is an effective means of reducing smoking and the beneficial spillover influence of cigarette taxation on alcohol consumption among smokers may be mediated by reductions in smoking. In addition, smokers often give higher priority to smoking cigarettes than using alcohol and illicit drugs (Kozlowski et al., 1989), and another reason considered is that smokers who continue to smoke following cigarette tax increases have less disposable income to spend on alcohol and thus may reduce their consumption. Further, changes in alcohol-related state policies that are systematically correlated with increases in state excise cigarette taxes may have also impacted changes in drinking behaviors. While we adjusted for changes in alcohol price between waves, and included state as a fixed effect in our analyses to account for potential confounding by unmeasured state-level variables that may be correlated with smoking and drinking, future research that includes simultaneous changes in smoking and additional state policies is needed to tease apart the potential mechanisms underlying the association between increases in cigarette taxes and reductions in drinking behaviors.

This study had several limitations. Smoking and alcohol consumption were measured retrospectively via self-report, potentially limiting the accuracy of our findings. In addition, while participants may have moved out of states between Waves I and II of the NESARC, data on participant residence at Wave II were not available. However, moving from one state to another is not expected to be systematically related to cigarette taxation, and this limitation would likely create additional random error and result in an underestimation of the true impact of cigarette taxation on reductions in drinking behaviors. Cohort attrition could bias our findings if participants lost to follow-up were different in their smoking and drinking behaviors. Further, increases in excise cigarette taxes take effect in states at different points throughout the calendar year (and can occur multiple times), and states varied in the length of time between cigarette tax increases and Wave II interviews. This likely biased the estimates of the effects of increases in excise cigarette effects downward, making it more difficult to detect a result (e.g., cigarette tax increases occurring just prior to Wave II interviews would count the same as cigarette tax increases that occurred just after Wave I, even though the effect would be expected to be much smaller in the former scenario). In addition, we do not investigate the association between increases in cigarette taxes and changes in smoking behaviors. The NESARC is not an ideal source to test this association, as the data can only be analyzed at the state level, and thus, we cannot control for access to cheaper sources of tobacco (e.g., geographic distance to lower tax jurisdictions or tax-exempt places such as Native American reservations). Finally, we are unable to account for bulk purchasing, discount/generic brands, and internet purchases, which can undermine the effects of tax increases, and would need to be considered to do this analysis properly. Nevertheless, many large scale studies have documented the robust and consistent relation between increases in cigarette taxes and reduced cigarette consumption, and the intent of our paper is not to replicate those findings, but to explore an unanswered question

of whether increases in cigarette taxes are related to changes in alcohol consumption among U.S. adults.

In summary, the current study is the first to utilize a large, longitudinal, representative U.S. sample to examine the secondary public health benefits of cigarette taxation on alcohol consumption. Together with recent findings that smoke-free legislation is associated with reductions in alcohol consumption (Kasza et al., 2012; McKee et al., 2009) and alcohol use disorders (Young-Wolff et al., 2013), our results may have significant clinical and policy implications, and suggest that the public health benefits of tobacco-related policies may extend to drinking behaviors. Our findings suggest that statewide increases in cigarette taxes may offer a broad approach to prevent alcohol-related morbidity and mortality among those at greatest risk (e.g., men, hazardous drinkers, young adult smokers). These results also underscore the potential importance of investigating the spillover influence of substance-related policies on a range of undesirable outcomes that we do not consider in this paper. For example, this line of research could be extended to examine whether smoke-free bar policies are associated with lower levels of sexual assault and drunk driving among young adults. Future research should also investigate whether gender interacts with other demographic variables (e.g., age, race/ethnicity), to predict changes in drinking following increases in cigarette taxes. Additional prospective, longitudinal studies are needed to further evaluate the cross-over influence of cigarette taxation on alcohol-related outcomes and to more fully understand the broader public health implications of cigarette taxation for prevention and treatment.

Acknowledgments

Funding: Supported by NIH (R21 AA018273; P50DA033945 (ORWH & NIDA); T32 HL007034).

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Table 1

Demographic characteristics and alcohol consumption measures among past-year drinkers, stratified by smoking status and hazardous drinking status among smokers

	Nonsmokers				Smokers			
	All (N = 16643)		All (N = 4830)		Hazardous drinkers (N = 2576)		Not hazardous drinkers (N = 2242)	
	N	%	N	%	N	%	N	%
Sex								
Male	7760	47*	2374	49	1412	55**	1287	57
Female	8883	53	2456	51	1164	45	955	43
Age group								
18-29	3430	21**	1254	26	840	33**	411	18
30-39	3961	24	1151	24	663	26	486	22
40-49	3587	22	1183	24	603	23	579	26
50+	5665	34	1242	26	470	18	766	34
Race/ethnicity								
White	10472	63**	3190	66	1733	67	1449	65
Black	2441	15	831	17	363	14	467	21
Hispanic	3126	19	609	13	372	14	236	11
Other	604	4	200	4	108	4	90	4
Education								
<High school	1604	10**	829	17	457	18	367	16
High School	4050	24	1706	35	878	34	823	37
Some College+	10989	66	2295	48	1241	48	1052	47
Income								
\$0 - 19,999	6148	37**	2292	47	1218	47	1066	48
\$20,000 - 34,999	4120	25	1277	26	717	28	557	25
\$35,000 - 69,999	4564	27	1032	21	523	20	508	23
\$70,000+	1811	11	229	5	118	5	111	5
Marital Status								
Married	9564	57**	2171	45	1044	41**	1123	50
Not married	7079	43	2659	55	1532	59	1119	50

Nonsmokers				Smokers			
All (N =16643)				All (N = 4830)			
		N	%	N	%	N	%
		Mean	(std dev)	Mean	(std dev)	Mean	(std dev)
State tobacco tax (cents)							
Wave 1	58.03	(40.97)**	51.63	(40.67)	51.23	(39.96)	52.17
Wave 2	88.71	(55.80)**	84.19	(56.65)	83.44	(55.12)	85.20
Alcohol Consumption							
Frequency (days/week)							
Wave 1	1.43	(1.97)**	1.84	(2.24)	2.62	(2.38)**	0.94
Wave 2	1.40	(1.93)**	1.68	(2.17)	2.27	(2.43)**	1.01
Typical amount (drinks/day)							
Wave 1	2.20	(1.82)**	3.31	(2.94)	4.77	(3.36)**	1.66
Wave 2	1.97	(1.87)**	2.85	(2.68)	3.84	(3.04)**	1.72
Binge frequency (times/week)							
Wave 1	0.26	(0.91)**	0.67	(1.46)	1.29	(1.82)**	0.00
Wave 2	0.22	(0.71)**	0.52	(1.15)	0.86	(1.39)**	0.15
						Mean	(std dev)

Table 2
Change in alcohol consumption as a function of change in cigarette tax among smokers and nonsmokers (N = 21473)

Smoking status	Sex	Change in cigarette tax	Frequency of consumption			Amount typically consumed			Frequency of binge drinking		
			Number of days per week (overall mean ~1.5 days/week; males=2.0, females=1.1)	N	Mean change ^I	Coeff. ²	p	Number of drinks per typical day (overall mean ~2.4 drinks/day; males=3.0, females=2.0)	N	Mean change ^I	Coeff. ²
Smokers ³	Both	No change	2143	-0.17	Referent	2132	-0.34	Referent	2074	-0.09	Referent
		Increase	2687	-0.15	-0.07	0.282	-0.57	-0.16	0.026	-0.20	-0.10
	Males	No change	1049	-0.20	Referent	1041	-0.33	Referent	1001	-0.09	Referent
		Increase	1325	-0.22	-0.10	0.296	-0.68	-0.34	0.005	-0.25	-0.13
Nonsmokers	Females	No change	1094	-0.14	Referent	1091	-0.34	Referent	1073	-0.09	Referent
		Increase	1362	-0.09	-0.03	0.763	-0.45	0.04	0.622	-0.16	-0.05
	Both	No change	8394	-0.01	Referent	8406	-0.19	Referent	8369	-0.05	Referent
		Increase	8249	-0.05	-0.03	0.430	-0.27	-0.06	0.124	-0.04	0.00
	Males	No change	3951	-0.04	Referent	3953	-0.17	Referent	3924	-0.08	Referent
		Increase	3809	-0.09	0.01	0.851	-0.30	-0.10	0.132	-0.06	0.01
	Females	No change	4443	0.01	Referent	4453	-0.21	Referent	4445	-0.03	Referent
		Increase	4440	-0.01	-0.07	0.141	-0.23	-0.03	0.414	-0.02	-0.01

Among those who reported any alcohol consumption during the past year when measured at baseline

¹ Unadjusted

² Adjusted for age, race, education, income, marital status, baseline cigarette tax, corresponding baseline alcohol consumption, and change in alcohol price

³ Additionally adjusted for nicotine dependence
Additionally adjusted for sex

Table 3

Change in alcohol consumption as a function of change in cigarette tax among smokers, stratified by hazardous drinking (HZ) status at baseline (N = 4818)

Baseline HZ status	Sex	Change in tobacco tax	Frequency of consumption			Amount typically consumed			Frequency of binge drinking		
			Number of days per week (overall mean ~1.8 days/week; males=2.3, females=1.4)			Number of drinks per typical day (overall mean ~3.3 drinks/day; males=4.0, females=2.7)			Number of times per week (overall mean ~0.7 times/week; males=0.9, females=0.5)		
			N	Mean change ¹	Coeff. ²	N	Mean change ¹	Coeff. ²	N	Mean change ¹	Coeff. ²
HZ	Both ³	No change	1138	-0.37	Referent	1128	-0.74	Referent	1073	-0.33	Referent
		Increase	1438	-0.33	-0.01	1425	-1.08	-0.22	1359	-0.51	-0.13
	Males	No change	621	-0.35	Referent	614	-0.78	Referent	575	-0.37	Referent
		Increase	791	-0.35	-0.06	780	-1.19	-0.41	738	-0.56	-0.15
Not HZ	Females	No change	517	-0.40	Referent	514	-0.71	Referent	498	-0.30	Referent
		Increase	647	-0.31	0.04	645	-0.93	0.03	621	-0.44	-0.10
	Both ³	No change	998	0.08	Referent	999	0.13	Referent	995	0.18	Referent
		Increase	1244	0.05	-0.15	1243	0.01	-0.09	1240	0.13	-0.05
	Males	No change	425	0.06	Referent	425	0.32	Referent	423	0.29	Referent
		Increase	530	-0.02	-0.22	530	0.06	-0.26	527	0.19	-0.10
	Females	No change	573	0.09	Referent	574	-0.02	Referent	572	0.09	Referent
		Increase	714	0.11	-0.08	713	-0.03	0.07	713	0.09	0.00

Among those who reported any alcohol consumption during the past year when measured at baseline

¹ Unadjusted

² Adjusted for age, race, education, income, marital status, nicotine dependence, baseline tobacco tax, corresponding baseline alcohol consumption, and change in alcohol price

³ Additionally adjusted for sex