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Effects of alcohol taxes on alcohol-related disease mortality in New York State from 1969 to 2006

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Abstract

Objective—The relationship of increased alcohol taxes to reductions in alcohol-related harm is well established. Few studies, however, have examined the effects of sudden decreases in alcohol tax rates or effects of narrow tax changes limited to specific beverage types. In the current study, we: (1) examine whether tax increases on spirits have similar effects in reducing alcohol-related disease mortality as increasing taxes on all types of alcoholic beverages simultaneously, and (2) evaluate effects of beer-specific tax decreases in New York State on mortality.

Method—We used a time-series, quasi-experimental research design, including non-alcohol deaths within New York State and other states' rates of alcohol-related disease mortality for comparison. The dataset included 456 monthly observations of mortality in New York State over a 38-year period (1969–2006). We used a random-effects approach and included several other important covariates.

Results—Alcohol-related disease mortality declined by 7.0% after a 1990 tax increase for spirits and beer. A spirits-only tax increase (in 1972) was not significantly associated with mortality but a data anomaly increased error in this effect estimate. Small tax decreases on beer between 1996 and 2006 had no measurable effect on mortality. Doubling the beer tax from \$0.11 to \$0.22 per gallon, a return to New York State's 1990 levels, would decrease deaths by an estimated 250 deaths per year.

Conclusions—Excise tax increases on beer and spirits were associated with reductions in alcohol-related disease mortality. Modifying tax rates on a single beverage type does not appear to be as effective as doing so on multiple alcoholic beverages simultaneously. In New York, small decreases in beer taxes were not significantly associated with alcohol-related disease mortality.

Keywords

Alcohol; Mortality; Tax; New York; Policy

1. Introduction

Preventing excessive alcohol use is one of the United States Surgeon General's priorities for improving the nation's health (National Prevention Council, 2011). In 2010, the Centers for Disease Control and Prevention's (CDC) Task Force on Community Preventative Services

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recommended that states raise alcohol excise taxes because this action is recognized as an effective way of reducing excessive consumption and alcohol-related harm at the population-level (Centers for Disease Control and Prevention, 2010; Elder et al., 2010; Wagenaar, Tobler, & Komro, 2010). In the current study, we examine the effects of alcohol excise taxes legislated in two distinct forms: beverage-specific taxation and the effects of decreases in the alcohol excise tax rate.

The public health benefit of increasing alcohol taxes on reducing alcohol-related harm is well-established for a wide-range of outcomes. Epidemiological and econometric literature spanning the past half century provides strong evidence for the effects of alcohol taxes on injuries and harm, consumption rates, and various alcohol-related outcomes—well-documented in recent meta-analyses (Wagenaar, Salois, & Komro, 2009; Wagenaar et al., 2010). Nevertheless, the number of studies specifically of effects of tax policies on alcohol-related disease outcomes is modest, compared to evaluations of drinking and injury outcomes. To help fill that relative gap in the literature, the current study examined the effects of alcohol tax changes in New York State specifically on alcohol-related disease mortality.

Two recent studies in the United States report reductions in alcohol-related disease mortality in Alaska and Florida after simultaneous tax increases on beer, wine, and spirits (Maldonado-Molina & Wagenaar, 2010; Wagenaar, Maldonado-Molina, & Wagenaar, 2009). For the current study, we examined tax changes in New York, since they were not implemented simultaneously for all types of beverages, and legislated tax changes in New York include both increases and decreases in tax rate over the 1969 to 2006 study period.

Although legislated reductions in excise taxes are relatively rare over the past several decades, state legislatures can choose to repeal, provide exemptions for, or decrease alcohol taxes. In 2009, for example, New York considered two bills to repeal alcohol tax increases even during the current state budget crisis (Marin Institute, 2009). In Finland, large alcohol tax decreases and subsequent price reductions were associated with increases in alcohol-related mortality (Herttua, Makela, & Martikainen, 2008; Koski, Siren, Vuori, & Poikolainen, 2007). In the United States, seven studies evaluated the effect of alcohol taxes on alcohol-related disease mortality (Cook & Tauchen, 1982; Heien & Pompelli, 1987; Maldonado-Molina & Wagenaar, 2010; Rush, Steinberg, & Brook, 1986; Schweitzer, Intriligator, & Salehi, 1983; Sloan, Reilly, & Schenzler, 1994; Wagenaar, Maldonado-Molina, & Wagenaar, 2009); however, none have examined the effects of *decreasing* alcohol taxes.

1.1. Current study

The purpose of this study is to (1) examine whether tax increases limited to one type of beverage have similar effects on mortality as increasing taxes on all types of alcoholic beverages simultaneously, and (2) evaluate effects of beer tax *decreases* on alcohol-related disease mortality in New York State. We chose New York State (excluding New York City) as the study area because: (a) its excise tax history includes several increases in one or more combinations of beverage types, (b) it is one of only three states, along with South Carolina and Arkansas, to reduce excise taxes on beer in the last four decades, and (c) it has implemented tax increases during periods where its per capita rate of ethanol consumption was significantly lower than in states previously studied (National Institute on Alcohol Abuse and Alcoholism, 2009). The latter provides an opportunity to understand the effects of taxes on alcohol-related disease mortality in an average consumption environment (Kerr, 2010). Table 1 summarizes all legislated changes in New York State's nominal excise tax rates by beverage type from 1969 to 2006.

2. Methods

2.1. Research design

We used a time-series quasi-experimental research design. The objective was to identify effects of increases or decreases in alcohol tax rates on alcohol-related disease mortality while controlling for possible alternative explanations for an observed effect using comparison data series. Comparison time-series controls for many factors that operate similarly across states and outcome measures (e.g., economic conditions, national social trends); thus, it includes many potential confounders for which reliable measures are not available. The time-series included 456 repeated monthly observations from January 1969 to December 2006.

2.2. Measures

Alcohol-related disease mortality measures are based on data from death certificates recorded in the US National Vital Statistics System of the National Center for Health Statistics (NCHS). We obtained the complete annual dataset containing one record on each deceased person for each year from 1969 through 2004 from the National Bureau of Economic Research (National Bureau of Economic Research, 2010). Data after 2004 are not publicly available; therefore, we obtained records from the NCHS of the Centers for Disease Control and Prevention. From these data, we created monthly counts (excluding NYC) of deaths, stratified by the underlying cause of death, occurring in New York State and then for all other states as a group (49 US states plus DC and NYC). We excluded deaths occurring in NYC in the dependent variable because the city implements excise taxes independent of the state (New York State Department of Taxation and Finance, 2010) and a large number of state-wide deaths are attributable to NYC in proportion to its large population (<http://www.nyc.gov/html/dcp/html/census/popcur.shtml>).

2.2.1. Alcohol-related disease mortality—The dependent variable is the monthly rate of mortality from causes, either acute disease or chronic disease that are either: (a) causes 100% attributable to excessive alcohol intake or (b) selected causes with direct or indirect alcohol-attributable fractions (AAF). Direct AAFs are estimated based on directly observed relationships between alcohol and the condition in a population. Indirect AAFs are estimated from prevalence and the condition-specific relative risk of death (<http://www.cdc.gov/alcohol/ardi.htm>).

Cause of death 100% attributable to alcohol include alcohol poisoning, excessive blood level of alcohol, alcoholic psychosis, alcohol abuse, alcohol dependence syndrome, alcohol polyneuropathy, degeneration of nervous system due to alcohol (added in ICD version 10), alcoholic myopathy (added in ICD version 10), alcohol cardiomyopathy, alcoholic gastritis, alcoholic liver disease, and alcohol-induced chronic pancreatitis. Chronic causes with a direct AAF include liver cirrhosis, unspecified acute pancreatitis, and chronic pancreatitis. Chronic causes with an indirect AAF include malignant neoplasms of lip, oral cavity, and pharynx, malignant neoplasm of esophagus, and malignant neoplasm of larynx. We define “alcohol-related” disease to be those ICD codes for conditions with AAFs > 0.35 based on previous research (English et al., 1995; Rhem, Patra, & Popova, 2006; Shultz et al., 1991). The complete list of ICD-codes defining “alcohol-related” disease deaths (Table 2) has been published previously (Maldonado-Molina & Wagenaar, 2010). Acute injury deaths such as suicide and traffic crashes are purposely not included—the focus of this study is alcohol-related disease.

Mortality rates per 100,000 population 15 and over were calculated using population files from the Surveillance, Epidemiology, and End Results (SEER) Program of the National Cancer Institute (National Cancer Institute, 2011).

2.2.2. Alcohol taxes—The Alcohol Policy Information System (APIS) provides summaries of tax rates for multiple classes of alcoholic beverages, details on changes in rate, full legal citations and text from the relevant codified statutes, starting with calendar year 2003 (<http://www.alcoholpolicy.niaaa.nih.gov>). We collected data for the period from 1969 to 2003 using experienced research attorneys and standard legal research methods on the records of codified statutes in Westlaw (<http://www.westlaw.com>) and LexusNexis (<http://www.lexisnexis.com>) when available, and law library paper copy for earlier years. Fig. 1 shows the real (i.e., adjusted for inflation) tax rates, in 2009 dollars, for beer, wine, and spirits in New York State for the 1969 to 2006 period.

Data on per capita personal income data were obtained from the Bureau of Economic Analysis (<http://www.bea.gov/regional/reis/>) as is defined as the income of all persons from all sources including wages and salaries, employer-provided health insurance, dividends and interest income, social security benefits, and other types of income. Alcohol taxes were adjusted for inflation using the Consumer Price Index for all urban consumers (CPI-U), obtained from the US Department of Labor, Bureau of Labor Statistics (<ftp://ftp.bls.gov/pub/specialrequests/cpi/cpiat.txt>).

2.3. Analytical strategy

Analyses were conducted in three phases. In Phase 1, we used a seasonal autoregressive integrated moving average (ARIMA) with structure (0,1,1)(0,1,1)₁₂ to model patterns of autocorrelation in the time series. The equation, in back-shift notation, for this model is $(1-B^{12})Y_t = \alpha + (1-\theta B^{12})u_t$, where Y_t is the alcohol-related mortality rate by month from $t=1$ (January 1969) to $t=456$ (December 2006); α is a constant; θ is the first-order seasonal moving average parameter operating on u_t which is a random error (white noise) component, and B is the backshift operator such that $B^{12}(Y_t) = Y_{t-12}$. As expected, the month-to-month (lag=1) and seasonal (lag=12) moving average terms were highly significant ($p < 0.0001$).

In Phase 2, three outcome models were estimated: (a) raw frequency, (b) rate per 100,000 population, and (c) natural logs of rate per 100,000 population. The frequency model represents the average monthly effect accounting for multiple tax changes throughout the historical series. Rates per population were examined to assess whether observed differences were because of population changes over the 38-year period, and it is a metric commonly reported by epidemiologists and others. Natural logs were modeled to ensure estimates were not affected by heteroscedasticity—changing variance in death rates over time. The comparison states (49 US states plus DC and NYC) covariate was included to ensure any estimated effects for New York State are not because of any of many other historical, healthcare, and societal changes over time that operate in common across states.

In phase 3, we examined the effects of tax increases or decreases separately using a generalized linear mixed model. The model can be written as $Y_t = \beta_0 + \beta_1 X_{1t} + \beta_2 X_{2t} + \beta_3 X_{3t} + \beta_4 X_{4t} + \beta_5 X_{5t} + \beta_6 X_{6t} + \beta_7 X_{7t} + \beta_8 X_{8t} + \phi Z_t + \epsilon_t$ where Y is alcohol-related disease mortality by month from $t=1$ (January 1969) to $t=456$ (December 2006); β_1 to β_8 are the effects of implementing each tax change and X_{1t} to X_{8t} are equal to 0 before the tax change took effect and 1 after the change (i.e., step function coding); ϕ is a vector of estimates that control for the effects of Z which include national (49 US states plus DC and NYC's alcohol-related disease mortality) and New York-specific conditions (per capita personal income and New York's non-alcohol related mortality), and ϵ_t is the error term. Non-alcohol related mortality is defined as all deaths exclusive of the list that defines our

alcohol-related outcome (identified in the Appendix). We included significant seasonal components as a random effect by specifying a Toeplitz or banded covariance structure. This can be interpreted as a moving average structure with order equal to $q-1$, where $q=13$. A Toeplitz structure is similar to the first-order autoregressive structure (where correlation decreases exponentially across the lags of the time points), but the Toeplitz structure is not as rigid as AR(1) for diminishing correlations across the lags (Hedeker & Gibbons, 2006). We used SAS 9.1 (SAS Institute, 2004) for all analyses.

3. Results

3.1. Effect of beer taxes on mortality

Rates of alcohol-related disease mortality in New York from 1969 to 2006 are shown in Fig. 2. Vertical lines denote months where sudden legislative changes in excise tax rates took effect. The frequency of alcohol-related disease mortality declines by an estimated 89 deaths per month for each unit (\$1 per gallon) increase in the beer tax ($p<0.0001$) (Table 3). Based on the mean monthly number of deaths over the 1969 to 2006 period ($\mu=200$), this represents a 45% reduction in deaths. The rate per 100,000 population of such deaths declines by -0.82 ($p<0.001$), a 34% reduction from the mean rate of 2.42. The comparison states' alcohol-related disease mortality ($p<0.0001$), New York State's non-alcohol-related disease mortality ($p=0.0101$) and the state's per capita personal income ($p<0.0001$) were significant predictors of New York's alcohol-related disease mortality, as expected, and effectively controls for numerous other factors. The double-log models provided direct elasticity estimates. The elasticity effect estimate is -0.07 ($p<0.0001$), indicating that doubling of the tax rate is related to a 7% decline in deaths.

3.2. Sensitivity analysis

We tested sensitivity of using a covariate representing alcohol-related deaths in license states (instead of all US states). License states ($n=35$) are those states, similar to New York, that do not operate state-owned (monopoly) alcohol sales. In a monopoly state, what constitutes alcohol tax versus simply an increase in (state-determined) price is ambiguous. Therefore, license states may be more comparable to NY in this context. Results did not change. For example, the estimated number of deaths per month was very similar [from 89 to 88].

3.3. Effect of tax increase in distilled spirits in 1972

In 1972 only, the mortality file is limited to a 50% sample of death certificates (Xu, Kochanek, Murphy, & Tejada-Vera, 2010). Assuming that this sample is representative of population mortality, our approach was to double the counts to estimate deaths in this year. Because this year coincided with an increase in spirits, we performed a sensitivity analysis on the final model using the lower and upper limit (95% CI) of this estimate. Limits were calculated from the standard error found in Vital Statistics of the United States, 1972, Vol. II-Mortality Part A (www.cdc.gov/nchs/products/vsus.htm). The monthly percent errors are computed as:

$$V_{x'} = \sqrt{(N - x') / x' (N - 2)}$$

where $V_{x'}$ is the square root of the relative variance of the estimate x' , where x' is the estimated number of alcohol-attributable deaths ($\text{Registered Deaths}_{1972} * 2$), and N is the number of registered deaths in 1972 in a specified geographic area or other subgroup.

When calculated as a doubling of the registered deaths, the excise tax increase for spirits (January 1972) was not associated with a significant change in alcohol-related disease mortality ($p=0.28$). When the lower limit of the 95% CI of alcohol-related disease mortality (~15 deaths fewer per month) was modeled, the tax increase in spirits-only was associated with lower alcohol-related disease mortality ($p=0.03$) (Table 4). The mortality rate per 100,000 population declines by 0.10, a 4.1% reduction from the mean rate of 2.42, when using the lower limit of alcohol-related disease mortality.

3.4. Effect of tax increases for two or more types of beverages in 1983, 1989, and 1990

Results show significant reductions in alcohol-related disease mortality following the concurrent increase in both beer and spirits excise taxes in June 1990. The rate per 100,000 population of such deaths declines by 0.17 ($p=0.01$), a 7.0% reduction from the mean rate of 2.42. Effects of smaller tax increases in May 1983 ($p=0.62$) were not significant. Increases in similar magnitude in July 1989 were also not significant ($p=0.22$), though in the hypothesized direction. We performed a sensitivity analysis for the June 1990 effect because we suspected that it might be confounded by the close timing of the July 1989 tax. The estimated effect of the June 1990 tax increased by 35% when the July 1989 tax was removed from the model.

3.5. Effect of tax decreases for beer between 1996 and 2006

New York State implemented four small beer tax decreases between 1996 and 2003, none of which had a statistically significant effect on alcohol-related disease mortality. The overall effect across all the small beer tax decreases was also not significant ($p=0.823$).

4. Discussion

The purpose of this study was to test the effects of sudden increases and decreases in alcohol excise tax rates on alcohol-related disease mortality in New York State. Findings suggest the need to test the effectiveness of combined policy strategies to reduce alcohol-related mortality. To reduce alcohol-related disease mortality, changes in all alcoholic beverages simultaneously is apparently more effective than changes to a single alcoholic beverage. Recent small beer tax decreases in New York State were not associated with subsequent increases in alcohol-related disease mortality. To the best of our knowledge, this is first study of the effects of legislated alcohol *tax decreases* in the United States.

Unexpectedly, the spirits-only tax in 1972 did not decrease alcohol-related disease mortality despite the fact that it was substantial increase (+44%) (from \$2.25 to \$3.25 per gallon) at the wholesale level. Other evidence suggests that this tax increase, plus an additional 12% markup by retailers at the time, did result in higher liquor prices to the consumer (Bonnie & O'Connell, 2004; Nagle, 1972). Moreover, per capita spirits consumption in New York appears to have declined in response to these higher prices. According to the National Institutes for Alcohol Abuse and Alcoholism, spirits consumption from 1971 to 1972 declined by 12%—from 1.41 to 1.24 gallons of ethanol per capita (National Institute on Alcohol Abuse and Alcoholism, 2009). This 12% one-time drop appears substantial given that the average year-over-year decrease in spirits consumption was only 3.5% from 1970 to 1997.

In contrast to previous research in the United States, (Maldonado-Molina & Wagenaar, 2010; Wagenaar, Maldonado-Molina, & Wagenaar, 2009), the current study did not find a significant effect of increases in excise taxes for 1983 in New York on reductions in alcohol-related disease mortality. This may be due to the relatively small proportional tax increase in New York State (+23% on average) compared to Florida (+28% on average) and Alaska

(+36% on average) (Maldonado-Molina & Wagenaar, 2010; Wagenaar, Maldonado-Molina, & Wagenaar, 2009). Small tax effects in New York State in 1983 may be statistically undetectable.

The decrease in alcohol-related disease mortality after the increase in beer and spirits taxes in June 1990 is consistent with recent studies in the United States (Maldonado-Molina & Wagenaar, 2010; Wagenaar, Maldonado-Molina & Wagenaar, 2009). Alcohol-related disease mortality declined by 7.0% after the 1990 tax increase. Sensitivity analysis indicated that the independent effect of the 1990 tax may be underestimated due to a substantial tax increase just 11 months prior (July 1989). Findings indicate that for every \$1 per gallon increase in the beer tax, alcohol-related disease deaths would decrease by 45%. Doubling the beer tax (100% increase) from \$0.11 to \$0.22 per gallon, a return to New York State's 1990 levels, would decrease deaths by an estimated 7%, or approximately 250 deaths per year. This finding is consistent with other studies suggesting a 78% increase in beer taxes would reduce traffic fatalities by approximately 7% in the United States (Ruhm, 1996).

New York State's recent decreases in beer taxes were not associated with increases in alcohol-related disease mortality. The decreases in taxes were very small (one to two cents per gallon), and likely too small to drive prices enough to encourage any increase in population-level beer consumption or alcohol-related disease deaths. This result is consistent with the idea that a small-to-medium decrease in the excise tax would not change prices when its proportional contribution to the final product price is small (Osterberg, 2011). Observational data also support the finding that alcohol-related disease mortality was not associated with decreasing beer taxes during this time. For example, New York's apparent per capita beer consumption declined from 0.97 to 0.94 gallons between 1996 and 1997, and binge drinking rates, which are driven mostly by beer drinkers, did not increase in New York in the 1990s (Nelson et al., 2002). In contrast, Finland is a country where the alcohol excise tax is a large proportion of the final beverage price, and alcohol-related mortality increased only after a substantial all-beverage tax decrease (−33% on average). These large tax reductions led to an 18% average price reduction in alcoholic beverages followed by a 10% increase in alcohol consumption (Duncan, Alpert, Duncan, & Hops, 1997).

The current study should be interpreted in light of several limitations. First, in 1972 only, the National Center for Health Statistics instituted a 50% sampling rate of mortality records, introducing extra sampling error into the current analyses. To address this limitation, sensitivity analyses were performed to increase confidence in results reported from that year. Second, the data series includes only 37 monthly data points for modeling prior to 1972, reducing the power of our models to detect change around this time. Third, findings apply only to New York State, and thus findings may not apply to alcohol tax policies and mortality in other states. Finally, in 2009, New York State increased beer taxes by 18% (to \$0.14 per gallon); however, mortality data are not yet available and must await future studies.

In conclusion, a tax change focused on one part of the alcoholic beverage market is not as effective as a tax change including all beverage types. Findings add to the literature by demonstrating that alcohol taxation remains a robust policy instrument for reducing alcohol-related disease mortality even when state-level alcohol consumption and alcohol-related disease mortality are relatively low. Our results may be most applicable to public health policy makers in states like New York and in other regions of the United States with average per capita consumption levels.

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Fig. 1.
Real tax rates (2009 dollars) for beer, wine, and spirits in New York State, 1969–2006.

Fig. 2.

Alcohol-related disease mortality per 100,000, 1969–2006, New York State (excluding New York City). (•) Observed mortality. Solid black line shows the $ARIMA(0,1,1)(0,1,1)_{12}$ model. Solid vertical lines indicate month and year of tax increases and hatched lines are tax decreases. S-Spirits, B-Beer, W-Wine.

Table 1

Legislated changes in nominal alcohol excise tax rates in New York State, 1969–2006

Month	Year	\$ per gallon			Percent Change		
		Beer	Spirits	Wine	Beer	Spirits	Wine
Baseline	1969	0.04	2.25	0.10	–	–	–
February	1972	0.04	3.25	0.10	–	44%	–
May	1983	0.06	4.08	0.12	22%	26%	22%
July	1989	0.11	5.29	0.19	100%	30%	58%
June	1990	0.21	6.44	0.19	91%	22%	–
January	1996	0.16	6.44	0.19	–24%	–	–
January	1999	0.14	6.44	0.19	–6%	–	–
April	2001	0.13	6.44	0.19	–7%	–	–
September	2003	0.11	6.44	0.19	–12%	–	–

Dollars per gallon rounded to two decimal places.

Table 2

Alcohol-related mortality measures by ICD-code, alcohol-attributable fraction 0.35

ICD-8 (1976–1978)	ICD-9 (1979–1998)	ICD-10 (1999–2005)
2910 291.1 291.2 291.3	291.0 291.1 291.2 291.3 291.4 291.5	F10.0 F10.1 F10.2 F10.3 F10.4 F10.5
291.9 303.0 303.1 303.2	291.8 291.9 303 305.0 357.5 425.5 535.3	F10.6 F10.7 F10.8 F10.9 G62.1 I42.6
303.9 571.0 980.0 E860	571.0 571.1 571.2 571.3 790.3 980.0	K29.2 K70.0 K70.1 K70.2 K70.3 K70.4
	E860.0 E860.1	K70.9 G31.2 K86.0 R78.0 X45 Y15
		T51.0 T51.9
140.0 140.1 140.2 140.9 141.0	140.0 140.1 140.3 140.4 140.5 140.6	C00.0 C00.1 C00.2 C00.3 C00.4 C00.5
141.1 141.2 141.3 141.9 142.0	140.8 140.9 141.0 141.1 141.2 141.3	C00.6 C00.8 C00.9–C01 C02.0 C02.1
142.8 142.9 143.0 143.1 143.9	141.4 141.5 141.6 141.8 141.9 142.0	C02.2 C02.3 C02.4 C02.8 C02.9 C03.0
144 145.0 145.1 145.8 145.9	142.1 142.2 142.8 142.9 143.0 143.1	C03.1 C03.9 C04.0 C04.1 C04.8 C04.9
146.0 146.8 146.9 147 148.0	143.8 143.9 144.0 144.1 144.8 144.9	C05.0 C05.1 C05.2 C05.8 C05.9 C06.0
148.1 148.8 148.9 149 150	145.0 145.1 145.2 145.3 145.4 145.5	C06.1 C06.2 C06.8 C06.9 C07 C08.0
161.0 161.8 161.9 571.8	145.6 145.8 145.9 146.0 146.1 146.2 C08.1	C08.8 C08.9 C09.0 C09.1 C09.8
571.9 577.0 577.1	146.3 146.4 146.5 146.6 146.7 146.8	C09.9 C10.0 C10.1 C10.2 C10.3 C10.4
	146.9 147.0 147.1 147.2 147.3 147.8	C10.8 C10.9 C11.0 C11.1 C11.2 C11.3
	147.9 148.0 148.1 148.2 148.3 148.8	C11.8 C11.9 C12 C13.0 C13.1 C13.2
	148.9 149.0 149.1 149.8 149.9 150.0	C13.8 C13.9 C14.0 C14.2 C14.8 C15.0
	150.1 150.2 150.3 150.4 150.5 150.8	C15.1 C15.2 C15.3 C15.4 C15.5 C15.8
	150.9 161.0 161.1 161.2 161.3 161.8	C15.9 C32.0 C32.1 C32.2 C32.3 C32.8
	161.9 571.5 571.6 577.0 577.1	C32.9 K74.0 K74.1 K74.2 K74.3 K74.4
		K74.5 K74.6 K85 K86.1

Table 3

Overall effects of alcohol excise tax rate (adjusted by inflation) on alcohol-related disease mortality, New York State, 1969–2006

	Estimate	Std. Error	<i>t</i>	<i>p</i>	Lower CI ^a	Upper CI
Raw Frequency						
Real Tax Rate	−89.437	11.540	−7.75	<0.001	−112.120	−66.757
Per Capita Personal Inc	−5.270	0.597	−8.83	<0.001	−6.442	−4.096
NY Non-AR mortality	0.005	0.002	3.08	0.002	0.002	0.009
Other States AR Mortality ^b	0.019	0.004	5.09	<0.001	0.011	0.026
Rate per 100 k population						
Real Tax Rate	−0.827	0.129	−6.42	<0.001	−1.081	−0.574
Per Capita Personal Inc	−0.052	0.004	−12.98	<0.001	−0.059	−0.044
NY Non-AR mortality	0.004	0.002	2.58	0.010	0.001	0.007
Other States AR Mortality	0.663	0.066	10.06	<0.001	0.534	0.793
Elasticity (log-log model)						
Real Tax Rate	−0.072	0.001	−7.26	<0.001	−0.091	−0.052
Per Capita Personal Inc	−0.023	0.002	−14.06	<0.001	−0.026	−0.019
NY Non-AR mortality	0.002	0.001	2.55	0.010	0.0004	0.003
Other States AR Mortality	0.244	0.027	8.93	<0.001	0.190	0.298

AR, alcohol-related; real alcohol tax rate (\$ per gallon, adjusted for inflation); Per Capita Personal Income (\$1,000 per person); DFs=450.

^a95% Confidence.

^b49 US states plus DC and NYC.

Table 4

Effects of individual tax changes on alcohol-related disease mortality, New York State, 1969–2006

Beverage ^a	Effective Date	Estimate ^b	Std Error	<i>t</i>	<i>p</i>	Lower CL ^c	Upper CL
(+S)	FEB 1972 ^d	−0.04	0.05	−0.89	0.37	−0.129	0.048
(+B, +S, +W)	MAY 1983	−0.03	0.06	−0.49	0.62	−0.145	0.094
(+B, +S, +W)	JUL 1989	−0.08	0.06	−1.21	0.23	−0.204	0.049
(+B, +S)	JUN 1990	−0.17	0.06	−2.77	0.01	−0.292	−0.050
(−B)	JAN 1996	−0.01	0.04	−0.17	0.86	−0.093	0.078
(−B)	JAN 1999	0.02	0.05	0.41	0.68	−0.082	0.125
(−B)	APR 2001	−0.04	0.05	−0.69	0.48	−0.135	0.064
(−B)	SEP 2003	0.04	0.05	0.84	0.40	−0.060	0.149

^aParentheses indicate beverage-type (B=Beer, S=Spirits, W=Wine) and direction of tax.^bEstimates are adjusted for other states' AR mortality, NY non-AR mortality, and per capita personal income.^c95% confidence.^d95% CI: LL [−0.1004, p=0.0314], UL [−0.0199], p=0.6760] DFs=444.