Tobacco Control Programs and Tobacco Consumption

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The Centers for Disease Control and Prevention (CDC) believe that adequate funding of tobacco control programs by all 50 states would reduce the number of adults who smoke by promoting quitting, preventing young people from ever starting, reducing exposure to secondhand smoke, and eliminating disparities in tobacco use among population groups. CDC has established guidelines for comprehensive tobacco control programs, including recommended funding levels, in *Best Practices for Comprehensive Tobacco Control Programs* (CDC 1999; hereafter called *Best Practices*). Recommendations are based on best practices in nine program elements: community programs to reduce tobacco use, chronic disease programs to reduce the burden of tobacco-related diseases, school programs, enforcement, statewide programs, countermarketing, cessation programs, surveillance and evaluation, and administration and management. CDC recommends annual funding per capita to range from $7 to $20 in smaller states (population less than 3 million), $6–$17 in medium-sized states (population 3–7 million), and $5–$16 in larger states (population more than 7 million).

CDC (2002) estimates that total expenditures of $861.9 million in 2002 were allocated to tobacco control from national and state sources in the United Sates, or $3.16 per capita. Actual spending in all states was roughly 56 percent of the "lower-bound" or minimum *Best Practices* funding recommendation for that year, with only six states (Hawaii, Maine, Maryland, Minnesota, Mississippi, and Ohio) meeting or exceeding minimum recommendations, and 18 states providing less than 33 percent of recommended floors (CDC 1999). CDC

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called for more than $3 billion in additional tobacco control spending in each of 2001 and 2002 to meet minimum *Best Practices* recommendations.

This article examines whether state tobacco control programs lowered both adult tobacco consumption and youth smoking during 2001 and 2002 using newly available data published in CDC (2001, 2002) on expenditures of these programs. A secondary issue is whether or not divergence of actual funding from minimum *Best Practices* recommendations explains any of the differences between tobacco consumption in the states. That is, does the fact that a state funds above or below minimum levels indicate anything about tobacco consumption in that state relative to other states? The informational content of the *Best Practices* funding guidelines has not been previously examined. This study examines whether spending expansion along the lines of the *Best Practices* guidelines provides a useful benchmark based on past effectiveness of those programs in controlling tobacco consumption.

Previous Literature

Studies of the impact of tobacco control programs often focus on consumption changes following a particular policy event such as a new control program. Manley et al. (1997) concluded that per capita monthly sales fell in states participating in the ASSIST (American Stop Smoking Intervention Study) program relative to states not participating. Pierce et. al. (1998) reported that California control programs significantly lowered tobacco use. While these and other studies show falling tobacco use following implementation of new tobacco control programs, they fail to control for factors that may also cause consumption to fall. Tobacco control programs themselves therefore may or may not be causing observed declines in tobacco use and, even if in fact they do contribute, studies overstate impacts of control programs on tobacco use when they do not properly control for other contributing factors.

Three studies control for one or more factors outside of the tobacco control programs themselves. Hu, Sung, and Keeler (1995a) control for state excise taxes and tobacco firm media expenditures when concluding that state media expenditures, or counteradvertising, exert a negative impact on cigarette consumption. The authors measured tobacco control expenditures as "media placement expenditures" by the Tobacco Control Section of the California Department of Health Services and calculated that California spent almost $20 million over the 1980–93 study period. The authors suggest that

counteradvertising by tobacco control authorities may not be a particularly cost-effective method of lowering tobacco use because tobacco firms appear to effectively reverse this tobacco control policy through their own advertising. Hu, Sung, and Keeler (1995b) estimate that sales of cigarettes in California were reduced by 819 million packs from the third quarter of 1990 through the fourth quarter of 1992 owing to an additional 25-cent state tax increase, while the anti-smoking media campaign reduced cigarette sales by 232 million packs during the same period.

Farrelly, Pechacek, and Chaloupka (2003) examine the impact of state tobacco control expenditures on cigarette sales over 1981–2000 and conclude that increases in such expenditures lower per capita cigarette sales after controlling for excise taxes, smuggling, and other state-specific factors. The authors collected their own data from federal, state, and private funding sources and then considered three specifications for estimating effects of expenditures on cigarette consumption: contemporaneous, lagged annual, and cumulative. Lagged annual and cumulative specifications allow for past expenditures to affect current consumption. The authors concluded that past and current expenditures on tobacco control influence current tobacco use and, based on their empirical results, estimated that aggregate cigarette sales would have fallen by an additional 9 percent by year 2000 if states had spent at minimum funding levels associated with CDC's *Best Practices*. The authors did not directly examine the effectiveness of minimum *Best Practices* funding recommendations, but rather calculated the effect on consumption in their model if spending were to be increased to the minimum recommendation.

This literature survey suggests that examination of more recent data is an obvious avenue for further research since data collected in Farrelly, Pechacek, and Chaloupka (2003) ended in 2000. The authors report that real tobacco control expenditures averaged $1.22 in 2000, which is below the averages of $3.73 (2001) and $4.00 (2002) in the CDC data set used here. More recent tobacco control programs therefore appear more generously funded, reflecting perhaps greater use of tobacco settlement revenues, greater urgency on the part of public health authorities to control smoking, or measurement differences between data sets. A new research avenue concerns whether the *Best Practices* funding recommendations are useful targets for states to follow when allocating additional funds to their tobacco control programs. This article addresses that issue by examining whether states that fund closer to the *Best Practices* guidelines exert greater reduction in tobacco use than those programs that do not. If so, then it might be argued that the *Best Practices* guidelines offer

useful comparisons of how well various state programs are funded according to a valid benchmark.

Tobacco Control Funding and Expenditures

While four states (Arizona, California, Massachusetts, and Oregon) were early pioneers in tobacco control programs, most states have only recently been funding programs in a comprehensive effort aimed at lowering tobacco use (CDC 2001, 2002). Programs previously relied primarily on raising excise taxes to discourage tobacco use and this focus probably explains the extensive literature assessing price and tax elasticities of demand for tobacco. Laws on smoking in public places are another form of tobacco control program that vary considerably across states. The American Lung Association (2004) ranks states by laws ensuring smoke-free air and, in 2003, gave three states (California, Delaware, and New York) a grade of A, seven states a grade of B, four states a grade of C, and all other states a grade of F. Following Farrelly, Pechacek, and Chaloupka (2003), such laws can be considered a goal of tobacco control programs rather than a tool, thus allowing tobacco control expenditures to reflect a comprehensive array of tobacco control program characteristics. This assumption is applied to this study as well.

State spending on tobacco control programs comes from a variety of sources. In 2004, for instance, the Government Accounting Office (GAO 2004) reported that 46 states received more than $12 billion in tobacco settlement revenues (Master Settlement Agreement), and that the four states (Florida, Minnesota, Mississippi, and Texas) that settled independently with the tobacco industry also received substantial revenue. These funds included payments from tobacco companies and, for some states, revenues from the securitized proceeds of the sale of bonds backed by future payments made to them by tobacco companies. However, the Master Settlement Agreement does not in any way dictate how funds are to be allocated, although there was some perception that states would significantly expand funding of tobacco control programs. Recent evidence, however, indicates that many of these dollars have gone toward closing state government deficits and costs associated with general health care programs (Gross et al. 2002; Johnson 2004; Sloan et al. 2005). State governments also may fund tobacco control programs through general revenues and from revenues stemming from tobacco taxation. For instance, CDC (2002) reports that 12 states appropriated $13.6 million from general revenue to support tobacco control programs in 2002. More than $8 billion in fiscal year 2004 was collected in cigarette tax revenue in the

50 states and some of these dollars could also have been used to fund tobacco control programs (Orzechowski and Walker 2004). CDC (2002) estimates that state government investment in tobacco control for fiscal year 2002 totaled $774.7 million from tobacco settlement funds, state excise tax revenues, or general revenues.

Funding also comes from federal and private sources. Federal funding of state tobacco control programs includes CDC's Office on Smoking and Health that manages the National Tobacco Control Program, which provided $59 million during the 12 months ending in May 2002. The Health and Human Service's (HHS) Substance Abuse and Mental Health Services Administration (SAMHSA) provide substance abuse block grants that support state efforts as well. Private contributions to tobacco control programs come from such organizations like the Robert Wood Johnson Foundation and the American Medical Association.

Table 1 displays descriptive statistics of per capita funding estimates of tobacco control programs in 2001 and 2002. Data are available for all 50 states in 2001 and 48 states in 2002. Funding estimates in 2002 were not available at the time of publication of the data set for Arizona and Massachusetts. Average per capita funding was $3.73 in 2001 and $4.00 in 2002, with ranges of $0.10–$20.82 in 2001 and $0.33–$19.16 in 2002. *Best Practices* average minimum per capita funding was $7.13 in 2001 and 2002. Thus, on average, states were only roughly funding a little more than one-half of recommended minimums.[1] In 2001, only seven states (Indiana, Vermont, Mississippi, Arizona, Massachusetts, Maine, and Ohio) were at or above minimum prescriptions and, in 2002, six states (Minnesota, Maryland, Mississippi, Maine, Ohio, and Hawaii) met this floor.[2] In 2001, average (median) per capita "underfunding" was $4.05 ($4.22) and, in 2002, it was $4.66 ($5.18). The data therefore exhibit substantial variation in actual funding levels as well as variation from prescribed floors defined by CDC's *Best Practices*. For example, in 2002, Wyoming was farthest below its *Best Practices* floor: it spent $4.16 per

[1]The CDC (1999) *Best Practices* funding formula is based on experiences of California, Massachusetts, and other states with comprehensive programs, and is the sum of (1) countermarketing: $1.00–$3.00 per capita, (2) cessation (minimum): $1 per adult (screening) + $2 per smoker (brief counseling), and (3) cessation (covered programs): $1 per adult (screening) + $2 per smoker (brief counseling) + $13.75 per smoker (50 percent of program cost for 10 percent of smokers) + $27.50 per smoker (approximately 25 percent of smokers covered by state financed programs) + 10 percent of previous components for surveillance and evaluation + 5 percent of previous components for administration and management.

[2]However, the two missing states in 2002, Arizona and Massachusetts, did exceed their *Best Practices* minimums in the previous year.

TABLE 1

Descriptive Statistics
Tobacco Control Expenditures per Capita

	Actual 2001	Best Practices 2001	Actual 2002	Best Practices 2002
Average	$3.73	$7.13	$4.00	$7.13
Median	2.92	6.12	3.51	6.12
Minimum	0.10	4.87	0.33	4.81
Maximum	20.82	14.95	19.16	14.81
Std. Dev.	4.06	2.45	3.64	2.46
Sample Size	50	50	48	48

capita, or $10.65 below the $14.81 floor. Hawaii was farthest above its floor: it spent $19.16 per capita, or $10.33 above its floor of $8.83.

The funding data report CDC (2002) notes several limitations to this data collection. Reported amounts exclude appropriations for multiple purposes that included an unspecified amount of funding for tobacco control. State investments are based on appropriations, rather than expenditures, and the funding from national sources is based on award amounts. Expenditures may differ from appropriated or awarded amounts because of delays in implementation, program cuts, or the establishment of trusts or endowments. The report also does not evaluate whether funding was actually used to support components defined in CDC's *Best Practices.* Finally, the *Best Practices* guidelines do not disaggregate data to single out various components so it is impossible to determine relative effectiveness of counter-advertising expenditures versus counseling expenditures versus any other spending category. It is unlikely that all components offer identical influences on tobacco consumption on a per-dollar basis, but examining various possibilities is currently not an option with this data set.

Modeling the Effects of Tobacco Control Expenditures on Tobacco Use

Equation (1) estimates the effects of tobacco control programs on tobacco consumption, holding constant other factors that might contribute to changes in consumption. The dependent variable CIG_i is the number of tax-paid per capita cigarette sales (in packs) and is obtained from Orzechowski and Walker (2004). The log of CIG_i is

examined so that the price elasticity is directly estimated when the log of the price variable is included on the right-hand-side of the equation.

$$(1) \quad CIG_i = f(PRICE_i, SMUG_i, Y_i, UE_i, BA_i, MORMON_i, INDIAN_i, MILITARY_i, CONTROL_i)$$

$PRICE_i$ is the real ($2,002) price per package of cigarettes in cents, as reported in Orzechowski and Walker (2004), and is expected to be inversely related to cigarette consumption. The log of price is used because it allows direct calculation of the price elasticity of demand. Federal and state excise taxes were also considered in place of prices per pack but results using taxes are not reported here because their use did not alter results of the empirical work.

The dependent variable refers to legally sold cigarette packs whereby sellers collect excise taxes, but demanders also purchase cigarettes illegally smuggled across borders due to tax differentials. High-tax states are expected to lose some portion of total sales to neighboring states with lower tax rates and therefore taxed sales are too high in states from which cigarettes are bootlegged and too low in states to which cigarettes are smuggled. $SMUG_i$ controls for estimation bias and is defined as the ratio of the tax for a given state to the population-weighted average of taxes for bordering states. A simple average of tax rates of surrounding states was also calculated but did not provide significantly different results from the one using a population-weighted average. Values for Hawaii and Alaska are set to 1 because they do not border other states and so they are assumed to exhibit neither tax advantages nor disadvantages relative to other states. This ratio is hypothesized to carry a negative sign because higher values indicate greater incentives for that state's smokers to purchase from surrounding states offering lower taxes.

It is common to control for smuggling, and past studies have shown that smuggling is an important determinant of a state's cigarette demand. However, significance of variables that measure tax differentials of adjoining states is likely to diminish over time with rising Internet sales. Distance from seller clearly becomes a fading concern for buyers when they have access to low-tax cigarettes over the Internet. Many Internet merchants are located in low-tax states such as North Carolina, Virginia, and Kentucky, as well as on American Indian reservations that sell untaxed cigarettes, thus suggesting that tax differentials between bordering states will become less important in determining a state's cigarette sales (GAO 2002). It is expected then that over time smuggling variables based on cross-state border

measures will become less significant in empirical studies of the demand for cigarettes.

Y_i controls for income and is defined as the real ($2,002) median income of a four-person family as published by the U.S. Census. The sign on Y_i is ambiguous since, while cigarettes may be an income-elastic good that indicates a positive sign, higher income individuals may also smoke less if they exhibit greater health concerns over smoking, thus suggesting a negative sign. The sign is therefore an empirical question. The unemployment rate UE_i comes from the U.S. Bureau of Labor Statistics. The effect of unemployment rates on consumption is ambiguous because higher values may cause more smoking due to greater anxiety over job loss, or higher values may lead to reduced consumption due to fewer jobs. BA_i, the percentage of population aged 25 and over with a bachelor's degree or more, is obtained from the U. S. Census and controls for the expectation that consumption falls with education.

The percentage of the population that is Mormon, $MORMON_i$, controls for a population group that discourages smoking among its disciples and is therefore expected to exert a negative effect on consumption. This measure is obtained from data complied by Green (2004). $INDIAN_i$ is the percentage of population in 2003 of Native American descent and $MILITARY_i$ is the percentage of population in active military duty in 2002. Both variables control for availability of untaxed cigarettes in a state and are calculated from U.S. Census data. Both are expected to exert negative effects on cigarette consumption.

Finally, $CONTROL_i$ is the CDC-defined tobacco control expenditure per capita variable defined previously. Regressions were run with tobacco control expenditures as a percentage of gross state product as an alternative measure of the size of tobacco control programs and are not shown here because this substitution did not significantly change results. Farrelly, Pechacek, and Chaloupka (2003) found evidence of contemporaneous and lagged effects of tobacco control expenditures on cigarette consumption using data the authors themselves collected. CDC currently provides two years of data—2001 and 2002—and so the present examination is limited to a two-year time span. However, this study controls for past spending in the four states (Arizona, California, Massachusetts, and Oregon) known to have relatively long-lived and large control programs.[3] Examination is conducted on whether spending and tobacco consumption in these four

[3]Farrelly, Pechacek, and Chaloupka (2003) ran separate regressions on these four states along with their examinations of all states together.

states differ significantly from other states and will suggest whether lagged effects have led to significant reductions in tobacco use beyond those experienced by other states. A spending slope dummy is constructed using dichotomous variables that take the value of 1 for these four states and 0 otherwise, and allows for testing of differences experienced by these long-standing programs.

Table 2 displays summary statistics of all variables defined above for the two years of data.

TABLE 2

SUMMARY STATISTICS

	2001 Mean	2001 Std. Dev.	2002 Mean	2002 Std. Dev.
CIG	81.70	25.01	79.90	24.00
PRICE	358.00	37.80	393.00	56.40
SMUG	0.96	0.61	1.03	0.82
Y	56,752.97	7,532.66	58,633.58	7,707.34
UE	4.48	0.87	5.32	1.01
BA	24.93	4.31	26.00	4.52
MORMON	2.62	8.46	2.62	8.46
INDIAN	1.75	3.05	1.75	3.05
MILITARY	0.46	0.55	0.46	0.55
CONTROL	3.73	4.06	4.00	3.64

NOTES: Values for $MORMON_i$, $INDIAN_i$, and $MILITARY_i$, are the same for both years.

Estimates of the Effects of Tobacco Control Spending on Tobacco Sales

Table 3 displays ordinary least squares estimates of cigarette demand. Years 2001 and 2002 are pooled together yielding 98 observations in total, with two missing observations because Arizona and Massachusetts did not meet the reporting deadline for the CDC (2002) publication. The Chow test involving equality of coefficients of the two different (year) regressions indicated failure to reject the hypothesis of equal coefficients and so pooling of data is appropriate.

The first column shows that cigarette price exerts a significant and negative effect on per capita tobacco consumption with an estimated elasticity coefficient of -0.90 and is in line with the literature showing that the demand for tobacco is inelastic. The smuggling incentive variable exerts a negative and statistically significant effect on

TABLE 3

Effects of Tobacco Control Spending on Cigarette Sales per Capita

Explanatory Variables	(1)	(2)	(3)	(4)	(5)
Threshold Dummy			25 percent	50 percent	75 percent
Log(PRICE)	–0.903*	–0.830*	–0.716*	–0.859	–0.706*
	(3.85)	(3.75)	(2.57)	(3.20)	(2.60)
SMUG	–0.105*	–0.188*	–0.154*	–0.134*	–0.152*
	(3.05)	(3.64)	(3.44)	(3.13)	(3.48)
Y	–9.8E-07	–6.1E-07	–0.000	–3.2E-07	–0.000
	(0.33)	(0.33)	(0.60)	(0.10)	(0.45)
UE	–0.019	–0.014	–0.015	0.004	–0.011
	(0.80)	(0.46)	(0.58)	(0.18)	(0.39)
BA	–0.013**	–0.011***	–0.013***	–0.013**	–0.015**
	(2.32)	(1.97)	(1.96)	(2.06)	(2.42)
MORMON	–0.013*	–0.013*	–0.013*	–0.013*	–0.012*
	(5.11)	(5.38)	(5.00)	(5.46)	(5.00)
INDIAN	–0.012	–0.011	–0.013	–0.016***	–0.018***
	(1.56)	(1.42)	(1.51)	(1.90)	(1.99)
MILITARY	–0.060	–0.087**	–0.060	–0.082	–0.047
	(1.39)	(2.12)	(1.15)	(1.63)	(0.94)
TOBACCO CONTROL	0.002	0.005	0.010	0.033	0.037
	(0.79)	(0.85)	(0.65)	(1.62)	(1.40)
4-STATE DUMMY		–0.052*			
× TOBACCO CONTROL		(3.57)			

THRESHOLD DUMMY			0.049	0.207***	0.390**
			(0.60)	(1.95)	(2.19)
THRESHOLD DUMMY × TOBACCO CONTROL			0.027	0.006	−0.02
			(0.90)	(0.23)	(0.71)
INTERCEPT	10.38*	9.844*	9.290*	9.759*	8.874*
	(8.06)	(8.07)	(6.20)	(6.85)	(6.05)
Std. error of regression	0.2057	0.1932	0.207	0.186	0.194
Obs. below threshold			36	56	78
Observations	98	98	86	85	85
F-statistic	14.01	15.57	10.57	12.86	11.78
R^2 (adjusted)	0.55	0.60	0.55	0.61	0.58
Mean, dependent variable	4.35	4.35	4.36	4.35	4.35

NOTES: t-scores in parentheses; 2-tailed tests: *1 percent, **5 percent, ***10 percent.

consumption, thus supporting the hypothesis that a rise in a state's tax relative to bordering states lowers that state's sales of taxed cigarettes. Income and unemployment rates do not exert effects that are different from zero. Percentage of population with at least a bachelor's degree and percentage of population that is Mormon are estimated to exert negative effects on consumption. The percentage of population in active military and the percentage of population of Native American descent do not exert significant effects on taxed cigarette sales. Finally, per capita expenditure of tobacco control programs does not exert a statistically significant effect on tobacco sales thus conflicting with Farrelly, Pechacek, and Chaloupka (2003) which found contemporaneous and lagged expenditures exerting significant and negative effects on tobacco consumption over 1981–2000.

The second column estimates tobacco consumption and controls for the possibility that past control efforts of the four states (Arizona, California, Massachusetts, and Oregon) with long-standing tobacco control programs are an important determinant of current tobacco sales. The results indicate no changes in the control variables that were previously significant in estimates in column (1) except percentage of population in active military duty that now exerts a negative effect on consumption. The slope dummy for the tobacco control spending variable is significant and negative thus indicating that, while an additional dollar in the four states with long-standing programs lowers tobacco consumption, this effect does not exist in the other states as a group.

The final three columns of Table 3 display estimations of tobacco consumption that control for underfunding by state tobacco control programs to determine if divergence of actual funding from the *Best Practices* recommendations explains any of the variation in cigarette sales. Three dummies are constructed that qualitatively measure different thresholds of underfunding: 25 percent, 50 percent, and 75 percent. That is, the first dummy equals 1 if tobacco control funding is less than or equal to 25 percent of the *Best Practices* floor for that state. Similar dummies are defined for thresholds of 50 percent and 75 percent. The following numbers of observations meet the underfunding definitions: 36 at the 25 percent threshold, 56 at 50 percent, and 78 at 75 percent. Both intercept and tobacco control spending slope dummies are inserted into the basic equation in column (1). States that spend at or above the spending floors are excluded in these estimations to allow a focus on those states failing to meet funding floors. A separate regression was also run on the full data set that included slope and intercept dummies measuring whether or not a state was underfunded and, because neither slope nor

intercept dummies were statistically significant, this regression is not displayed here. The results of this separate regression indicate that simply achieving the spending floor does not provide an effect on consumption that differs from states failing to achieve their floors—both groups of states do not show any significant effect on consumption from their tobacco control spending.

The intercept dummy is significant and positive in the cases of thresholds of 50 percent and 75 percent, but spending slope dummies are never found to exert significant influences. States failing to meet these two thresholds have higher intercepts than other states thus indicating higher base levels of cigarette sales. However, states failing to meet thresholds do not exhibit any different relation between tobacco control spending and cigarette sales than states meeting thresholds. That is, there is no effect of tobacco control spending on consumption. Contrary to previous estimation, coefficients on Native American shares of the population are now significant and negative in equations with 50 percent and 75 percent thresholds. In sum, while there is evidence that underfunded states exhibit higher base levels of cigarette consumption, there is no evidence indicating that higher funding would exert effects on consumption that differ according to the degree to which they are underfunded.

Estimates of the Effects of Tobacco Control on Youth Smoking

The relationship between tobacco control spending and youth smoking is of great interest because youth smoking prevention is often cited as a vital component of any tobacco control program. Lowering youth smoking is believed to be key to lowering consumption by the same group when they become adults. The basic equation (1) is reestimated for 2002 with the same independent variables as before, but with the youth smoking rate as the dependent variable. CDC (2003) defines youth smoking as "current cigarette smoking" in grades 9–12, which occurs when students "smoked cigarettes on 1 or more of the 30 days preceding the survey." Data on youth smoking are available for 46 states in 2002. However, with one missing value for tobacco control program spending, there are 45 observations. Three specifications for tobacco control spending are considered: contemporaneous, contemporaneous and one lagged year separately, and contemporaneous and one lagged year combined. Unfortunately, control for whether the four states with longer-standing programs

exhibit significant differences from other states in their impact on youth smoking could not be conducted because of insufficient observations on these four states.

Table 4 displays three estimations utilizing the three different tobacco control spending specifications. The evidence indicates that four variables exert significant effects on youth smoking: smuggling

TABLE 4

EFFECTS OF TOBACCO CONTROL SPENDING ON YOUTH SMOKING

Explanatory Variables	(1)	(2)	(3)
PRICE	–0.100	–0.010	–0.010
	(0.76)	(0.73)	(0.77)
SMUG	–0.630***	–1.630***	–1.628***
	(1.85)	(1.82)	(1.85)
Y	–.0002	–.0001	–.001
	(1.65)	(1.62)	(1.65)
UE	–0.288	–0.304	–0.297
	(0.39)	(0.40)	(0.42)
BA	–0.356**	–0.356**	–0.356**
	(2.08)	(2.04)	(2.08)
MORMON	–0.300*	–0.300*	–0.300*
	(4.39)	(4.32)	(4.39)
INDIAN	0.501*	0.497**	0.498**
	(2.18)	(2.10)	(2.19)
MILITARY	–0.933	–0.843	–0.869
	(0.68)	(0.51)	(0.70)
CONTEMPORANEOUS TOBACCO CONTROL	0.041	0.012	
	(0.20)	(0.03)	
LAGGED TOBACCO CONTROL		0.027	
		(0.10)	
CONTEMPORANEOUS & LAGGED TOBACCO CONTROL			0.020
			(0.22)
INTERCEPT	55.39*	53.38*	55.37*
	(7.55)	(7.43)	(7.54)
Std. error of regression	3.959	4.017	3.959
Observations	45	45	45
F-statistic	5.60	4.90	5.60
R^2 (adjusted)	0.48	0.47	0.48
Mean, dependent variable	30.29	30.29	30.29

NOTES: t-scores in parentheses; 2-tailed tests: *1 percent, **5 percent, ***10 percent.

incentives (negative sign), percent of population with bachelor's degree (negative sign), that are Mormon (negative sign), and of Native American descent (positive sign). Cigarette price, income, unemployment, percent of population on active duty, and all tobacco control spending specifications never exert effects statistically different from zero, thus indicating no evidence that spending on tobacco control programs leads to lower youth smoking. These results support the earlier empirical evidence that tobacco control programs do not influence taxed cigarette sales.

Table 5 examines whether extent to which underfunding exists explains any of the variation of youth smoking by including above-discussed thresholds of 25 percent, 50 percent, and 75 percent to the youth smoking equation. Only the specification with the contemporaneous spending on tobacco control variable is displayed because estimations with lagged spending do not exhibit any significant differences. The following numbers of observations meet the underfunding definitions: 17 at the 25 percent threshold, 25 at 50 percent, and 38 at 75 percent. Both intercept and spending on tobacco control slope dummies are again considered.

The results indicate that the underfunding status of state spending programs do not explain any of the variation in youth smoking between states. However, the Native American variable is no longer significant in any of the three estimations (was positive and significant in Table 4). Smuggling, real income, education, and Mormon variables are significant and negative in all estimations. In sum, underfunding status does not explain any of the variation between youth smoking in the states.

Conclusion

This article finds little or no evidence that tobacco control spending exerted significant effects on overall cigarette sales or youth smoking in 2001 and 2002, and this evidence is not influenced by the degree to which states diverge from the CDC *Best Practices* guidelines. The CDC's guidelines, therefore, do not appear to indicate productive benchmarks for states on whether to expand funding of tobacco control programs.

Why might these results conflict with previous research? Previous examination focused on cross-sectional and time series data, while the present study examines two adjoining years (2001 and 2002) of cross-sectional data. Other than possible differences in data collection methods, differences in time periods may be contributing to the different conclusions. CDC (2004) estimates that adult smoking

TABLE 5

EFFECTS OF TOBACCO CONTROL SPENDING WITH THRESHOLDS ON YOUTH SMOKING

Explanatory Variables	(1)	(2)	(3)
Threshold Dummy	25 percent	50 percent	75 percent
PRICE	0.010	0.010	0.020
	(0.65)	(0.60)	(0.93)
SMUG	–3.140**	–3.616**	–3.568**
	(2.19)	(2.54)	(2.35)
Y	–0.0002***	–0.0002***	–0.0002***
	–1.720	–2.050	–1.730
UE	–0.550	0.011	–0.723
	(0.65)	(0.01)	(0.75)
BA	–0.587*	–0.573*	–0.614*
	(3.06)	(2.99)	(3.14)
MORMON	–0.273*	–0.277*	–0.262*
	(3.99)	(4.09)	(3.76)
INDIAN	0.108	0.242	0.149
	(0.37)	(0.80)	(0.51)
MILITARY	1.747	0.902	2.181
	(0.85)	(0.41)	(1.00)
CONTEMPORANEOUS TOBACCO CONTROL	0.617	0.632	0.161
	(1.45)	(1.39)	(0.25)
THRESHOLD DUMMY	2.823	3.003	–0.118
	(1.23)	(1.14)	(0.24)
THRESHOLD DUMMY × TOBACCO CONTROL	–0.879	–0.173	–0.100
	(1.25)	(0.27)	(0.14)
INTERCEPT	53.40*	51.79*	56.77*
	(7.18)	(6.85)	(6.42)
Obs. below threshold	17	25	38
Std. error of regression	3.812	3.795	3.914
Observations	39	39	39
F-statistic	5.32	5.39	4.92
R^2 (adjusted)	0.55	0.56	0.53
Mean, dependent variable	30.51	30.51	30.51

NOTES: t-scores in parentheses; 2-tailed tests: *1 percent, **5 percent, ***10 percent.

prevalence declined from 33.2 percent in 1980 to 22.5 percent in 2002. A potential problem with examining time series data is that a portion of the fall in tobacco consumption is probably due to heightened health concerns of the public over smoking that are unrelated to tobacco control programs in place. It is clearly difficult to separate effects

from growing health concerns that are unrelated to tobacco control programs from those related to tobacco control programs, and perhaps previous examination of time series data overestimated effects from the latter on cigarette consumption. The present study is probably little affected by this issue because it is unlikely that significant changes in health concerns took place between 2001 and 2002.

It has also been assumed that tobacco control spending is exogenous in both this study and past studies, but spending decisions may be influenced by factors that also influence tobacco consumption.[4] For example, numbers of smokers or tobacco-related jobs may influence state spending in ways similar to research showing that probabilities that states pass laws prohibiting smoking in public places are influenced by those same factors.[5] A potential endogeneity problem arises if states with relatively rapid declines in tobacco consumption are also more likely to fund tobacco control programs more generously than other states. An inverse relationship between tobacco control spending and tobacco consumption may then simply mean that states characterized by greater distaste toward smoking also spend more on tobacco control programs than other states. This possibility is suggested in this article because the four states with long-standing tobacco control programs are also states that have experienced decreased cigarette sales and rising spending on tobacco control. Of course, it is also possible that this inverse relationship might indicate that spending more on tobacco control leads to lower tobacco consumption. Testing of these competing hypotheses regarding causality is clearly critical to our understanding of how tobacco control programs influence tobacco use and would appear to be a productive area for future research.

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[4]Gross et al. (2002) and Marlow (2006) conclude that state spending on tobacco control is unrelated to smoking prevalence. That is, holding other relevant factors constant, states with higher smoking prevalence do not spend more on tobacco control than states with lower prevalence. These findings would appear consistent with the results of the present article that finds no systematic effect of state spending on smoking prevalence.

[5]Dunham and Marlow (2000) find that state smoking laws are influenced by whether or not a state has a significant tobacco presence, and Hersch, Del Rossi, and Viscusi (2004) find that state smoking laws are responsive to voter preferences.

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