

Impact of tobacco control spending and tobacco control policies on adolescents' attitudes and beliefs about cigarette smoking

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Abstract: While much is known about the impact of tobacco control policies on youth cigarette demand, very little is known about the impact of tobacco control policies on youth's attitudes and beliefs toward smoking. This paper is the first econometric study to examine the impact of state-level tobacco control spending, youth access laws, clean indoor air laws and cigarette prices on adolescents' attitudes and beliefs about cigarette smoking. The data for this study were extracted from the 1991–2000 nationally representative surveys of 8th-, 10th- and 12th-grade students as part of the Monitoring the Future Project. Weighted probit equations were employed to estimate the attitudes and beliefs equations. The results clearly indicate that increased state spending on tobacco control, stronger clean indoor air laws and youth access laws and higher cigarette prices are effective in changing youth's attitudes and beliefs toward smoking.

Keywords: tobacco, policy, attitudes, beliefs, cigarette, smoking

Introduction

The health implications of cigarette smoking have been the subject of intensive investigation since the early 1950s. There has been a tremendous expansion in scientific knowledge of the health hazards of cigarette smoking throughout this period. In particular, cigarette smoking has been causally linked to coronary heart disease and atherosclerosis, stroke and chronic obstructive pulmonary disease, as well as cancers of the lung, larynx, oesophagus, mouth and bladder (USDHHS 1989). In addition, smoking is known to contribute to the development of cancers of the pancreas, cervix and kidney and has been linked to other conditions that constitute an extensive array of serious health consequences (USDHHS 1989).

Despite the deleterious health effects of cigarette smoking, approximately 46.5 million adults in the United States aged 18 years and over were current smokers in 2000, representing nearly one-quarter (23.3%) of the total US adult population (CDC 2002a). Even more troubling, however, is that nationally representative surveys imply that each day approximately 6000 adolescents in the United States aged 12–17 years try their first cigarette (CDC 1998). Moreover, estimates imply that 3000 persons aged less than 18 years become daily smokers each day (CDC 1998). Since many adolescent smokers continue to use tobacco products as adults, the prevention of smoking in adolescence remains an important public policy challenge into the 21st century.

The public health campaign to reduce tobacco-related death and disease in the United States began in the mid-1960s following the release of the first Surgeon General's report, which causally linked cigarette smoking to lung cancer and a host of other detrimental diseases. While consumer education and information dissemination were the mainstays early in the campaign against tobacco, the arena shifted to public policy interventions in more recent years. By the 1980s, both state and federal governments began increasing cigarette excise taxes, imposing restrictions on smoking in public places, and imposing restrictions on children's access to cigarettes in an attempt to curtail smoking among the American people. Over the past 15 years, state governments developed and implemented comprehensive tobacco control programmes in an effort to reduce the disease, disability and death that result from tobacco.

Many of the longest-standing state programmes are funded by state and other tobacco excise tax revenues earmarked for tobacco control. The first major comprehensive state programmes resulted from ballot initiatives that increased state cigarette and other tobacco product excise taxes and earmarked much of the new revenues generated by the tax increases for tobacco control. In 1988, voters in California created the first comprehensive

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state programme by passing Proposition 99, which raised the cigarette tax by 25 cents per pack. In 1992, voters in Massachusetts followed suit by passing the Question 1 referendum, raising the cigarette tax by 25 cents per pack. Several states followed the lead of California and Massachusetts by using ballot initiatives to raise tobacco excise taxes and fund comprehensive programmes. Other states created an earmarked excise tax-funded programme legislatively. Most recently, in November 2001, voters in the state of Washington overwhelmingly adopted a 60-cent increase in the state cigarette excise tax, with a significant portion of the new revenues earmarked for a comprehensive state programme.

Other state tobacco control programmes are funded by individual state settlements with cigarette companies or by the funds states receive through the Master Settlement Agreement (MSA) with the tobacco industry. In 2002, the four states that settled individually – Mississippi, Texas, Florida and Minnesota – spent a portion of their settlement funds on state tobacco control programmes (CDC 2002b). Similarly, in 2002, 38 of the states that were a part of the MSA had set aside some of their settlement funds for a tobacco control programme.¹

Several national programmes have also contributed significant resources to state efforts to reduce tobacco use. The first major effort was the Americans' Stop Smoking Intervention Study programme (ASSIST), a partnership between the National Cancer Institute (NCI) and the American Cancer Society (ACS) that supported state-based coalitions focused on changing tobacco control policies in 17 states during the period from 1991 through 1998. During the same period, the Centers for Disease Control and Prevention (CDC) funded the remaining states (excluding California) and the District of Columbia under its Initiatives to Mobilize for the Prevention and Control of Tobacco Use (IMPACT) programme. In 1999, these two programmes were replaced by the CDC-funded National Tobacco Control Program that supports tobacco control efforts in all 50 states, the District of Columbia, and seven territories (USDHHS 2000). Since 1994, the Robert Wood Johnson Foundation's SmokeLess States programme has also funded tobacco control coalitions in numerous states (currently 42). This programme, which is administered by the American Medical Association, emphasises strengthening state tobacco control policies.

Overall, CDC estimates that state investment in tobacco control efforts was US\$861.9 million, or \$3.16 per capita, in the 2002 fiscal year (CDC 2002b).² Although considerably

higher than it was even a few years ago, the investment in most states is well below the level CDC recommends as the minimum needed to support a comprehensive tobacco control programme (CDC 1999, 2002b). In its initial Best Practices guidelines released in 1999, CDC recommended a minimum average per capita spending of \$5.98 for the United States, with the state levels ranging from a low of \$5.12 in California to a high of \$15.39 in Wyoming (CDC 1999). On average, the CDC upper estimate was nearly three times as high, at \$15.85 per capita for the United States. Moreover, as of 2002, funding in 18 states was one-third, or less, of the minimum recommended by CDC; only six states had reached the minimum level of funding (CDC 2003). However, recent economic conditions and consequent state budget problems have resulted in either the elimination of, or significant reductions in, funding for many state tobacco control programmes.

By comparison, total marketing expenditures for the five major US cigarette companies in 2001 (the latest year available) were \$11.2 billion, more than 13 times the total investment in state tobacco control efforts (FTC 2003). The 2001 marketing expenditures were a record high for these companies and represented a 66.6% increase from spending in 1998.

While a significant amount of economic research has investigated the impact of tobacco control policies on youth and young adult cigarette demand and a significant amount of psychosocial research has investigated the impact of youth's attitudes and beliefs on smoking status, to our knowledge, no research has examined the role of tobacco control policies on changing adolescents' attitudes and beliefs about tobacco. This paper attempts to fill that void by providing the first econometric analysis of the impact of state-level tobacco control expenditures, youth access laws, clean indoor air laws, cigarette prices, and socioeconomic and demographic characteristics on adolescents' perceptions about cigarette smoking.

Brief literature overview

Numerous psychosocial papers on the impact of adolescents' attitudes and beliefs about cigarette smoking have been published over the past several decades. Many of these studies have concluded that adolescents' beliefs about smoking are strong predictors of adolescent smoking status and smoking onset. These beliefs include perceived health consequences of smoking (Wang et al 1995; Flay et al 1998; Steptoe et al 2002), perceived social approval (Collins et al 1987; Wang et al 1995; Flay et al 1998), perceived smoking

prevalence (Collins et al 1987; Flay et al 1998), perceived perception of smokers (Norman and Tedeschi 1989; Dinh et al 1995), perceived commitment not to smoke (Pierce et al 1996; Unger et al 1997; Flay et al 1998), perceived benefits of smoking (Wang et al 1995) and various others.

Similarly, a significant amount of economic research has concluded that tobacco control policies are strong predictors of adolescent smoking status and smoking onset. Numerous studies have concluded that cigarette price increases and cigarette excise increases decrease youth and young adult smoking prevalence and average daily consumption (Lewit et al 1981; Chaloupka and Grossman 1996; Chaloupka and Wechsler 1997; Chaloupka and Pacula 1998; Harris and Chan 1999; Tauras and Chaloupka 1999; Ross and Chaloupka 2003). A few recent studies have concluded that cigarette prices are very important determinants of adolescent smoking initiation (Tauras et al 2001; Cawley et al 2003, 2004). Other studies have found an inverse relationship between adolescent smoking and youth access laws (Jason et al 1991; Chaloupka and Pacula 1998). Moreover, several studies have found more stringent clean indoor air legislation to decrease smoking among young adults (Chaloupka and Wechsler 1997; Tauras and Chaloupka 1999). Finally, Tauras et al (forthcoming) found state-level tobacco control spending to decrease both the propensity to smoke and the intensity with which youths smoke.

To summarise, much has been learned about the impact of tobacco control policies and adolescents' attitudes and beliefs on the demand for cigarettes among youth. However, no study to date has examined the role of tobacco control policies on youth's attitudes and beliefs toward smoking. In this paper, we examine the impact of state-level tobacco control expenditures, youth access laws, clean indoor air laws, cigarette prices, and socioeconomic and demographic characteristics on adolescents' attitudes and beliefs about cigarette smoking.

Data and methods

The data for this study are taken from the 1991–2000 surveys of 8th-, 10th- and 12th-grade students conducted by the Institute for Social Research at the University of Michigan as part of the Monitoring the Future (MTF) Project (Johnston et al 2001). MTF has conducted nationally representative surveys of between 15 000 and 19 000 high school seniors each year since 1975, and of similar numbers of 8th- and 10th-grade students since 1991. These surveys focus on the use of alcohol, tobacco and illicit drugs among youth and young adults and related attitudes and beliefs. Given the

nature of the data being collected, extensive efforts are made by MTF to ensure that the data collected are accurate and informative. For example, students are assured of confidentiality, and all questionnaires are administered by trained University of Michigan interviewers.

Because many questions are required to cover all the topic areas, the MTF questionnaire content was divided into six different questionnaire forms for high school seniors and distributed to participants in a way that ensures six virtually identical random subsamples. The 8th- and 10th-grade questionnaire content was divided into two different questionnaires between the years 1991 and 1996, expanding to four forms in 1997. Many of the questions dealing with attitudes and beliefs about cigarette smoking are form specific and are not answered by all individuals. Therefore, all the tables in this paper list the sample sizes upon which the regressions and simulations are based.

Twelve dependent variables on attitudes and beliefs about smoking are examined in this paper. The first, 'great risk', is a dichotomous indicator equal to one for youths who agreed that there is great risk in smoking one or more packs of cigarettes per day; otherwise, it is equal to zero. The second, 'bad judgement', is a dichotomous indicator equal to one for youths who agreed that becoming a smoker reflects bad judgement; otherwise, it is equal to zero. The third, 'dirty habit', is a dichotomous indicator equal to one for youths who agreed that smoking is a dirty habit; otherwise, it is equal to zero. The fourth, 'disapprove adult smoking', is a dichotomous indicator equal to one for youths who strongly disapproved of adults smoking one or more packs of cigarettes per day; otherwise, it is equal to zero. The fifth, 'public smoking ban', is a dichotomous indicator equal to one for youths who believed adults should be prohibited from smoking in certain public places; otherwise, it is equal to zero. The sixth, 'prefer to date nonsmokers', is a dichotomous indicator equal to one for youths who agreed that they prefer to date nonsmokers; otherwise, it is equal to zero. Our a priori expectation was for tobacco control policies to have a positive and significant impact on the aforementioned six dependent variables.

On the contrary, we surmised an inverse relationship to exist between the ensuing six dependent variables and the tobacco control policy variables. The seventh dependent variable, 'harm exaggerated', is a dichotomous indicator equal to one for youths who agreed that the harmful effects of cigarettes have been exaggerated; otherwise, it is equal to zero. The eighth, 'smokers enjoy life', is a dichotomous indicator equal to one for youths who agreed that smokers

know how to enjoy life more than nonsmokers; otherwise, it is equal to zero. The ninth, 'smoke 1+ packs daily and quit', is a dichotomous indicator equal to one for youths who agreed that they could smoke a pack of cigarettes a day for a year and still be able to quit; otherwise, it is equal to zero. The tenth, 'smoking is not dangerous – you can quit', is a dichotomous indicator equal to one for youths who agreed that smoking is not dangerous because individuals can always quit later; otherwise, it is equal to zero. The eleventh, 'easy access', is a dichotomous indicator equal to one for youths who believed it is very easy to obtain cigarettes; otherwise, it is equal to zero. Finally, the twelfth dependent variable, 'don't mind being near smokers', is a dichotomous indicator equal to one for youths who agreed that they don't mind being around people who are smoking; otherwise, it is equal to zero.

Using the survey data, we constructed several independent variables to control for other factors thought likely to affect smoking attitudes and beliefs. These were as follows: the age of the respondent in years; the age of the respondent in years squared; gender (male and female – reference category); average earned weekly income in 1982–1984 dollars; average income from other sources in 1982–1984 dollars; separate indicators for youths surveyed in 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999 and 2000 – reference category; separate indicators for respondents surveyed in the 8th grade, 10th grade and 12th grade – reference category; indicators of race/ethnicity (black, Hispanic, Asian, Native American, other race and Caucasian – reference category); and indicators of parental education for mother and father separately (less than high school graduate, at least some college, and high school graduate – reference category).

Tobacco control expenditures

Using state identifiers, a variable reflecting inflation-adjusted per capita expenditures on tobacco control was merged with the survey data. This variable was obtained from Matthew Farrelly and colleagues at the Research Triangle Institute and was derived by combining real per capita state-specific excise tax funding and other state-appropriated funds earmarked for tobacco control programmes with real per capita nongovernmental state-level expenditures and per capita tobacco control expenditures from the following national programmes: Americans' Stop Smoking Intervention Study programme, Initiatives to Mobilize for the Prevention and Control of Tobacco Use, SmokeLess States and the National Tobacco Control Program. Unfortunately, no

information is available on what types of tobacco control interventions each programme utilises and how much is spent on each intervention. Thus, the overall real per capita state tobacco control expenditure variable reflects total resources allocated toward tobacco control in each state.

Clean indoor air laws

Using state identifiers, we merged a clean indoor air index variable with the survey data. This variable was obtained from Gary Giovino and colleagues at the Roswell Park Cancer Institute. Nine separate restrictions make up the index variable: restrictions on smoking in private worksites, restaurants, recreational facilities, shopping malls, health facilities, public transit facilities, cultural facilities, public schools and private schools. These restrictions take on a value between 0 and 5 depending on the strength of the regulation. The index is derived by adding up the restriction ratings for each of the nine restrictions, giving additional weight to restrictions on smoking in places more likely to be frequented by youth, including restaurants, recreational facilities, cultural facilities, shopping malls, private schools and public schools.

Youth access laws

On the basis of state identifiers, we merged a youth access index with the survey data. This index is based on the measure developed by Alciati and associates (1998) for the NCI. The index captures the extensiveness and comprehensiveness of state policies aimed at reducing youth access to tobacco products. Nine separate restrictions constitute the youth access index variable: minimum age of purchase, packaging, clerk intervention, photo identification, vending machine availability, free distribution of samples, graduated penalties, random inspections and state-wide enforcement. Each of these restrictions takes on a value of either 0–4 or 0–5, depending on the strength of the regulation. The youth access index is derived by summing up the restriction ratings for each of the nine restrictions.

Cigarette prices

According to the state in which each youth's school was located, we also merged cigarette prices with the survey data. We obtained price data from the annual *Tax Burden on Tobacco*. Until 1999, the Tobacco Institute published state-level cigarette prices as of 1 November. Since then, Orzechowski and Walker (2001) have published the data. These prices are weighted averages for a pack of 20 cigarettes and are inclusive of state-level excise taxes applied to

cigarettes. Because the price published is as of 1 November and the surveys are conducted between February and June of each year, we created a weighted average price for the first 6 months of each year, assuming a linear trend in the net-of-tax price and adjusting for state and federal cigarette excise tax changes. To account for changes in the relative price of cigarettes over time, all cigarette prices are deflated by the national Consumer Price Index published by the Bureau of Labor Statistics (2003) (1982–1984 = 100).

Tobacco-producing state indicator

It is possible that unobserved state sentiment toward smoking may affect both attitudes toward smoking and tobacco control policy enactment. To control for this possibility, a dichotomous indicator for whether the respondent resided in a tobacco-producing state when the surveys were conducted was included in the models. This indicator takes on a value of one if the individual resided in Kentucky, North Carolina, Georgia, South Carolina, Tennessee or Virginia, and zero otherwise.

Empirical methods

Given the limited nature of the dependent variables, ordinary least squares techniques are not appropriate. Instead, we used probit methods to estimate the attitudes and beliefs equations. The probit methods employ weights to account for differential sampling probabilities. In addition, the attitudes and beliefs equations employ Huber's (1967) algorithm for obtaining robust standard errors.

Table 1 contains the regression estimates for the dependent variables that are expected to be positively related to the tobacco control variables. Table 2 contains the regression estimates for the dependent variables that are expected to be inversely related to the tobacco control variables. The same set of independent variables is included in all equations: real per capita tobacco control expenditures; clean indoor air index; youth access index; real average price of cigarettes; tobacco-producing state indicator; and a variety of demographic and socioeconomic variables including age, age squared, gender, race, parental education, real earned income, real income from other sources, dummy variables for each year in the sample excluding one, and dummy variables for grade level of respondent excluding one. In addition, indicators for respondents with missing data for race, parental education and income are included in the models. These missing value indicators were created to prevent the loss of a large number of observations. For example, if the mother's education is unknown, each of the

mother's education variables take on a value of zero, while an additional indicator, unknown mother's education, takes on a value of one. This missing value indicator takes on a value of zero for all respondents whose mother's education is known.

Results

Tobacco control expenditures

In general, the results for the real state-level tobacco control spending variable conform to our a priori expectations. That is, a positive and significant relationship is found between tobacco control spending and the following dependent variables: great risk; bad judgement; dirty habit; disapprove adult smoking; and prefer to date nonsmoker. Similarly, a negative and significant relationship is found between tobacco control spending and the following dependent variables: smokers enjoy life; easy access; and don't mind being near smokers. The tobacco control expenditure variable fails to reach statistical significance at conventional levels for the remaining four dependent variables.

Clean indoor air laws

A positive relationship is found between smoke-free air laws and all the attitudes and beliefs expected to be positively related to stronger tobacco control policies. However, the smoke-free air index is statistically significant at the 5% level of a two-tailed test only when the great risk and disapprove adults smoking outcomes are examined. With respect to the outcomes that are expected to be negatively related to stronger tobacco control policies, the smoke-free air index is found to have a negative and significant impact on the harm exaggerated, smokers enjoy life, easy access, and don't mind being near smokers outcomes. Smoke-free air laws are found to be insignificant determinants of the smoke 1+ packs daily and quit and smoking is not dangerous – you can quit outcomes.

Youth access laws

With the exception of the public smoking ban outcome where the youth access index is not significantly different from zero, stronger youth access laws are found to have a positive and significant impact on all the outcomes expected to be positively related to stronger tobacco control policies. In contrast, stronger youth access laws are found to have a negative and significant impact on only the don't mind being near smokers outcome. The youth access index fails to reach conventional significance levels for the other outcomes

Table 1 Smoking attitudes and beliefs expected to be positively related to tobacco control policies

<i>Variables</i>	<i>Great risk</i>	<i>Bad judgement</i>	<i>Dirty habit</i>	<i>Disapprove adults smoking</i>	<i>Public smoking ban</i>	<i>Prefer to date nonsmoker</i>
Tobacco control spending	0.029 (13.94)	0.022 (6.70)	0.023 (6.68)	0.031 (6.51)	0.013 (1.53)	0.033 (9.50)
Smoke-free air index	0.004 (11.03)	0.001 (1.61)	0.001 (1.06)	0.003 (3.74)	0.000 (0.13)	0.000 (0.41)
Youth access index	0.002 (4.26)	0.004 (6.87)	0.004 (6.86)	0.004 (4.42)	0.000 (0.15)	0.006 (8.97)
Real price of cigarettes	0.001 (7.91)	0.000 (0.29)	0.000 (0.40)	0.001 (1.40)	0.002 (2.00)	0.000 (-0.33)
Tobacco-producing state	-0.004 (-0.47)	-0.006 (-0.50)	-0.016 (-1.29)	-0.076 (-4.22)	0.022 (0.68)	-0.051 (-3.98)
Age	0.082 (2.61)	-0.159 (-2.75)	-0.138 (-2.39)	-0.145 (-0.65)	0.590 (1.41)	-0.157 (-2.65)
Age squared	-0.003 (-2.97)	0.005 (2.46)	0.004 (2.15)	0.005 (0.77)	-0.018 (-1.50)	0.003 (1.66)
Male	-0.168 (-35.98)	0.053 (7.03)	-0.064 (-8.53)	-0.040 (-3.75)	-0.102 (-5.27)	0.091 (11.90)
Black	0.147 (19.92)	0.215 (17.38)	0.124 (9.95)	0.446 (27.36)	0.228 (7.58)	0.214 (16.83)
Hispanic	0.082 (9.91)	0.063 (4.58)	-0.030 (-2.17)	0.213 (10.76)	0.107 (3.01)	0.131 (9.29)
Asian	0.142 (11.10)	0.074 (3.69)	0.071 (3.54)	0.371 (13.74)	0.199 (3.87)	0.188 (8.95)
Native American	-0.073 (-4.23)	-0.020 (-0.71)	-0.045 (-1.66)	-0.103 (-1.92)	-0.093 (-1.01)	-0.152 (-5.59)
Other race	0.038 (3.49)	0.014 (0.80)	0.006 (0.34)	0.206 (7.28)	0.073 (1.46)	-0.020 (-1.14)
Father less than high school	-0.066 (-7.83)	-0.057 (-4.01)	-0.061 (-4.36)	-0.015 (-0.78)	0.041 (1.19)	-0.110 (-7.84)
Father college graduate	0.108 (18.15)	0.082 (8.43)	0.055 (5.69)	0.085 (6.33)	0.049 (2.02)	0.106 (10.88)
Mother less than high school	-0.069 (-8.10)	-0.016 (-1.10)	-0.024 (-1.71)	0.024 (1.25)	0.077 (2.19)	-0.062 (-4.39)
Mother college graduate	0.078 (13.76)	0.027 (2.91)	0.010 (1.10)	0.018 (1.44)	0.038 (1.67)	0.065 (7.01)
Income from work	-0.002 (-16.00)	-0.002 (-10.81)	-0.002 (-11.50)	-0.002 (-11.66)	-0.002 (-6.90)	-0.003 (-19.02)
Income from other sources	-0.003 (-15.90)	-0.003 (-12.20)	-0.004 (-15.69)	-0.003 (-8.24)	-0.003 (-4.31)	-0.005 (-20.21)
Grade 8	-0.402 (-26.17)	-0.004 (-0.15)	-0.055 (-2.05)	-	-	-0.169 (-6.17)
Grade 10	-0.182 (-17.72)	-0.110 (-5.51)	-0.098 (-4.95)	-	-	-0.090 (-4.48)
1991	-0.114 (-7.77)	0.091 (3.90)	0.067 (2.87)	0.148 (4.40)	0.104 (1.71)	0.128 (5.39)
1992	-0.138 (-9.84)	0.124 (5.54)	0.100 (4.48)	0.161 (4.97)	0.153 (2.59)	0.111 (4.86)
1993	-0.099 (-6.65)	0.076 (3.17)	0.054 (2.29)	0.129 (3.73)	0.123 (1.96)	0.073 (3.02)
1994	-0.157 (-10.16)	0.018 (0.74)	-0.010 (-0.41)	0.054 (1.48)	0.163 (2.49)	-0.003 (-0.11)
1995	-0.208 (-13.25)	0.004 (0.15)	-0.013 (-0.54)	-0.037 (-1.00)	0.111 (1.67)	-0.024 (-0.93)
1996	-0.184 (-11.69)	-0.040 (-1.58)	-0.050 (-2.00)	-0.033 (-0.88)	0.076 (1.12)	-0.105 (-4.16)
1997	-0.154 (-10.01)	-0.065 (-2.63)	-0.071 (-2.90)	-0.067 (-1.84)	0.006 (0.09)	-0.113 (-4.59)
1998	-0.127 (-9.01)	-0.043 (-1.88)	-0.044 (-1.96)	-0.062 (-1.87)	-0.011 (-0.19)	-0.064 (-2.81)
1999	-0.067 (-5.81)	-0.003 (-0.16)	-0.006 (-0.34)	-0.019 (-0.71)	-0.016 (-0.32)	-0.027 (-1.51)

NOTE: All equations also include an intercept and missing value indicators for race, parental education and income. Z-statistics are in parentheses. The critical values for the z-statistics are 2.58 (2.33), 1.96 (1.64), 1.64 (1.28) at the 1%, 5% and 10% significance levels, respectively, based on a two-tailed (one-tailed) test. Questions regarding the disapprove adults smoking and public smoking ban were asked only of 12th-grade students. The sample sizes for the great risk, bad judgement, dirty habit, disapprove adult smoking, public smoking ban, and prefer to date nonsmoker outcomes are 434844, 160778, 160454, 87515, 24111 and 162272.

Table 2 Smoking attitudes and beliefs expected to be negatively related to tobacco control policies

<i>Variables</i>	<i>Harm exaggerated</i>	<i>Smokers enjoy life</i>	<i>Smoke 1+ packs daily and quit</i>	<i>Smoking is not dangerous – you can quit</i>	<i>Easy access</i>	<i>Don't mind being near smokers</i>
Tobacco control spending	0.003 (0.60)	-0.013 (-1.97)	-0.011 (-1.47)	0.005 (0.47)	-0.019 (-7.41)	-0.029 (-7.09)
Smoke-free air index	-0.003 (-3.91)	-0.002 (-2.06)	0.000 (-0.32)	0.002 (1.13)	-0.002 (-3.43)	-0.003 (-4.02)
Youth access index	0.001 (1.44)	-0.001 (-1.15)	-0.001 (-1.04)	-0.003 (-1.40)	0.000 (-0.93)	-0.002 (-2.70)
Real price of cigarettes	-0.001 (-1.71)	0.000 (-0.79)	-0.001 (-2.23)	-0.002 (-2.15)	0.000 (1.08)	-0.001 (-2.13)
Tobacco-producing state	-0.026 (-1.50)	-0.023 (-0.90)	-0.011 (-0.34)	0.023 (0.57)	-0.011 (-1.04)	0.025 (1.72)
Age	-0.200 (-2.64)	-0.085 (-0.80)	-0.108 (-0.82)	-0.177 (-1.09)	0.699 (11.52)	0.278 (4.11)
Age squared	0.010 (3.84)	0.005 (1.48)	0.005 (1.16)	0.009 (1.76)	-0.023 (-11.17)	-0.008 (-3.65)
Male	0.103 (9.75)	0.265 (17.03)	0.246 (12.86)	0.239 (9.50)	0.011 (1.81)	-0.055 (-6.38)
Black	0.392 (25.40)	0.247 (10.86)	0.304 (11.37)	0.266 (7.58)	-0.244 (-24.71)	-0.237 (-15.92)
Hispanic	0.268 (15.35)	0.184 (7.42)	0.227 (7.38)	0.235 (6.08)	-0.186 (-17.40)	-0.118 (-7.42)
Asian	0.149 (5.32)	0.016 (0.37)	-0.050 (-0.90)	-0.082 (-1.04)	-0.432 (-27.74)	-0.297 (-11.33)
Native American	0.308 (9.11)	0.216 (4.73)	0.125 (1.56)	0.317 (3.45)	-0.058 (-2.72)	0.113 (3.83)
Other race	0.208 (9.15)	0.165 (5.09)	0.226 (5.53)	0.228 (4.36)	-0.155 (-11.57)	-0.067 (-3.33)
Father less than high school	0.131 (7.19)	0.118 (4.69)	0.024 (0.75)	0.044 (1.06)	0.053 (4.60)	0.083 (5.41)
Father college graduate	-0.104 (-7.65)	-0.111 (-5.64)	-0.135 (-5.45)	-0.073 (-2.17)	-0.022 (-2.78)	-0.118 (-10.70)
Mother less than high school	0.063 (3.47)	0.080 (3.08)	0.080 (2.35)	0.124 (2.86)	0.010 (0.86)	0.090 (5.81)
Mother college graduate	-0.081 (-6.20)	-0.053 (-2.80)	-0.057 (-2.39)	-0.074 (-2.32)	-0.010 (-1.39)	-0.100 (-9.49)
Income from work	0.002 (9.80)	0.003 (10.06)	0.003 (6.39)	0.002 (4.40)	0.003 (20.22)	0.003 (16.04)
Income from other sources	0.004 (12.02)	0.005 (12.71)	0.005 (7.94)	0.006 (8.37)	0.006 (23.67)	0.005 (17.71)
Grade 8	0.810 (20.97)	0.646 (11.44)	0.190 (2.97)	0.714 (8.72)	-	0.186 (6.00)
Grade 10	0.427 (14.49)	0.336 (7.69)	0.076 (1.71)	0.376 (6.33)	0.497 (44.27)	0.136 (5.93)
1991	-0.105 (-3.21)	-0.101 (-2.04)	-	-	-0.158 (-8.55)	-0.148 (-5.46)
1992	-0.042 (-1.36)	-0.039 (-0.86)	-	-	-0.005 (-0.31)	-0.091 (-3.53)
1993	-0.037 (-1.12)	-0.033 (-0.68)	-	-	0.145 (7.59)	-0.086 (-3.12)
1994	-0.024 (-0.72)	-0.018 (-0.37)	-	-	0.221 (11.15)	-0.056 (-1.98)
1995	-0.023 (-0.66)	0.003 (0.06)	-	-	0.238 (11.72)	0.004 (0.14)
1996	0.008 (0.24)	0.036 (0.72)	-	-	0.279 (13.82)	0.091 (3.21)
1997	-0.041 (-1.22)	-0.056 (-1.11)	-0.085 (-1.89)	-0.078 (-1.32)	0.204 (10.39)	0.065 (2.34)
1998	0.002 (0.07)	0.022 (0.49)	-0.096 (-2.38)	-0.046 (-0.85)	0.138 (7.68)	0.055 (2.12)
1999	0.031 (1.24)	0.024 (0.64)	-0.081 (-2.74)	0.024 (0.61)	0.085 (5.99)	0.059 (2.85)

NOTE: All equations also include an intercept and missing value indicators for race, parental education and income. Z-statistics are in parentheses. The critical values for the z-statistics are 2.58 (2.33), 1.96 (1.64), 1.64 (1.28) at the 1, 5 and 10% significance levels, respectively, based on a two-tailed (one-tailed) test. The question regarding access to cigarettes was asked only of 8th- and 10th-grade students; therefore, the dichotomous 8th-grade indicator is omitted as the reference category in this equation. Questions regarding smoke 1+ packs daily and quit and smoking is not dangerous – you can quit were not asked prior to 1997. The sample sizes for the harm exaggerated, smokers enjoy life, smoke 1+ packs daily and quit, smoking is not dangerous – you can quit, easy access, and don't mind being near smokers outcomes are 160 562, 162 568, 50 886, 50 891, 286 555 and 160 923, respectively.

thought likely to be inversely related to stronger tobacco control policies.

Cigarette prices

Cigarette prices are found to have a positive and significant impact on the great risk and public smoking ban outcomes and a negative and significant impact on the harm exaggerated, smoke 1+ packs daily and quit, smoking is not dangerous – you can quit, and don't mind being near smokers outcomes. Cigarette prices are found to be insignificant determinants of the other smoking attitudes and beliefs.

Simulations

Since the probit models that are employed to estimate the equations are nonlinear in nature, the estimated parameters do not directly provide meaningful information for understanding the exact relationship between the tobacco control variables and the attitudes and beliefs about smoking. Therefore, the estimates from the probit equations are used to perform simulations that predict the probability of each

Table 3 Predicted probabilities for outcomes expected to be positively related to tobacco control policies

	<i>Tobacco control spending</i>	<i>Smoke-free air index</i>	<i>Youth access index</i>	<i>Cigarette price</i>
Great risk				
Min	60.62	59.20	60.38	58.70
Mean	61.20	61.20	61.20	61.20
Max	71.13	65.90	62.41	66.19
Bad judgement				
Min	41.03	41.00	39.36	41.33
Mean	41.48	41.48	41.48	41.48
Max	49.74	42.66	44.81	41.78
Dirty habit				
Min	53.42	53.56	51.72	53.67
Mean	53.88	53.88	53.88	53.88
Max	62.08	54.66	57.21	54.30
Disapprove adults smoking				
Min	28.83	27.96	27.66	28.44
Mean	29.35	29.35	29.35	29.35
Max	39.99	32.81	31.93	31.35
Public smoking ban				
Min	44.57	44.74	44.72	42.10
Mean	44.84	44.84	44.84	44.84
Max	49.76	45.07	45.01	50.69
Prefer to date nonsmokers				
Min	62.12	62.65	60.01	62.93
Mean	62.77	62.77	62.77	62.77
Max	73.80	63.06	66.92	62.43

NOTE: The sample sizes for the great risk, bad judgement, dirty habit, disapprove adult smoking, public smoking ban, and prefer to date nonsmoker outcomes are 434 844, 160 778, 160 454, 87 515, 24 111 and 162 272.

Table 4 Predicted probabilities for outcomes expected to be negatively related to tobacco control policies

	<i>Tobacco control spending</i>	<i>Smoke-free air index</i>	<i>Youth access index</i>	<i>Cigarette price</i>
Harm exaggerated				
Min	9.21	9.92	8.98	9.75
Mean	9.23	9.23	9.23	9.23
Max	9.66	7.68	9.64	8.22
Smokers enjoy life				
Min	2.54	2.69	2.60	2.62
Mean	2.50	2.50	2.50	2.50
Max	1.85	2.08	2.34	2.26
Smoke 1+ packs daily and quit				
Min	8.26	8.23	8.43	9.39
Mean	8.14	8.14	8.14	8.14
Max	6.79	8.03	7.80	6.74
Smoking is not dangerous – you can quit				
Min	3.28	3.09	3.55	4.10
Mean	3.30	3.30	3.30	3.30
Max	3.61	3.55	3.03	2.48
Easy access				
Min	71.51	71.89	71.38	70.79
Mean	71.18	71.18	71.18	71.18
Max	64.80	69.37	70.86	71.97
Don't mind being near smokers				
Min	19.85	20.31	20.40	20.11
Mean	19.43	19.43	19.43	19.43
Max	12.82	17.68	17.15	18.41

NOTE: The sample sizes for the harm exaggerated, smokers enjoy life, smoke 1+ packs daily and quit, smoking is not dangerous – you can quit, easy access, and don't mind being near smokers outcomes are 160 562, 162 568, 50 886, 50 891, 286 555 and 160 923, respectively.

outcome (ie probability that the dependent variable will take on the value of one) under alternative assumptions about the tobacco control policies.

Tables 3 and 4 provide the predicted probabilities for the models estimated in Tables 1 and 2, respectively, when the tobacco control policies are set individually to the minimum, mean and maximum values found in the sample, holding all other independent variables (including the other tobacco control policies) at their mean. For example, holding all other covariates at their mean, varying the tobacco control expenditure variable from the minimum value found in the sample to the maximum value found in the sample increases the predicted probability of respondents agreeing that there is great risk in smoking one or more packs of cigarettes per day (great risk outcome) from 0.6062 to 0.7113, an increase of 10.51 percentage points. Similarly, holding all other covariates at their mean, varying the smoke-free air, youth access and cigarette price variables one at a time from their minimum to their maximum values increases the predicted probability of responding positively to the great risk outcome

by 6.70, 2.03 and 7.49 percentage points, respectively. The simulations for the other outcomes can be interpreted in the same fashion.

Discussion

The aforementioned results clearly indicate that increased state spending on tobacco control, stronger clean indoor air laws and youth access laws and higher cigarette prices are effective in changing adolescents' attitudes and beliefs toward smoking. By changing youth's attitudes and beliefs toward tobacco, stronger tobacco control policies are likely to decrease cigarette consumption by youths, which in turn is likely to translate into a decrease in the future burden of tobacco in the United States. It should be noted that some states spend a proportion of their tobacco funds to increase enforcement of youth access and clean indoor air laws. In these states, state appropriations for enforcement make the youth access and clean indoor air laws more effective.

Acknowledgements

Support for this research was provided by grants from the Robert Wood Johnson Foundation to the University of Illinois at Chicago (ImpacTeen: A Policy Research Partnership to Reduce Youth Substance Use) and the University of Michigan (Youth, Education and Society (Yes!)) as part of its initiative Bridging the Gap: Research Informing Practice for Healthy Youth Behavior. Additional support for analysis was provided by the Centers for Disease Control and Prevention's Office on Smoking and Health, under a subcontract from the Research Triangle Institute. The data from the Monitoring the Future surveys were collected under a grant from the National Institute on Drug Abuse. We thank Deborah Kloska, Tomas Rinkunas and Stavros Tsipis for their assistance.

Notes

¹ Settlement funding for tobacco control in Arizona and Massachusetts were not included in these calculations because their state budgets had not been finalised at the time the CDC released its report.

² The currency used throughout the paper is US dollars.

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