

## Tobacco Use among Massachusetts Youth: Is Tobacco Control Working?<sup>1</sup>

Stephen Soldz, Ph.D.,<sup>2</sup> Peter Kreiner, Ph.D., Thomas W. Clark, B.A., and Milly Krakow, Ph.D.

Health and Addictions Research, Inc., Boston, Massachusetts 02116

### INTRODUCTION

**Background.** This paper examines whether the Massachusetts Tobacco Control Program is affecting the rates of smoking and smokeless tobacco use among Massachusetts' youth.

**Methods.** School survey data from the Massachusetts Prevalence Study were analyzed to estimate differences between 1993 and 1996 rates of youth cigarette and smokeless tobacco use, attitudes toward smoking, and awareness of cigarette ads and promotions of anti-smoking messages.

**Results.** Lifetime and Current Smoking rates declined significantly among middle school males, contrasting with stable national trends. Among girls in this age group, Lifetime and Current Smoking did not change significantly. Hispanic middle school students exhibited a significant decline in Lifetime Use. There were no significant changes in Lifetime or Current Smoking rates among high school students. Lifetime use of smokeless tobacco declined among middle school students while Current Use declined among both middle and high school students. Students reported declines in awareness of cigarette ads or promotions and increases in awareness of antismoking messages.

**Conclusions.** These results provide evidence for cautious optimism regarding the impact of tobacco control, but indicate that these efforts should begin earlier and that additional research is needed to understand and address the problems of tobacco use by girls.

© 2000 American Health Foundation and Academic Press

**Key Words:** smoking; tobacco control; tobacco trends; smoking attitudes; tobacco advertising; smokeless tobacco; youth smoking.

Despite significant progress in reducing adult smoking [1,2] and essentially stable rates of adult smokeless tobacco use [3-5], young people are still taking up smoking and the use of smokeless tobacco. Between 1994 and 1997, smoking rates among youth rose nationally. For example, the Monitoring the Future study (MTF), a national survey of substance use among 8th, 10th, and 12th graders, found that past month smoking rates stayed essentially stable among the 8th grade while increasing among the 10th and 12th grades [6]. For each of the three grades, the increase was greater for girls than boys. In contrast, after increasing from 1991 to 1994, rates of youth smokeless tobacco use fell modestly between 1994 and 1997. Comparable results have been found with the Youth Risk Behavior Survey (YRBS), another national survey [7].

Increases in youth use of tobacco potentially portends future increases in adult smoking and smokeless tobacco use. The 1991 National Household Survey on Drug Abuse found that 88% of those who ever tried a cigarette did so by age 18 years [8]. Furthermore, studies have found that between 33 and 50% of youth who initiated smoking went on to become regular users [7,9-11].

Ultimate success in reducing tobacco use and its attendant health costs necessitates progress in reducing the rate at which youth begin smoking and using smokeless tobacco. The Massachusetts Tobacco Control Program (MTCP) [12,13], one of the most comprehensive in the nation, is using cigarette tax revenue to fund a variety of initiatives to reduce smoking incidence and prevalence among both youth and adults. If these efforts are succeeding in affecting teen tobacco use, we would expect that rates of smoking and smokeless tobacco use among teens in the state would decline or at least increase at a slower rate than nationally.

In 1992 Massachusetts passed a referendum that raised the cigarette tax 25 cents per pack and mandated that the resulting revenue be used for tobacco control

<sup>1</sup> This study was supported by the Massachusetts Department of Public Health Bureau of Substance Abuse Services and the Massachusetts Tobacco Control Program.

<sup>2</sup> To whom correspondence and reprint requests should be addressed at 531 Beech Street, Roslindale, MA 02131. E-mail: [ssoldz@soldzresearch.com](mailto:ssoldz@soldzresearch.com).



and other health promotion efforts. As a result, MTCP was created in 1993 with the goal of reducing "both the number of people who smoke and the amount of tobacco smoked" [13]. One of the three main thrusts of MTCP is to prevent young people from initiating smoking and to reduce their access to tobacco.

To accomplish this goal, MTCP has fostered youth prevention efforts in three broad categories:

1. *Community efforts* to increase enforcement of youth-access provisions, including banning free samples, requiring permits for tobacco retailers, restricting access to vending machines or banning them entirely, staging buy attempts by minors, and funding community-based tobacco prevention programs.

2. *School efforts* to inform youth of the harmful effects of smoking and to involve them in positive efforts to prevent smoking, including building peer leadership in this area, and funding school-based tobacco prevention programs.

3. *Media efforts* including enlisting celebrities in antismoking public relations efforts and implementing statewide media campaigns aimed at reducing smoking and smokeless tobacco use.

Studies have indicated that such efforts are successful in increasing local retailer compliance with regulations forbidding sales to minors [14] and in increasing awareness of antismoking messages among young people [13]. To date, however, there is inconclusive evidence as to whether MTCP is reducing actual youth smoking rates [14]. Recent analyses of biennial Massachusetts YRBS data from 1993 through 1997 show the 1997 rates of lifetime smoking down slightly among students in grades 9 through 12, while current smoking and frequent smoking increased from 1993 to 1997, though the rate of increase was less for the 1995 to 1997 period than for the previous 2-year period [15].

Since 1984, Health and Addictions Research has conducted the triennial Massachusetts Prevalence Study for the Massachusetts Department of Public Health, surveying alcohol, tobacco, and other drug use among Massachusetts 7th through 12th grade public school students. The 1993 survey found increases from 1990 in current smoking rates among both middle and high school students in the state [16]. The increase among middle school students was nearly 10 percentage points, from 12.6 to 22.5%. Current use of smokeless tobacco rates also increased among both middle and high school students. Among high school students the rates increased from 6.5 to 9.3%, while the middle school rates increased nearly 300%, from 1.4 to 5.5%. Thus MTCP was initiated at a time when tobacco use was increasing in middle and high school students both nationally and in Massachusetts. The most recent Massachusetts Prevalence Study, conducted in the fall and winter of the 1996–1997 school year, provides the first

evidence to assess whether MTCP is affecting increasing trends in smoking and smokeless tobacco rates.

The goal of the current study is to evaluate the impact of MTCP on use, attitudes, and awareness of tobacco advertising and antismoking messages. If MTCP has had an effect, we would expect to see a decline in tobacco use, an increase in antismoking attitudes, and an increase in the awareness of antismoking messages in the media. We also investigated changes in the awareness of tobacco company ads and promotions.

## METHODS

### *Sampling*

From 1984 to 1990, participants consisted of students in a random sample of Massachusetts public school classrooms, stratified by county and grade. The sample was derived through a two-stage sampling process: stage one identified schools and numbers of classrooms of each grade selected. In stage two, the actual classroom(s) chosen for participation were randomly selected by research staff from a list provided by the school's homerooms, health classes, or other nontracked subjects. Such classes were used in order to minimize bias introduced by level of academic performance or students' areas of interest. For 1993 and 1996, this sample was supplemented by an additional sample of students in a random sample of public school classrooms in five urban areas with strong nonwhite student representation, stratified by the proportion of minority students in each grade. The urban oversampling was conducted to allow for more precise estimates of prevalence rates among minority youth in the state.

In 1993, white students comprised 50% of the sample, blacks 24%, Hispanics 19%, and others (Asians and Native Americans) 7%, while in 1996 whites comprised 48% of the sample, blacks 23%, Hispanics 21%, and others 8%. Participants were nearly evenly divided by gender: In 1993, males constituted 48% of the sample, while in 1996 males constituted 50%. In 1993, 5,248 students from 134 public schools in 74 communities across the state participated, while in 1996, 5,766 seventh through twelfth graders from 171 public schools in 90 communities participated. For the first time, the 1996 sample added 1125 sixth grade students, who are not included in the present analyses due to the absence of trend data for them. There were no significant differences in the gender or racial/ethnic composition of the sample from 1993 to 1996 among either the middle or high school students.

### *Questionnaire*

The survey questionnaire consisted of a core of questions asked regularly since 1984, with additional tobacco questions added in 1987, 1993, and 1996. The

1996 instrument contained 98 items divided into five sections: a background section assessing respondent demographics; one section each on tobacco, alcohol, and other drugs; and a final section on other issues such as substance use education and driving while under the influence of substances. While the reliability and validity of the instrument were not formally assessed, the items used in this study were similar or identical to items included in other national surveys, such as Monitoring the Future [6] which are known to be reliable and valid.

The items used in this paper include gender and the following:

*Race/ethnicity.* For the present study, only white, black, and Hispanic, defined as exclusive categories, are examined.

*College plans.* Answers to the question "What do you plan to do when you get out of high school?" were coded as Yes = "go to college" or No = any other response (i.e., "join the Armed Services," "go to work," "something else or unsure").

*Lifetime smoking.* Answers to the question "How old were you when you smoked a whole cigarette for the first time?" were coded No if the respondent selected "I have never smoked a whole cigarette" and all other responses were coded as Yes.

*Current smoking.* Answers to the question "During the last 30 days (past month), on how many days did

you use cigarettes?" were coded No if the respondent selected "I did not smoke cigarettes during the last 30 days" and all other responses were coded Yes.

*Lifetime smokeless tobacco use.* Answers to the question "In your lifetime (ever), how often did you use chewing tobacco or snuff?" were coded No if the respondent selected "Never" and all other responses were coded Yes.

*Current smokeless tobacco use.* Answers to the question "In the last 30 days (past month), how often did you use chewing tobacco or snuff?" were coded No if the respondent selected "never" and all other responses were coded Yes.

*Awareness of cigarette ads.* Based on affirmative responses to the question, "In the last 30 days (past month), have you seen or heard any ads or promotions for cigarettes in the following places?" Response categories were: "On TV," "On radio," "On billboards," "On posters or pamphlets," "On clothing," "In newspapers or magazines," "At sporting events," and "Other places." Multiple responses were allowed. We analyzed each source separately, as well as analyzing a summary score of the number of distinct sources that were checked.

*Awareness of antismoking messages.* Based on answers to the question, "In the last 30 days (past month), have you seen or heard any anti-smoking messages in the following places?" Response categories were the same as for Awareness of Cigarette Ads, and, as with

TABLE 1  
Percent Lifetime Smokers among Massachusetts Youth

	7th-8th grade			9th-12th grade		
	1993	1996	Change 1993-1996	1993	1996	Change 1993-1996
Total	37.4 (2.5)	34.1 (2.4)	-3.3 (3.4)	56.8 (1.8)	55.3 (1.6)	-1.5 (2.0)
Gender						
Male	43.4 (2.7)	34.6 (2.6)	-8.8* (3.8)	56.5 (2.4)	53.3 (2.0)	-3.2 (3.1)
Female	31.9 (3.3)	33.5 (2.8)	+1.6 (3.8)	57.0 (2.2)	57.2 (2.1)	+0.2 (2.6)
Race						
Black non-Hispanic	42.7 (3.7)	40.8 (4.1)	-1.9 (5.5)	47.8 (2.5)	48.8 (3.2)	+1.0 (4.1)
Hispanic	47.2 (4.0)	33.4 (3.3)	-13.8* (5.2)	53.7 (3.7)	52.8 (3.1)	-0.9 (4.9)
White non-Hispanic	37.6 (2.8)	33.6 (2.7)	-4.0 (4.0)	59.4 (2.0)	57.1 (1.9)	-2.4 (2.8)
College Plans						
Yes	33.4 (2.6)	29.7 (2.4)	-3.7 (3.5)	53.6 (1.8)	51.5 (1.8)	-2.1 (2.5)
No	55.1 (4.1)	46.9 (3.6)	-8.2 (5.4)	70.6 (2.8)	68.2 (2.5)	-2.4 (3.2)

Note. Based on responses to the question "How old were you when you smoked a whole cigarette for the first time?" Standard errors in parentheses.

\*  $P < 0.05$ .

that item, multiple responses were allowed. These items were analyzed similarly to Awareness of Cigarette Ads.

*Availability of cigarettes.* Responses of "Very easy" or "Fairly easy" to the question "How difficult do you think it would be for you to get cigarettes?" were coded Yes and all other responses were coded No.

*Friends smoking.* Responses of "Many" or "Almost all" to the question "In the last 30 days (past month), how many of your friends smoked cigarettes?" were coded Yes and all other responses were coded No.

*Friends' disapproval of smoking.* Answers to the question "How many of your friends disapprove of smoking," were coded similarly to Friends Smoking.

*Bothered by smokers.* Responses of "A fair amount" or "Very much" to the question "How much does it bother you to be around a smoker?" were coded as Yes and all other responses as No.

*Considered quitting.* Affirmative responses to the question "Have you thought about quitting smoking in the last six months?" were coded as Yes. This question was only asked of current smokers.

#### Procedure

*School recruitment.* School superintendents and principals were notified in a letter from the Commissioners of the Departments of Public Health and Education that classes in their districts had been chosen to

participate in the study. Phone calls were made to obtain principals' cooperation. In 1993, 96% (94% in 1996) of selected schools agreed to participate. Of those refusing, about half cited recent participation in another survey as the reason. Eighty-four percent (83% in 1996) of students enrolled in selected classes participated; the 16% student nonresponse rate included both absentees and refusers. Thus, combined, the 1993 survey had a 81% response rate and the 1996 survey an 78% rate. These participation rates compare very favorably with the 39 to 56% rates for MTF [17].

*Data collection.* The Massachusetts Prevalence Study surveys were collected over a 3-month period, from November through January. Students participated voluntarily and all responses were anonymous. Spanish translations of the survey instrument were provided when needed. These translations were back-translated to assure accuracy. In 1996 the Spanish version was administered to 120 youth; comparable data are not available for earlier years. Surveys were administered by trained survey administrators (two per classroom), and teachers were asked not to be present during the survey administration. The survey took about 40 min to complete.

#### Weighting and Data Analysis

As the sample was stratified by county and urban area, we used weights adjusted for differential selection

**TABLE 2**  
Percent Current Smokers among Massachusetts Youth

	7th-8th grade			9th-12th grade		
	1993	1996	Change 1993-1996	1993	1996	Change 1993-1996
Total	22.5 (1.9)	21.0 (2.1)	-1.5 (2.8)	33.6 (1.7)	35.6 (1.7)	+2.0 (2.5)
Gender						
Male	25.6 (2.4)	19.1 (2.2)	-6.5* (3.2)	31.0 (1.9)	34.8 (2.3)	+3.8 (3.0)
Female	19.7 (2.4)	23.1 (2.6)	+3.4 (3.5)	35.8 (2.2)	36.4 (2.0)	+0.6 (2.8)
Race						
Black non-Hispanic	22.5 (4.5)	15.8 (2.3)	-6.7 (5.0)	21.7 (3.0)	18.7 (2.7)	-3.0 (4.0)
Hispanic	27.2 (4.0)	18.0 (2.7)	-9.2 (4.8)	25.5 (3.9)	31.2 (3.6)	+5.7 (5.4)
White non-Hispanic	23.4 (2.1)	22.0 (2.5)	-1.4 (3.3)	36.4 (1.8)	38.0 (1.9)	+1.6 (2.7)
College Plans						
Yes	19.8 (1.9)	16.8 (1.9)	-3.0 (2.7)	29.2 (1.5)	30.8 (1.8)	+1.6 (2.3)
No	34.7 (4.3)	33.3 (3.6)	-1.1 (5.6)	52.2 (3.4)	52.0 (2.7)	-0.2 (3.9)

*Note.* Based on responses to the question, "During the last 30 days, on how many days did you use cigarettes?" Reported are percentage of respondents who reported anything but "I did not smoke cigarettes during the last 30 days." Standard errors in parentheses.

\*  $P < 0.05$ .

probabilities. Since the sample was stratified and clustered in classrooms, we analyzed the survey adjusting for the complex sample design effect using the adjusted Wald test of independence for the adjusted  $F$  statistic [18,19]. For most analyses, we combined grades 7 and 8 into one group (middle school) and grades 9 through 12 into another (high school).

## RESULTS

### Smoking Trends

Lifetime Smoking rates did not significantly change among either middle or high school students from 1993 to 1996 (Table 1). Among subgroups of middle school students, there were statistically significant declines in Lifetime Smoking from 1993 to 1996 for male and Hispanic students. There was no significant change in any of the high school subgroups examined.

Current Smoking rates for middle school students as a whole did not change significantly from 1993 to 1996 (Table 2). Among subgroups, males exhibited a significant decline. There were no significant changes in Current Smoking among high school students, either taken as a whole or taken among subgroups.

### Smokeless Tobacco Trends

Among middle school students, Lifetime Smokeless Tobacco Use exhibited a significant decrease from 1993 to 1996 (8.9%) (Table 3). Males, females, whites, and

students with college plans all exhibited significant declines.

Among high school students, the 1996 decrease in lifetime use was not significant. Among subgroups, males and whites exhibited significant decreases.

Among middle school students, Current Smokeless Tobacco Use significantly declined in 1996 (Table 4). Among subgroups, males and whites exhibited significant declines. High school students also exhibited a significant decline in 1996. Among subgroups, use among males and whites declined significantly.

### Awareness of Cigarette Ads

Table 5 contains the frequencies of students who reported seeing cigarette ads or promotions from various sources, as well as the total number of sources where such ads were seen. For middle school students there was a significant decline in the mean number of sources where cigarette ads and promotions were seen, as well as in the proportion of students noticing ads from the following four sources: billboards, newspapers/magazines, posters, and other places. High school students did not report a decline in the mean number of sources, but did exhibit declines in the number of students who saw ads from three sources: newspapers/magazines, posters, and other places.

TABLE 3

Percent Lifetime Use of Smokeless Tobacco among Massachusetts Youth

	7th-8th grade			9th-12th grade		
	1993	1996	Change 1993-1996	1993	1996	Change 1993-1996
Total	16.1 (1.7)	8.9 (1.6)	-7.2** (2.4)	24.6 (1.7)	20.2 (1.5)	-4.4 (2.3)
Gender						
Male	26.6 (2.7)	14.5 (2.5)	-12.1** (3.7)	41.2 (2.5)	34.1 (2.3)	-7.1* (3.4)
Female	6.3 (1.3)	2.9 (1.0)	-3.4* (1.7)	9.6 (1.3)	7.3 (1.2)	-2.3 (1.8)
Race						
Black non-Hispanic	12.4 (3.3)	6.9 (2.5)	-5.5 (4.1)	9.1 (2.2)	10.8 (3.0)	1.7 (3.8)
Hispanic	10.6 (2.7)	6.4 (2.1)	-4.2 (3.4)	9.6 (2.1)	12.0 (2.7)	2.4 (3.5)
White non-Hispanic	17.8 (2.1)	9.5 (2.0)	-8.3** (2.9)	28.5 (1.7)	22.6 (1.7)	-5.9* (2.4)
College Plans						
Yes	14.5 (2.2)	6.8 (2.5)	-7.7* (3.5)	22.3 (2.0)	18.5 (1.9)	-3.8 (2.5)
No	23.1 (2.7)	15.2 (2.4)	-7.9 (4.1)	34.1 (3.1)	26.3 (2.9)	-7.8 (4.4)

Note. Standard errors in parentheses.

\*  $P < 0.05$ .

\*\*  $P < 0.01$ .

**TABLE 4**  
Percent Current Use of Smokeless Tobacco among Massachusetts Youth

	7th-8th grade			9th-12th grade		
	1993	1996	Change 1993-1996	1993	1996	Change 1993-1996
Total	5.5 (1.0)	2.4 (0.5)	-3.1** (1.2)	9.3 (0.9)	5.6 (0.6)	-3.7** (1.1)
Gender						
Male	9.7 (1.8)	4.1 (1.0)	-5.6** (2.0)	18.6 (1.8)	10.7 (1.2)	-7.9** (2.1)
Female	1.7 (0.7)	0.5 (0.2)	-1.2 (0.7)	1.0 (0.3)	0.9 (0.4)	-0.1 (0.5)
Race						
Black non-Hispanic	3.1 (1.1)	0.8 (0.4)	-2.3 (1.2)	3.4 (1.5)	1.1 (0.8)	-2.3 (1.7)
Hispanic	6.0 (2.8)	3.0 (1.7)	-3.0 (3.3)	4.0 (1.5)	2.2 (1.3)	-1.8 (2.0)
White non-Hispanic	6.3 (1.2)	2.6 (0.6)	-3.7** (1.4)	10.3 (1.0)	6.6 (0.8)	-3.7** (1.3)
College Plans						
Yes	5.0 (1.7)	1.1 (0.5)	-3.9 (2.3)	7.9 (1.0)	5.3 (0.7)	-2.6 (1.5)
No	7.7 (2.1)	6.0 (1.7)	-1.7 (2.3)	15.4 (4.1)	6.7 (2.9)	-8.7 (5.0)

Note. Standard errors in parentheses.

\*\*  $P < 0.01$ .

#### *Awareness of Antismoking Ads*

Similar analyses were conducted for the sources of antismoking messages (Table 6). Middle school students reported significant increases in awareness of antismoking ads on TV and radio and a significant decrease on posters. High school students reported increases in noticing antismoking messages from billboards, TV, radio, and other places, and a decrease in messages noticed on posters. Neither group reported a change in the total number of sources where such ads were seen.

#### *Availability, Attitudes, and Peer Use*

Table 7 reports data on availability of cigarettes, friends' disapproval of smoking, the number of friends who smoke, whether students are bothered by smokers, and whether current smokers had considered quitting over the past 6 months. There were no significant changes from 1993 to 1996 among these variables in either middle or high school students. With the exception of being bothered by smokers, however, all variables changed in the direction that was consistent with the success of tobacco control.

### DISCUSSION

This study examined trends in smoking and smokeless tobacco rates, attitudes, and awareness of tobacco and antismoking ads as a way of assessing the success

of tobacco control efforts in Massachusetts. Current Smoking rates increased from 1990 to 1993 (prior to MTCP implementation) and then exhibited significant declines from 1993 to 1996 for middle school boys. This decline is in contrast to the essentially level rate for 8th grade boys reported in the national MTF study [6].<sup>3</sup> The decrease among the younger boys in Massachusetts suggests that MTCP may be successfully influencing these students. There is also grounds for optimism in the significant drop in Hispanic middle school students' Lifetime Smoking.

The findings for middle school girls were less positive: their Lifetime Smoking stayed essentially unchanged while their Current Smoking exhibited a nonsignificant increase. These trends are comparable to those reported by MTF for 8th grade girls. High school students also exhibited a nonsignificant increase in Current Smoking

<sup>3</sup> The Massachusetts Prevalence Study has been administered in November of the index year through January of the succeeding year. MTF is administered in the winter and spring of the index year [6]. Thus, for example, both 1993 Massachusetts Prevalence Study data and 1994 MTF data were collected during the 1993-1994 school year, though our data are collected earlier in that period. In Massachusetts Prevalence Study reports [16,24, 25], comparisons have traditionally been made with the previous year's MTF data as that was the only data available at the time of the reports. The contrasts between Massachusetts and national trends described in the present paper would be greater if we reported those comparisons. Thus, the results here reported are conservative.

**TABLE 5**  
Venues Cigarette Ads or Promotions Were Seen or Heard

Sources	7th–8th grade			9th–12th grade		
	1993	1996	Change 1993–1996	1993	1996	Change 1993–1996
Billboards	80.2 (2.0)	73.4 (1.7)	-6.8** (2.2)	83.3 (2.1)	82.8 (2.2)	-0.5 (2.4)
Clothing	72.5 (2.3)	68.1 (2.0)	-4.4 (3.1)	76.7 (1.9)	77.0 (1.5)	+0.3 (2.7)
Newspapers/magazines	82.7 (1.6)	74.0 (2.2)	-8.7** (2.7)	84.4 (1.2)	80.4 (1.0)	-4.0* (1.6)
Posters	58.9 (1.6)	49.0 (2.0)	-9.9** (2.6)	63.7 (1.2)	56.3 (1.1)	-7.4** (1.7)
Radio	37.5 (1.4)	36.4 (1.3)	-1.1 (1.5)	25.2 (0.9)	23.3 (0.9)	-1.9 (1.1)
Sporting events	47.5 (1.5)	46.7 (1.4)	-0.8 (1.7)	47.1 (1.2)	48.3 (1.3)	+1.2 (1.6)
TV	61.9 (1.7)	63.8 (1.6)	+1.9 (2.1)	42.9 (2.4)	49.6 (2.1)	+6.7 (3.6)
Other places	66.7 (1.7)	57.6 (1.4)	-9.1** (2.2)	66.2 (1.3)	59.4 (1.4)	-6.8** (1.9)
Ads, total number of sources	5.07 (0.10)	4.69 (0.10)	-0.38** (0.14)	4.89 (0.07)	4.83 (0.07)	-0.06 (0.09)

Note. With the exception of total number of sources, cell entries are percentages. Standard errors in parentheses.

\*  $P < 0.05$ .

\*\*  $P < 0.01$ .

rates. The high school results are consistent with results derived from the Massachusetts YRBS, finding that current smoking increased somewhat from 1993 to 1997 [15].

Comparisons with MTF [6] data indicate that high

school Current Smoking increased at rates only slightly slower than the national rates, suggesting that MTCP, initiated 3 years before these data were collected, was not as effective in reaching those students who were already in seventh through ninth grade. These results

**TABLE 6**  
Venues Antismoking Messages Were Seen or Heard

Sources	7th–8th grade			9th–12th grade		
	1993	1996	Change 1993–1996	1993	1996	Change 1993–1996
Billboards	39.6 (1.5)	43.7 (1.6)	+4.1 (2.2)	38.0 (1.5)	47.2 (1.5)	+9.2** (2.1)
Newspapers/magazines	51.5 (1.8)	50.0 (1.9)	-1.5 (2.3)	49.7 (1.6)	49.3 (1.5)	-0.4 (2.0)
Posters	55.8 (1.9)	44.8 (1.7)	-11.0** (2.5)	62.9 (1.7)	56.4 (1.5)	-6.5** (2.3)
Radio	44.1 (1.6)	52.2 (2.3)	+8.1** (2.8)	47.0 (1.4)	61.6 (1.4)	+14.6** (2.0)
School	68.1 (2.0)	62.8 (2.3)	-5.3 (3.0)	75.8 (1.3)	72.8 (1.5)	-3.0 (2.0)
Sporting events	29.0 (1.7)	28.8 (1.6)	-0.2 (2.3)	32.8 (1.5)	29.4 (1.3)	-3.4 (2.0)
TV	75.7 (1.5)	87.3 (1.7)	+11.6** (2.3)	77.8 (1.1)	88.4 (0.9)	+10.6** (1.4)
Other places	55.5 (1.8)	52.5 (1.7)	-3.0 (2.1)	57.8 (1.9)	50.0 (1.7)	-7.8** (2.5)
Antismoking messages total number of sources	4.17 (0.09)	4.22 (0.11)	+0.05 (0.14)	4.41 (0.07)	4.55 (0.08)	+0.14 (0.11)

Note. With the exception of total number of sources, cell entries are percentages. Standard errors in parentheses.

\*  $P < 0.05$ .

\*\*  $P < 0.01$ .

**TABLE 7**  
Availability, Attitudes, and Peer Group Use/Attitudes

	7th-8th grade			9th-12th grade		
	1993 (%)	1996 (%)	Change 1993-1996	1993 (%)	1996 (%)	Change 1993-1996
Availability of cigarettes	70.1 (2.5)	66.7 (2.4)	+3.4 (3.5)	92.7 (0.8)	91.7 (0.8)	+9.2 (1.3)
Friends' disapproval of smoking	49.7 (3.2)	54.8 (3.4)	+5.1 (4.1)	33.9 (1.7)	35.6 (1.8)	+1.7 (2.5)
Friends smoking	28.7 (2.7)	26.5 (2.4)	-2.2 (3.6)	46.0 (1.9)	46.9 (1.9)	+0.9+ (2.8)
Bothered by smokers?	60.2 (3.5)	58.3 (3.4)	-1.9 (4.0)	54.0 (2.1)	52.5 (1.9)	-1.5 (2.7)
Considered quitting in past 6 months	67.0 (4.1)	70.6 (3.0)	+3.6 (5.1)	70.5 (2.0)	75.2 (2.3)	+4.7 (3.1)

Note. Standard errors in parentheses.

suggest that any positive impact of MTCP on smoking rates among youth in Massachusetts was largely limited to males and Hispanic students in the lower grades. The failure to lower the smoking rates of older students is not surprising, given that MTCP began in 1993 and that these students already had elevated smoking rates in 1993. Our findings thus suggest that prevention efforts should begin when students are young, before experimentation with smoking has begun. However, nationally, most school-based tobacco prevention programs are aimed at the seventh, eighth, and ninth grades [20], when attitudes and behaviors may already be set and are harder to change.

Our results further suggest that tobacco control efforts are so far failing to counter cultural trends leading to increased smoking among girls. Since several studies suggest that girls smoke for different reasons than boys [21,22], success in future prevention efforts may require that messages be targeted specifically toward this extremely vulnerable population.

Similar to Current Smoking rates, Smokeless Tobacco Use exhibited increases in both Lifetime and Current Use from 1990 to 1993, followed by declines in many subgroups in 1996. These 1996 declines were considerably stronger than those reported from the MTF national study [6]. While such trends are certainly consistent with the success of Massachusetts' tobacco control efforts, it is also possible that smokeless tobacco was a fad for a brief period in the early 1990s. However, the fact that this decline in Massachusetts was greater than that seen nationally suggests that at least part of the decline is due to tobacco control efforts.

In addition to the reduction in smokeless tobacco rates among all subgroups and smoking rates among younger male and minority students, additional evidence for the positive effects of tobacco control efforts in Massachusetts can be seen in the decrease in awareness of cigarette ads or promotions through various media and the concurrent increase in the perception of antismoking messages. While the reasons for the decline in awareness of cigarette promotions are not clear,

this decline may be an indication that youth are becoming less susceptible to tobacco marketing efforts or that these promotions are actually declining in some venues. It appears that antismoking messages, which are a crucial piece of the MTCP strategy, are indeed being noticed. In a focus group study conducted with high-risk youth in Massachusetts, participants expressed strong praise for these ads [23]. As one youth put it: "You mean those anti-smoking commercials? Those commercials are awesome [agreement from group]. I love the new ones they have out."

The high rate of reported perception of cigarette ads or promotions on television (64% among middle school students and 50% among high school students in 1996) deserves comment, as these ads have been banned since 1971. It is possible that these reports represent a halo effect, reflecting the overall rate of perception of these messages in other venues. The other possibility, however, is that promotions such as the Virginia Slims Tennis Tournament and cigarette smoking in movies are, indeed, noticed and reported as tobacco promotions. If the latter interpretation is correct, these high rates strongly suggest the importance of supporting efforts to reduce the tobacco industry's product placement in televised events.

It should also be noted that awareness of both tobacco advertising and antismoking messages on posters declined significantly. These results suggest either that posters have declined in importance as a communication medium or that posters constitute a neglected medium for dissemination of antismoking messages.

Examination of the availability of cigarettes and attitudes toward smoking did not show any significant change from 1993 to 1996, though, the direction of change was positive. The high rates of availability of cigarettes (67% among middle school students and 92% among high school students) indicate that students who wish to can easily obtain them, despite the efforts to enforce regulations forbidding sales to minors. These results are consistent with those of Rigotti *et al.* [14],

who concluded that stronger, more consistent enforcement would be necessary before these efforts can truly influence cigarette availability.

In summary, these results provide suggestive evidence that MTCP has reduced teen smoking rates among younger males and minority students and that these efforts may have helped stem the trend toward increased use evident in the national figures. The results also suggest that MTCP has affected smokeless tobacco use among all youth subgroups, increased youth's awareness of antismoking messages, and may have increased antismoking attitudes. These results further suggest that prevention efforts may need to begin when students are very young in order to be effective. However, it must be kept in mind that the evidence for the effectiveness of MTCP from trend data is inferential and that it is possible that factors other than the state's tobacco control efforts may also be affecting these trends. The effectiveness of a major social intervention like tobacco control can ultimately only be evaluated by combining various types of studies, none of which can rule out all possible alternative explanations.

This study additionally demonstrates the value of tracking changes in tobacco use to better tailor future prevention messages for subgroups identified as having high smoking rates. In particular, the results underscore the importance of developing prevention messages and programs specifically targeted toward girls. Although there is some evidence for MTCP's effect on youth's smoking attitudes and behaviors, our findings also suggest that MTCP efforts need to be significantly expanded if youth smoking is to be eliminated as a significant public health issue.

#### ACKNOWLEDGMENTS

We thank Mary Brolin, Carolyn Celebucki, Nina Kammerrer, Steven Shalom, and several anonymous Massachusetts Department of Public Health reviewers for comments on the manuscript and Chantal Laperle, Betty Penno, and Robert Kramer for aid with editing.

#### REFERENCES

- Burns D, Lee L, Shen LZ. Cigarette smoking behavior in the United States. In: Burns D, Garfield L, Samet JM, editors. Smoking and tobacco control. Monograph 8. Changes in cigarette-related disease risks and their implications for prevention and control. Bethesda, MD: National Cancer Institute, 1997.
- Garfinkel L. Trends in cigarette smoking in the United States. *Prev Med* 1997;26:447-50.
- CDCP. Surveillance for selected tobacco-use behaviors—United States. *Morbidity and Mortality Weekly Report*, 1994.
- CDCP. State-specific prevalence among adults of current cigarette smoking and smokeless tobacco use and per capita tax-paid sales of cigarettes—United States, 1997. *MMWR* 1998;922-5.
- Nelson DE, Tomar SL, Mowery P, Siegel PZ. Trends in smokeless tobacco use among men in four states 1988 through 1993. *Am J Pub Health* 1996;86:1300-3.
- Johnston LD, O'Malley PM, Bachman JG. National survey results on drug use from the Monitoring the Future study, 1975-1997. Vol. 1. Secondary school students. Rockville, MD: National Institute on Drug Abuse; in press.
- CDCP. Selected cigarette smoking initiation and quitting behaviors among high school students. *MMWR* 1998;386-9.
- U.S. Department of Health and Human Services. Preventing tobacco use among people: A report of the Surgeon General. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 1994.
- Henningfield JE, Cohen C, Slade JD. Is nicotine more addictive than cocaine? *Pharmacol Biochem Behav* 1991;86:565-9.
- Hirschman RS, Leventhal H, Glynn K. The development of smoking behavior: Conceptualization and supportive cross-sectional data. *J Appl Soc Psychol* 1984; 14:184-206.
- McNeill AD. The development of dependence on smoking in children. *Br J Addict* 1991;86:589-92.
- Connolly G, Robbins H. Designing and effective statewide tobacco control program—Massachusetts. *Cancer* 1998;83:2722-7.
- Hamilton W. Independent evaluation of the Massachusetts Tobacco Control Program: Fourth annual report. Cambridge, MA: Abt Associates, 1998.
- Rigotti NA, DiFranza JR, Chang Y, Tisdale T, Kemp B, Singer DE. The effect of enforcing tobacco-sales laws on adolescents' access to tobacco and smoking behavior. *N Engl J Med* 1997; 337:1044-61.
- CDCP. Cigarette smoking among high school students—11 states, 1991-1997. *M MWR* 1999;48:686-92.
- Shukitt-Hale B, Clark TW, Williams CN, Krakow M, McCarty D. Tobacco, alcohol, and other drug use trends among Massachusetts public school adolescents 1984-1993. Boston: Massachusetts Department of Public Health, 1994. [Report prepared by Health and Addictions Research, Inc.]
- Gfroerer J, Wright D, Kopstein A. Prevalence of youth substance use: The impact of methodological differences between two national surveys. *Drug Alcohol Depend* 1997;47:19-30.
- Korn EL, Graubard BI. Simultaneous testing of regression coefficients with complex survey data: Use of Bonferroni *t* statistics. *Am Stat* 1990;44:27-276.
- StataCorp. Statistical software: Release 5.0. College Station, TX: Stata Corporation; 1997.
- Lynch BS, R. J. B. Growing-up tobacco free: Preventing nicotine addiction in children and youth. Washington, DC: Natl. Acad. Press, 1994.
- Taylor CB. Prospective study of risk factors for the initiation of cigarette smoking. *J Consult Clin Psychol* 1997;65:1011-6.
- Soldz S, Cui X. A risk factor index predicting adolescent cigarette smoking: A seven year longitudinal study. Boston, MA: Health and Addictions Research, Inc., 1998.
- Clark TW, Caspi-Yavin Y, Soldz S, Krakow M. Preventing adolescent substance use in Massachusetts: A focus group study. Boston: Massachusetts Department of Public Health, 1998.
- Briton NJ, Clark TW, Soldz S, Krakow M. Adolescent substance use in Massachusetts: Trends among public school students 1984-1996. Boston: Massachusetts Department of Public Health, 1997. [Report prepared by Health and Addictions Research, Inc.]
- Briton NJ, Clark TW, Baker AK, Posner J, Soldz S, Krakow M. Adolescent tobacco use in Massachusetts: Trends among public school students 1984-1996. Boston: Massachusetts Department of Public Health, 1997. [Report prepared by Health and Addictions Research, Inc.]

