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## Impact of the Massachusetts tobacco control programme: population based trend analysis

Lois Biener, Jeffrey E Harris, William Hamilton

### Abstract

**Objective** To assess the impact of the Massachusetts tobacco control programme, which, since its start in January 1993, has spent over \$200m—"the highest per capita expenditure for tobacco control in the world"—funded by an extra tax of 25 cents per pack of cigarettes.

**Design** Population based trend analysis with comparison group.

**Subjects** Adult residents of Massachusetts and other US states excluding California.

**Main outcome measures** Per capita consumption of cigarettes as measured by states' sales tax records; prevalence of smoking in adults as measured by several population-based telephone surveys.

**Results** From 1988 to 1992, decline in per capita consumption of cigarettes in Massachusetts (15%) was similar to that in the comparison states (14%), corresponding to an annual decline of 3-4% for both groups. During 1992-3, consumption continued to decline by 4% in the comparison states but dropped 12% in Massachusetts in response to the tax increase. From 1993 onward, consumption in Massachusetts showed a consistent annual decline of more than 4%, whereas in the comparison states it levelled off, decreasing by less than 1% a year. From 1992, the prevalence of adult smoking in Massachusetts has declined annually by 0.43% (95% confidence interval 0.21% to 0.66%) compared with an increase of 0.03% (-0.06% to 0.12%) in the comparison states ( $P < 0.001$ ).

**Conclusions** These findings show that a strongly implemented, comprehensive tobacco control programme can significantly reduce tobacco use.

### Introduction

In November 1992 voters in Massachusetts approved a ballot initiative, "Question 1," that added 25 cents to the cost of a pack of cigarettes, with the proceeds to be used on reducing tobacco use in the state. The tobacco surcharge was implemented in January 1993, and since then the state has appropriated over \$200m, about \$39m a year, for the Massachusetts tobacco control programme to support tobacco education and prevention. With a population of six million, this annual expenditure amounts to about \$6.50 for each man,

woman, and child—to date the highest per capita expenditure for tobacco control in the world.

The question addressed in this paper is whether this programme is succeeding in reducing tobacco use and exposure to environmental tobacco smoke in Massachusetts. We present data on two major outcomes: trends in cigarette consumption and prevalence of smoking in adults. These outcomes were chosen because they permit comparison with trends in other US states that have had no similar programme in place during this period.

### Subjects and methods

#### Massachusetts tobacco control programme

This programme was designed to increase the rate of adults stopping smoking, reduce smoking uptake by teenagers, and reduce exposure to environmental tobacco smoke. The programme's organisation and services were initially modelled on the National Cancer Association's ASSIST programme,<sup>1</sup> and it is similar in approach to the California tobacco control programme, which was initiated in 1989.<sup>2</sup> Three broad types of intervention have been implemented. The mass media campaign, which accounts for about a third of the annual expenditure, uses television, radio, print, and other channels to inform the public about the dangers of smoking and environmental tobacco smoke. Over 100 advertisements have been produced to date, some of the most notable featuring former models and lobbyists for tobacco companies or Massachusetts citizens describing their personal suffering because of cigarette smoking. Services, which have accounted for over 40% of annual expenditure, include local treatment to help smokers quit, youth leadership programmes, telephone counselling, and educational materials. Promotion of local policies has accounted for 12-19% of expenditure and funds the work of local boards of health and others who help initiate, develop, pass, and enforce local tobacco control ordinances. Detailed descriptions of the various interventions and their budget allocations are available in the annual programme report.<sup>3</sup>

#### Sources of data

*Massachusetts tobacco surveys*—A baseline survey of adults and youths was conducted in 1993-4,<sup>4</sup> and monthly surveys of adults have been ongoing since March 1995, which are aggregated annually to provide

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yearly estimates.<sup>5</sup> Estimates of adult smoking prevalence are derived from household screening interviews with an adult informant who reported on smoking status for all adult members of the household. The net bias due to proxy reporting has been shown to be less than 0.5%.<sup>6</sup> We considered adults to be current smokers if they were reported to have smoked 100 cigarettes in their lifetime and currently smoked “every day or some days.”

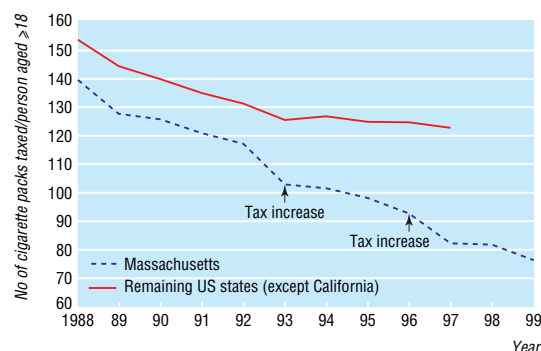
**Behaviour risk factor surveillance system (BRFSS)**—This is a population based telephone survey of health practices that is conducted by individual state agencies and supervised by the US Centers for Disease Control and Prevention. Although all 50 states currently participate in the surveillance system, only 42, including Massachusetts, participated consistently between 1989 and 1998. Using data from “core samples,” which are random samples of each state’s adult population, we estimated smoking prevalence for Massachusetts. For a comparison group, we pooled the survey data on 40 other states and the District of Columbia. This comparison group excludes California, which had an intensive antismoking programme in effect during that period. From 1996 onwards, the items used to define an adult smoker were identical to those used in the Massachusetts tobacco surveys. Before then, adult smokers were defined as those who reported having smoked at least 100 cigarettes in their lifetime and who smoked “now.” The earlier method has been found to yield an estimate of smoking prevalence that is about 1% lower than the current method.<sup>7</sup>

**Tobacco Institute reports**—We derived taxable cigarette consumption for Massachusetts and for the remaining US states other than California from monthly reports from the Tobacco Institute on tax receipts for wholesale cigarette deliveries.<sup>8</sup> Per capita rates (in packs per year) were based on the resident population aged 18 and over in Massachusetts and in the United States as a whole except for Massachusetts and California.

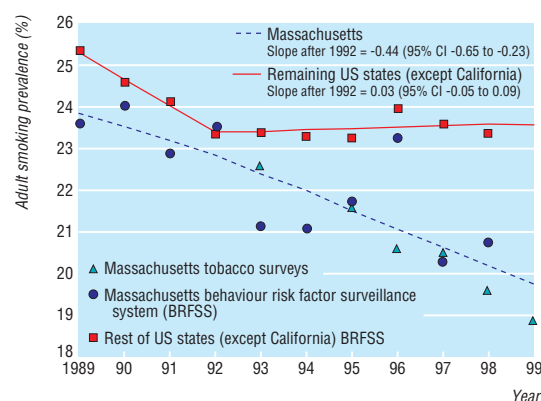
## Results

### Cigarette consumption

Figure 1 shows the annual per capita consumption of cigarettes in Massachusetts between 1988 and 1999 compared with the average consumption in the remaining states with the exception of California between 1988 and 1997 (the last calendar year for which data were available from the Tobacco Institute). From 1988 to 1992, the year before the tax was implemented, the declines in consumption for Massachusetts adults (15%) and for the average adult in the 48 comparison states (14%) were similar. This corresponds to an annual decline of 3-4% for each group. The following year consumption continued to decline by 4% in the comparison states but dropped 12% in Massachusetts in response to the tax increase. Price reductions by the major tobacco companies in the spring of 1993 made the retail cost of cigarettes in the state about the same as before the tax. Nevertheless, consumption in Massachusetts from 1993 onward has shown a consistent annual decline of more than 4%, while among adults in the 48 comparison states consumption levelled off, decreasing by less than 1% a



**Fig 1** Annual per capita cigarette sales (based on tax receipts for wholesale deliveries) in Massachusetts and in remaining 48 US states (excluding California)



**Fig 2** Trends in adult smoking prevalence in Massachusetts and remaining 48 states (excluding California)

year. This differential decline is a likely consequence of the tobacco control programme.

### Adult smoking prevalence

Figure 2 shows the point estimates of prevalence of adult smoking in Massachusetts and the comparison group (rest of United States). The data for Massachusetts are based on both the BRFSS from 1989 to 1999 and the Massachusetts tobacco surveys from 1993-4 (assigned to 1994) to 1999, while the comparison data are based on pooled BRFSS data for 40 states and the District of Columbia from 1989 to 1998. Table 1 shows the sample sizes for these estimates. The best fit regression lines fit the points to a linear spline (two connected line segments of varying slope) with a node at 1992, after which the Massachusetts tobacco control programme was implemented. We performed the regression analyses using STATA by weighted least squares, where the weights were equal to the inverse of the variance of each estimate. Standard errors were computed with programs that correct for the complex sampling design of the surveys. The Massachusetts regression line was drawn for the data points from both the BRFSS and the Massachusetts tobacco surveys.

For the rest of the United States, the slope after 1992 was 0.03% a year (95% confidence interval -0.06% to 0.12%), which is not statistically different

from zero ( $P=0.46$ ). For Massachusetts, the slope after 1992 was  $-0.43\%$  ( $-0.66\%$  to  $-0.21\%$ ) a year, which is significantly different from zero ( $P=0.001$ , by  $t$  test of the regression coefficient) and significantly different from the slope for the rest of the United States ( $P<0.001$ , by the Wald test). Hence, these data indicate that, after the tobacco control programme began, smoking prevalence among adults in Massachusetts declined at a significantly greater rate than among adults in other states where no comparable control programme was in effect.

## Discussion

Our analysis of the Massachusetts tobacco control programme shows that a strongly implemented, comprehensive control programme can reduce a population's health risks from tobacco use. Data on both cigarette consumption and smoking prevalence indicate a reduction in tobacco use in Massachusetts at a time when there has been little change in the rest of the country, with the exception of California. These results reinforce those from studies of the impact of the California tobacco control programme, which suggest that the programme produced a significant decline in the prevalence of adult smoking during its early years, which has continued at a slower rate in the most recent years.<sup>9 10</sup>

The impacts of particular aspects of the Massachusetts tobacco control programme have been presented in other studies. A prospective study of the impact of its antismoking television advertisements on children aged 12 and 13 years found that children who reported high levels of exposure to the advertisements in 1993-4 were only half as likely to be established smokers four years later as those who did not report early exposure to the advertisements.<sup>11</sup> The increase in the cost of cigarettes in Massachusetts has probably been an important factor in the decline of smoking in both adults and teenagers.<sup>12</sup> More than 3% of adult smokers reported that the 1993 price increase was part of the reason they stopped smoking, and a substantial number of adult and teenage smokers reported that they reduced their intake of cigarettes because of the increased cost.<sup>13</sup>

Massachusetts has spent more money per capita on tobacco control than any other US state. In 1998, 44 of the 50 other states plus the District of Columbia had provided little or no funding for tobacco control. The per capita expenditure of the six states that did provide funds ranged from \$0.24 to \$4.91.<sup>14</sup> Although \$6.50

**Table 1** Sample sizes from population surveys of prevalence of smoking

Year	BRFSS		
	Massachusetts	Rest of USA*	Massachusetts surveys
1989	1221	63 255	NA
1990	1291	70 809	NA
1991	1421	71 009	NA
1992	1463	76 227	NA
1993	1581	79 898	NA
1994	1771	81 313	21 909
1995	1768	86 974	5 736
1996	1781	95 400	6 175
1997	1742	105 485	7 423
1998	4944	113 214	6 229
1999	NA	NA	6 497

BRFSS=Behaviour risk factor surveillance system. NA=Not available.

\*Pooled data for the 40 states, excluding California, and District of Columbia that consistently participated in BRFSS.

per capita expenditure in Massachusetts is comparatively costly, it pales in comparison with the estimated smoking related healthcare cost to the state of \$2.4bn a year,<sup>15</sup> or \$600 for each man, woman, and child in Massachusetts. An initial econometric analysis of the impact of the Massachusetts programme indicates that, even with conservative assumptions, it has reduced the state's healthcare costs by \$85m annually (unpublished data).

Although tobacco consumption has generally been declining in most high income countries, it is increasing in developing countries, which are hard pressed to fund tobacco control interventions.<sup>16</sup> When considering the cost of tobacco control interventions, however, it is important to keep in mind the cost of failure to intervene. About 82% of the world's smokers live in low and middle income countries, which will bear the brunt of the expected 500 million tobacco related deaths among those smokers.<sup>17</sup> Our attempt to obtain information about expenditures outside the United States yielded little solid data, suggesting that national or state funding for tobacco control is quite rare (see table 2). There is an urgent need for investment in tobacco control. The World Health Organization is currently promoting a framework for tobacco control,<sup>16</sup> which, if implemented, could lead to substantial improvements in health internationally.

We acknowledge the important contributions to this paper of Amy L Nyman, Tory M Taylor, and Giulia Norton.

Contributors: LB coordinated the preparation of this paper and directed the design, data collection, and analysis of the Massachusetts tobacco surveys. WH directed the collection and

**Table 2** Per capita expenditures for tobacco control, by country or state or province. Values are in \$US (year for which data are available)

Australia	South Africa	France	Canada			USA	
			Ontario	British Columbia	UK	Massachusetts	California
0.48 (1997)	0.04 (current)	0.32 (current)	0.60 (2000-1)	1.11 (1999-2000)	0.89 (1999-2000)	6.50 (2000)	3.31 (2000)

Sources of data:

Australia—Population figures from Australian Bureau of Statistics, Jun 1998. Expenditure figures from personal communication with M Scollo, Centre for Behavioral Research in Cancer, Anti-Cancer Council of Victoria, Melbourne, 7 Mar 2000.

South Africa—Personal communication with Y Saloojee, National Council Against Smoking, 3 Mar 2000.

France—Personal communication with G Dubois, French Committee Against Smoking, 4 Feb 2000.

Ontario—Personal communication with T Stephens, Ontario Tobacco Research Unit, 8 Mar 2000.

British Columbia—Population figures from Statistics Canada, 1999. Expenditure figures from Ministry of Health.

United Kingdom—Population figures from Central Intelligence Agency.<sup>18</sup> Expenditure figures from Secretary of State for Health and Secretaries of State for Scotland, Wales and Northern Ireland.<sup>19</sup>

Massachusetts—Abt Associates.<sup>3</sup>

California—Farrelly et al.<sup>14</sup>

### What is already known on this topic

The state of California has had a comprehensive tobacco control programme in place since 1989

Analyses of smoking prevalence and cigarette consumption indicate significantly greater declines in California than in other US states since programme inception.

### What this study adds

Analysis of a well funded, comprehensive tobacco control programme in Massachusetts shows that, since its inception, the rate of decline of adult smoking has been significantly steeper than that in other US states except California

This study confirms that consistent, long term spending on antismoking advertisements, programmes to help people stop smoking, and promotion of tobacco control policies can reduce tobacco use in a population

analysis of the programme based data and wrote the sections of the paper that gave details of that methodology and the results. JEH performed the regression analysis of trends in prevalence of adult smoking using the BRFSS and Massachusetts data, wrote the description of this analysis, and prepared the figures related to the analysis. All three authors participated in drafting, editing, and revising the paper. Tory M Taylor helped gather data on expenditures for tobacco control and performed the literature review on the international health burden of tobacco use. Amy L Nyman managed the Massachusetts survey databases and performed analyses related to these surveys. Giulia Norton managed the Abt Associates data collection, prepared analysis files, and programmed the data analysis. The three authors are guarantors for the study.

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Competing interests: LB and WH work for organisations that are contractors to the Massachusetts tobacco control

programme. JEH has received compensation and research support through a public contract with the state of Massachusetts.

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## Targeting the kids



On p 362 Klein and St Clair present evidence indicating that some tobacco companies have allowed manufacturers of candy cigarettes (cigarette sweets) to use cigarette pack designs. Similar trademark infringement has been seen for many other products targeted at children. For example, the Tricked Squirt Cigarettes (shown here), which have a striking resemblance to Marlboro packaging, are intended for ages "5 and up." Instructions on the package tell users how to fill the "cigarette pack" with water and how to squirt it "at your target." The product was made in Hong Kong and distributed in 1999 by Air Host Inc (Memphis, Tennessee) to airport gift shops throughout the United States.

Whenever they are asked about this kind of trademark infringement, cigarette companies deny involvement in it and claim that they are aggressive in protecting their trademarks and copyrights. These companies, which spend hundreds of millions of dollars defending themselves in lawsuits, certainly have the means to protect their trademarks and to punish those who would dare to expropriate their valuable images and icons. Why, then, do so many companies fearlessly infringe on cigarette trademarks? Could it be that the cigarette makers' claims about protecting their copyrights don't hold water?

Ron Davis *North American editor, BMJ*

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