Hardening of the Target: Evidence From Massachusetts

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BACKGROUND For the greater part of the past two decades, adult cigarette smoking prevalence (defined as having smoked at least 100 cigarettes and smoked in the past month) has been steadily declining in the Commonwealth of Massachusetts and in the rest of the nation (Biener, Harris, and Hamilton 2000; CDC 1996; CDC 1999b). Since the beginning of the Massachusetts Tobacco Control Program (MTCP) in 1993/94, the smoking prevalence decline in Massachusetts is close to 2.5 times the national rate (minus California, which initiated a large tobacco control program in 1989) (Biener, Harris, and Hamilton 2000; Hamilton and Norton 2000; Hamilton, Norton, and Weintraub, 2001). Furthermore, when controlling for race/ethnicity, gender, and education level, Massachusetts has experienced significant declines since 1990 in smoking prevalence, while the rest of the nation, minus California, has not (Weintraub and Hamilton 2001).

Massachusetts' per capita consumption of cigarettes by adults (18-plus) is also declining. Since the start of the MTCP, it is declining at greater than 3.5 times the rate of decline of the rest of the nation, minus California (Biener, Harris, and Hamilton 2000). There is evidence that much of the early decline in adult smoking occurred among the more educated, more affluent population (U.S. DHHS 2000; Emery et al. 2000). This chapter examines changes in the characteristics of current smokers in Massachusetts from 1986 to 1999 and, where possible, compares their trends over time to those of current nonsmokers.

A commonly voiced opinion is that smokers are harder to treat or harder to reach now than a few years ago. With an estimated 340,000 fewer smokers in Massachusetts since 1986, logic posits that the "easy quits" would have occurred early in the process, leaving the target population of remaining smokers more hardened—i.e., less able physically or psychologically and/or less motivated to successfully quit as measured by number of quit attempts and intent to quit. These smokers might then be more nicotine-dependent as measured by time to first cigarette, number of cigarettes smoked per day, and use of a pack a day or greater. If they have tried to quit and failed, they may be more discouraged in their ability to quit successfully, less likely to continue to make quit attempts, and more adamant about remaining smokers. If earlier trends continued, they may also be less educated, less affluent, and perhaps less likely to have access to services.

Support for the premise of a hardening of the target is provided by an analysis of published studies of clinical treatment outcomes that controlled for type of services offered and revealed a significant linear trend toward less positive short-term cessation success since the 1980s (see Chapter 4). The author acknowledges that long-term quit success did not decline and posits environmental factors as a probable explanation. Over time, the participants in the studies that were part of the meta-analysis were also significantly more likely to be older, and when age was controlled in the analysis, the significant decrease in quit success was no longer evident.

In Massachusetts, anecdotal information from cessation providers and quantitative data from the Smoker's Quitline (Prout, Martinez, and Ballas 2001) provide limited support for this premise in that smokers in treatment services are smoking their first cigarette sooner upon awakening in 1999 than in 1994. There is evidence from demographic data collected through the Management Information Systems (MIS) that smokers using the Quitline counseling services, although not those using local cessation counseling, are also significantly older now than in 1994, with a mean age of 34.7 in 1993 and 39.2 in 2001. Abt Associates Inc. and Emery and colleagues (Abt Associates 2000, 2001; Emery et al. 2000) found age to be predictive of hardening in smokers. However, smokers in treatment are not smoking more cigarettes per day now than in 1994 (Prout, Martinez, and Ballas 2001; Hamilton and Norton 2000).

Data from national sources (see Chapters 7 and 8) do not support the thesis of a hardened target in the general population of current smokers in that smokers in states with lower rates of prevalence are not reporting higher numbers of cigarettes smoked (one proxy for dependence) over time. It is possible that current smokers in Massachusetts are not becoming more hardened and that the comprehensive public health model of changing social norms, while reducing access and providing treatment services, is still adequate to the task of reducing the morbidity and mortality associated with tobacco use.

An alternative hypothesis posits that the kinds of initiatives undertaken in Massachusetts (Hamilton and Norton 2000; Biener, Harris, and Hamilton 2000; CDC 1999a; Connolly and Robbins 1999; DiFranza, Celebucki, and Mowery 2001; Kozlowski et al. 2000; Bartosch and Pope 1999) and California (Gilpin et al. 2001; Pierce et al. 1998b) differentially affect the hardened core. From a health perspective, a tax increase differentially benefits those with higher marginal costs (relatively less disposable income, higher costs, or higher consumption) (CDC 1996; Chaloupka and Pacula 1999; Harris and Chan 1999; Wakefield and Chaloupka 2000). The increased social cost of smoking, like increased financial cost, may also differentially affect those with higher marginal costs—i.e., those who consume the most relative to their restricted opportunity or increased costs of smoking (Siegal, Biener, and Rigotti 1999; Wakefield et al. 2000). For example, a pack-per-day or greater smoker whose workplace becomes smokefree may have to quit smoking totally, or drastically reduce the number of cigarettes smoked, while one who smokes a few cigarettes may be able to accommodate

changing environmental constraints without altering consumption. Health-related symptoms that drive the smoker to quit or seek medical support may also be more likely to occur in this group, and physicians are known to intervene more often with smokers who are older, smoke more cigarettes, and have poorer health (Gilpin et al. 1993). Unfortunately, attrition (earlier death or disability) should also differentially affect this group as more-addicted smokers with longer smoking histories, presumably higher exposure to tobacco toxicity, and perhaps adjuvant unhealthy conditions (problem drinking, poor mental health, increased limitations) die sooner. This could leave the general population of remaining smokers less hardened in the long term.

If smokers who are less likely to be impacted by the increased "costs" of smoking, less likely to be exposed to interventions, less able to access services, or less successful with services offered increase over time as a proportion of the general population, then a hardening of the target could occur in the short term. For example, current smokers could become less affected by some policy initiatives over time; i.e., they could be less exposed or less responsive to the MTCP motivational/educational media campaign, not be working in employment covered by a smoking restriction, not have seen a physician, or not be covered by health insurance. Emery et al. (2000) describe the hardcore smoker in California (5.6% of current smokers in 1996) as more likely to be white, male, older, living without children in the home, feeling no family pressure to quit, educated at no higher level than high school, and earning $30,000 or less. Additionally, current smokers could be more likely to have other problems that make it more difficult to quit or easier to relapse, such as poor mental health (Lasser, Boyd, and Woolhandler 2000), physical disabilities (Brawarsky et al. 2002), limitations from these illnesses, or alcohol or drug problems. Furthermore, these conditions may also make it less likely that they would be affected by some of the MTCP's policy initiatives—e.g., work in a smokefree workplace.

The MTCP has always funded program components that address cessation as well as prevention of tobacco use, and the reduction of environmental tobacco smoke (ETS) exposure (Begay and Glantz 1997; Hamilton and Norton 2001). Access to free, on-demand telephone counseling services and free or sliding-scale community-based cessation groups has been a component of the program since its inception, as has outreach to harder-to-reach populations. A more complete discussion of MTCP tobacco treatment services can be found elsewhere (Hamilton and Norton 2000). Even as total funding decreased, tobacco treatment services were maintained at a fairly consistent percentage of overall funding (Hamilton and Norton 2001). It is also probable that the increased use of nicotine replacement products due to over-the-counter availability has benefited the more-addicted smoker (Biener, personal communication).

METHODS

Hypothesis

The change in smoking variables in the general population in Massachusetts would not provide evidence of a hardened target; that is, over time, current smokers would not be smoking more, smoking sooner upon awakening, attempting less quitting, or less inclined to quit. Similarly, it was expected that trends over time for smokers would not be toward becoming less educated, earning less money, less likely to be working for wages, less likely to have health insurance, less likely to have checkups, or more likely to have poor physical or emotional health, limited activities, or alcohol problems, or that the trends for these measures would not be worse for smokers than for nonsmokers. While differences between smokers and nonsmokers in these variables were anticipated, we did not expect the trends for these two groups to diverge over time. We hypothesized that the general population of current smokers would actually be less nicotine-dependent, more motivated to quit, and more likely to have had a medical checkup in the past year due in part to the MTCP.

Instruments

The data used for this chapter were collected through the Massachusetts Behavioral Risk Factor Surveillance System (BRFSS) from 1986 to 1999. The BRFSS is an annual, state-based, random-digit–dialed household telephone survey of health-related behaviors and conditions among adults 18 years of age and older that is conducted by all states in cooperation with the Centers for Disease Control and Prevention (CDC). Tobacco-use questions were first asked in 1986. The MTCP has augmented the BRFSS since 1994 with additional tobacco-related items and increased sample sizes. Topics and questions can vary from year to year.

During this reporting period, the Massachusetts BRFSS used a list-assisted methodology to sample households, and interviews were conducted with one randomly selected adult from each contacted household. The annual interview completion rate among contacted households ranged from 54% to 83%; the annual number of completed interviews ranged from 1,105 to 5,024. Completion rates were lower and the number of completed interviews higher in the later years. Characteristics of the BRFSS are described in detail elsewhere (CDC 1996).

Measures

Tobacco Use and Cessation Variables

"Current" smoking status is defined by two questions. In all years, all respondents were asked whether they smoked 100 cigarettes in their lifetime. From 1986 to 1995, those who responded "yes" were asked whether they now smoke cigarettes. In the 1996 to 1999 surveys, those who responded "yes" were asked whether they now smoke cigarettes every day, some days, or not at all. "Current smokers" are those adults who smoked 100 cigarettes in their lifetime and now smoke (1986 to 1995) or now smoke every day or some days (1996 to 1999). "Nonsmokers" are either those who did not smoke 100 cigarettes in their lifetime or those who smoked 100 cigarettes in their lifetime but do not now smoke. In 1994 and 1995, all smokers were asked, "On how many of the past 30 days did you smoke cigarettes?" "Daily smokers" are those who reported that they smoked 30 of the past 30 days in 1994 and 1995 and those who reported smoking every day for the 1996 to 1999 surveys.

From 1986 to 1999, all current smokers were asked about the number of cigarettes they smoked per day. From 1991 to 1993, all current smokers were asked if they quit smoking for one day or longer in the past year, and, between 1994 and 1999, daily smokers were asked the same question. In 1995 and from 1997 to 1999, nondaily smokers were asked whether or not they intentionally quit smoking for one day or longer in the past year. "Quit attempt" for daily and nondaily smokers combined, is reported for 1991 to 1993, 1995, and 1997 to 1999. From 1994 to 1999, all current smokers were asked whether or not they intended to quit in the next 30 days, whether or not they were thinking about quitting in the next 6 months, and how long after waking they smoked their first cigarette. "No intent to quit" is defined as no intent to quit in the next 30 days and not thinking about quitting in the next 6 months.

Demographic Variables During the years 1986 to 1999, respondents provided information on age, educational attainment, employment status, and income. "Less than high school" was defined as never attending school or completing a grade no higher than grade 11. "College graduate" was defined as completing 4 years or more of college. "Unable to work" was added as a separate response category to the employment status question in 1993. Therefore, "out of work/unable to work" is reported only for 1993 to 1999, while "employed for wages" is recorded since 1986 as one of the categorical responses, with "self-employed," "retired," and "out of work" as the other possible choices.

Health Status From 1992 to 1999, adults were asked about their health status. They were asked whether, in general, their health was excellent, very good, good, fair, or poor. In addition, during 1993 to 1999, adults were asked about their physical and mental health and whether they were limited in usual activities due to poor mental or physical health in the past month. "Poor mental health" was defined as having 14 or more days in the past month during which mental health was not good. "Activity limitation" was defined as having 14 or more days in the past month during which poor physical or mental health kept respondents from doing their usual activities.

Health Care Respondents were also asked about health care access. From 1991 to 1999, they were asked whether they had "any kind of health care coverage including health insurance, prepaid plans such as HMOs, or government plans such as Medicare." From 1987 to 1999, adults were asked how long it had been since they visited a doctor for a routine checkup. "No checkup in last year" was defined as those who did not answer "within the past year"; that is, they answered "within past 2 years," " 5 years," "more than 5 years," or "never."

Alcohol Use Questions about alcohol use were asked in 1986 to 1993 and in 1995, 1997, and 1999. "Problem drinking" was defined as consuming 5 or more drinks on any one occasion in the past month or consuming 60 or more drinks in the past month.

ANALYSIS Because BRFSS data are weighted to account for differential probability of selection and to partially adjust for nonresponse, SUDAAN was used to calculate *p* values that took into account the survey sampling scheme and weighting of the data (Shah, Barnwell, and Bieler 1996). Similarly, logistic regression was employed rather than chi-square for the trend test as the latter is not available in SUDAAN. Data for current rather than daily smokers were selected for analyses, because seven additional years could then be included. "Employed for wages" rather than "out of work/unable to work" is the preferred variable for the same reason.

Logistic regression models assessed trends over time in demographic, health status, health care access, and alcohol use characteristics for both current smokers and nonsmokers, and compared the trends of the two groups. We modeled the log odds of various characteristics (i.e., college graduate, fair/poor health, etc.). The independent variables were current smoking status, year, and an interaction term of current smoking status and year. The "year" term was used to test for trends for current smokers and nonsmokers in the following manner: In testing the trend for smokers, smokers were coded as 1 and nonsmokers as 0; coding was reversed when testing trends for nonsmokers, with nonsmokers coded as 1 and smokers as 0. The significance of the interaction term was used to test the difference in trends between smokers and nonsmokers. Similarly, linear regression was used with the same independent variables to assess trends over time in the continuous variable mean age.

Logistic regression models were also used to test trends over time in smoking characteristics among smokers. We modeled the log odds of smoking characteristics (i.e., quit attempt, less than 30 minutes to first cigarette after waking, greater than a pack a day). The independent variable was year. In addition, a linear regression model was used to test the trend in the mean number of cigarettes smoked per day.

RESULTS A total of 1,105 interviews were completed in 1986; 1,422 in 1987; 1,425 in 1988; 1,221 in 1989; 1,296 in 1990; 1,424 in 1991; 1,825 in 1992; 1,857 in 1993; 3,288 in 1994; 3,311 in 1995; 3,041 in 1996; 3,725 in 1997; 4,944 in 1998; and 5,024 in 1999. Table 9-1 depicts current smoking prevalence and smoking behaviors by year and by gender. Also displayed by year and by gender are the distributions of current smokers (Table 9-1) and current nonsmokers (Table 9-2) by education group, income level, employed for wages, out of work/unable to work, no health insurance, no checkup in past year, and the percentages of each with alcohol problems, poor mental health, fair/poor health, or those whose activities are limited by poor mental or physical health. Mean age is also recorded.

Table 9-1

Prevalence of Current Smoking by Year and Gender and the Distribution of Current Smokers by Year and Gender Across Demographic, Health-Related, and Tobacco-Dependence Characteristics,1986–1999

	Prevalence of Current Smoking													
Year	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
Current Smoker	27.9	27.6	27	23.7	24.1	22.9	23.5	21.1	22.3	22.7	22.7	20.5	21.1	19.3
Men	28.6	27.3	27.1	22	26.7	22.7	25.9	20.7	23.9	24.1	23.3	21	21.2	19.5
Women	27.2	27.9	26.8	25.1	21.8	23.1	21.2	21.4	20.7	21.5	22.2	20.2	21	19.1
	Distribution of Current Smokers by Year and Gender Across Demographic Characteristics													
Current Smokers														
Education: All														
<HS	20.9	17.1	21.1	18.2	18.3	16.4	14.6	15.1	14.9	13.6	17.3	12.5	13.4	13.8
HS grad	37.6	39.1	39.3	38.9	41.8	43.9	42.6	41.3	39.6	37.7	38.4	38.5	40.9	37.8
Some college	21.9	23.7	24	24.1	22.6	23.6	22	23.6	26.8	31.1	27.6	29	29.7	26.9
College grad	19.5	20.1	15.6	18.7	18.3	16.1	20.8	20	18.7	17.6	16.7	20	15.9	21.6
Education: Men														
<HS	26.5	19.9	22.9	16.3	19.9	19.5	17.2	18.1	13.4	15.1	22.2	11.6	14	15
HS grad	34.8	34.5	41.8	40.9	37.7	43	41	41	40	31.7	36.1	41.9	43.1	37
Some college	16.8	21.7	19.2	20.3	22.1	16.6	22.1	19.4	25	33.1	23.3	27.4	26.5	27.1
College grad	21.9	23.9	16.1	22.5	20.3	20.8	19.7	21.5	21.7	20.1	18.4	19	16.4	20.9
Education: Women														
<HS	15.8	14.7	19.6	19.6	16.7	13.8	11.8	12.4	16.5	12.1	12.7	13.4	12.9	12.7
HS grad	40.2	43.2	37.1	37.5	44.1	44.6	44.3	41.5	39.2	43.7	40.6	35.2	38.9	38.5
Some college	26.7	25.4	28.3	27.1	23.1	29.6	21.8	27.3	28.6	29.1	31.6	30.5	32.7	26.7
College grad	17.3	16.7	15.1	15.8	16.1	12	22.1	18.8	15.7	15	15.1	20.9	15.5	22.1
Income: All														
<$25,000	50.7	45.1	41	41.3	43.5	49.3	49	39.1	38.5	36.4	32.8	30.6	32.9	31.2
$25,000–34,999	16	15.3	20	16.2	15.3	17.5	13.7	18	24.9	15.2	22.4	16.2	18.3	16.1
$35,000–49,999	16.7	16.9	13	17	18.2	15.9	19.4	17.5	16.5	18.7	20.7	21.5	23.4	19.9
$50,000+	16.5	22.7	25	25.6	22.9	17.3	17.8	25.3	20.1	29.7	24.1	31.7	25.3	32.8
Income: Men														
<$25,000	49.5	46.5	37.7	37.7	35.3	38.2	42.2	39.4	33.1	27.9	26.7	32.6	29.2	30.7
$25,000–34,999	15.7	16.4	18.1	17.5	19.2	19.7	16	17.8	26.7	14.9	23.2	12.6	16.7	15.4
$35,000–49,999	21.1	14.7	13.3	20.1	23.5	23	23.3	18.2	19.2	21.4	22.4	23.6	23.1	17.4
$50,000+	13.7	22.4	30.8	24.7	22	19.1	18.5	24.6	21.1	35.9	27.6	31.2	31	36.3

continued

Table 9-1 (continued)

Distribution of Current Smokers by Year and Gender Across Demographic Characteristics (continued)

Year	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Income: Women														
<$25,000	51.7	44.7	43.6	44	52.9	58.9	56.9	38.9	44.5	44.5	38.5	28.6	36.5	31.6
$25–34,999	16.6	12.9	21.5	15.2	10.9	15.8	11.1	18.1	22.9	15.5	21.6	19.5	19.9	16.9
$35–49,999	12.8	19.3	14.7	14.6	12	9.7	15	17	13.5	16.2	19.1	19.6	23.7	22.2
$50,000+	18.9	23.1	20.1	26.3	24.2	15.6	17	26	19	23.9	20.8	32.2	19.9	29.3

Percentage of Current Smokers with Various Health-Related and Tobacco-Dependence Characteristics by Year and Gender

Current Smokers														
Empl. for Wages														
All	67.1	67.3	60.5	61	54.3	62.9	63.1	60.4	61	57	59.1	62.2	70	61.6
Men	68.9	72.4	63	66.5	60.6	68.2	59.7	61.5	64	61.5	61.2	66.3	71.7	62.1
Women	65.4	62.9	58.2	56.8	47.7	57.9	67	59.5	58	52.4	57.1	58.4	68.4	61.1
Out of Work/Unable to Work (18–64)														
All								15.5	11.1	13.7	14.4	15.1	9.7	11.9
Men								13.8	10.4	12	13.5	14.2	10.3	12.5
Women								17	11.7	15.5	15.3	16	9.1	11.4
No Health Insurance (18–64)														
All						18.1	19.4	21.7	18.6	18.7	20.9	16.6	18.2	13.3
Men						25.6	21.6	26.1	20.1	18.7	24.6	19.7	21.2	17.1
Women						10.9	16.9	17.6	17	18.8	17.1	13.7	11.4	9.8
No Checkup in Last Year														
All		32.5	36.4	37.4	38.2	37.3	28	37.9	37.1	38.9	34.1	33.9	31.1	26.7
Men		37.7	44.7	41.8	43.1	47.1	34.3	44.5	44.2	50.1	40.5	42.9	44.2	35.7
Women		28.1	29	34.1	32.9	29	23.2	32	31	27.7	28.1	25.7	19.1	18.4
Fair/Poor Health														
All							10.3	13.4	13.7	13.8	13.6	13	12.2	17.6
Men							11.8	14.4	9.4	15.1	12.8	14	13.1	17
Women							8.7	12.5	18.2	12.4	14.3	12.1	11.4	18.2
Poor Mental Health: 14+ Days in Last Month														
All	16.9	17.5	16.8	16.8	15.8	13	13.1							
Men	16.5	12.4	14.5	12.7	16.8	11.3	10.4							
Women	17.3	22.7	18.9	20.8	14.9	14.6	15.5							
Activities Limited by Poor Physical or Mental Health: 14+ Days in Last Month														
All								7	8.3	7.4	8.1	8.2	5.9	11
Men								7.3	8.6	7.9	7.1	8.9	6.8	8.4
Women								6.7	7.9	6.8	9.1	7.5	5.2	11.6

continued

Table 9-1 (continued)

Percentage of Current Smokers with Various Health-Related and Tobacco-Dependence Characteristics by Year and Gender (continued)

Year	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Alcohol Problem (Binge or Chronic Drinker)														
All	37.9	32.9	32.2	28.2	30.1	32.4	31.1	29.4		27.6		35.9		34.3
Men	55.1	48.8	42.9	46	37	45.4	43	39.6		35.6		49.7		43.2
Women	22.1	19.3	22.8	14.4	22.8	21.2	17.7	20.7		19.7		23.2		26
Quit Attempt														
All						55.1	53.8	60.5		59.7		58.9	57.3	63.5
Men						53	49.1	66.8		63.8		59.7	55.7	64.2
Women						56.7	59.3	54.9		55.5		58.2	58.7	62.9
Plan to Quit in Next 30 Days														
All									30.1	29.5	30.1	38.8	41.9	37.9
Men									29.9	33.5	30.8	38.2	44.5	40.8
Women									30.2	25.5	29.4	37.6	39.5	38.7
Time to First Cigarette <= 30 Minutes														
All									49.7	49.9	53.4	51	55.5	53.5
Men									51.3	54.2	57.5	51.5	62.4	53.1
Women									48	45.5	49.4	50.5	49.1	53.9
Mean Number Cigarettes Smoked per Day*														
All	20.3	18.7	19.4	20.1	19.3	19.2	18.7	16.7	15.9	17.4	16.6	15.6	16.2	15.4
Men	22.6	20.1	21.9	23	20.7	21.3	20.3	17.5	16.9	19.2	18.5	16.2	18.7	17.3
Women	18.4	17.6	17.2	17.9	17.8	17.4	17	15.9	14.8	15.6	14.7	14.9	13.9	13.6
Smoke More Than 1 Pack per Day*														
All	26.7	22.9	24.2	26.3	24.5	23.1	23.3	16.8	16.2	17.5	17.2	17.2	18.8	15.7
Men	32.3	25.3	30.7	37.6	30.5	31.7	26.3	19.7	19.5	20.8	22.2	17	24	21
Women	21.7	20.9	18.5	17.7	18	15.7	19.9	14.2	12.7	14.2	12.5	17.4	14	11
No Intent to Quit Smoking														
All									28	26.8	28	26.1	24.6	27.2
Men									31.6	24.4	28.2	26.8	24.6	25.9
Women									24.1	29.1	27.8	25.5	24.7	28.3
Age (Mean Age)														
All	39.9	40.5	39.8	40.9	40.4	39.8	39.3	39.5	40.9	40.6	42.1	39.7	38.8	41.6
Men	39.2	40.2	39.7	39.1	40.4	38.5	38.7	38.4	41.9	39	40.8	38.8	38.5	41.5
Women	40.6	40.6	40.1	42.2	40.4	41	39.9	40.4	39.8	42.1	43.4	40.6	39.1	41.7

* Includes some day and every day smokers. There was a change in questions and response categories in 1994. From 1986–1993, "On the average, about how many cigarettes a day do you now smoke?" was asked of daily and nondaily smokers. "Don't smoke regularly" was a response category. Therefore, the number of cigarettes smoked per day for "don't smoke regularly" is not included above for 1986–1993. Starting in 1994, daily smokers were asked the same question and nondaily smokers were asked, "On the average, when you smoked during the past 30 days, about how many cigarettes did you smoke a day?" There was no response category "don't smoke regularly." Also, there was a change in coding in 1994. Up to 1993, the maximum number of cigarettes smoked per day was 87. In 1994, that number changed to 76. Therefore, for 1986–1993, if number of cigarettes >76, number of cigarettes was set to 76.

Table 9-2
Distribution of Nonsmokers by Year and Gender for Demographic and Health-Related Characteristics, 1986–1999

	Distribution of Nonsmokers Across Demographic Characteristics													
Year	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
Not Current Smokers														
Education: All														
<HS	12.5	14.9	10.2	13.8	11.7	13.1	9.8	10.3	10.1	9.6	11.1	7.6	6.5	7.4
HS grad	29.4	27.2	29	25.5	30	27.8	28.4	25.3	27.2	25.7	24.6	27	28.3	28
Some college	25.4	25	25.8	25.8	23.8	24.8	22.4	25.7	25	23.7	25.1	26.4	25.5	24.5
College grad	32.7	32.9	35.1	34.9	34.5	34.3	39.4	38.6	37.7	41	39.1	39	39.6	40.1
Education: Men														
<HS	12.6	13.9	8	13.3	10.8	15.3	9.4	9.3	8.7	9.3	10.7	7.3	6.8	7
HS grad	24.6	24.6	26.3	22.9	29.4	22.1	27.3	24.8	26.2	23.7	23.3	25.7	26.7	27.3
Some college	23.5	22.2	28.6	23	23.6	24.9	20.1	23.7	24.4	20.6	22.1	25.5	23.7	22.6
College grad	39.3	39.3	37.1	40.8	36.2	37.7	43.1	42.2	40.7	46.5	44	41.5	42.9	43.1
Education: Women														
<HS	12.5	15.8	12	14.3	12.4	11.2	10.1	11.3	11.3	10	11.5	7.9	6.3	7.7
HS grad	33.5	29.5	31.4	27.9	30.5	32.8	29.3	25.8	28	27.5	25.8	28.1	29.8	28.7
Some college	27	27.5	23.3	28.3	24	24.8	24.3	27.6	25.5	26.4	27.8	27.2	27.2	26.1
College grad	27.1	27.3	33.3	29.6	33.1	31.3	36.3	25.3	35.1	36.2	34.9	36.8	36.7	37.4
Income: All														
<$25,000	41.9	39.3	34.3	36	30.3	34.9	31.4	32.2	31.8	26.2	25.3	24.1	22.9	19.3
$25,000–34,999	20.7	15.8	19.9	15.9	16.4	14.3	15.5	13.6	14.4	15	15.2	15.5	12.9	12.5
$35,000–49,999	15.7	19	18.2	17.2	21	18.9	19	17.7	19.5	18.2	17.5	20.6	19.7	17.2
$50,000+	21.6	25.8	27.6	30.9	32.3	31.9	34.1	36.5	34.3	40.5	42	39.9	44.4	51.1
Income: Men														
<$25,000	35.2	32.5	28.1	31.3	25	31.1	25.2	28.6	26.3	22.7	21.4	20.9	17.6	15.6
$25,000–34,999	22.3	19.2	23.9	14.7	18.9	14.2	18	13.4	15.5	16.4	15	13	14.1	12.9
$35,000–49,999	17.4	22.7	18.1	17.6	21.5	21.1	19.8	20.5	21.3	17.5	17.3	20.4	19.9	16.7
$50,000+	25.1	25.5	29.9	36.4	34.6	33.6	37	37.5	36.9	43.4	46.3	45.7	48.4	54.8
Income: Women														
<$25,000	47.7	45.5	40	40.4	34.7	38.3	36.6	35.5	36.7	29.5	28.9	27.2	28.2	22.9
$25,000–34,999	19.5	12.7	16.1	17	14.3	14.4	13.4	13.8	13.4	13.8	15.3	17.8	11.8	12
$35,000–49,999	14.3	15.7	18.4	16.8	20.6	16.8	18.3	15.2	17.9	18.9	17.8	20.8	19.5	17.7
$50,000+	18.5	26.1	25.5	25.8	30.3	30.5	31.7	35.5	32	37.9	38.1	34.2	40.4	47.4

continued

Table 9-2 (continued)

Percentage of Nonsmokers With Various Health-Related Characteristics

Year	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Not Current Smokers														
Empl. for Wages														
All	55.2	59.4	56.3	51.4	56.6	52.9	54	56.9	58.5	57	58.9	58.4	59.2	57.3
Men	65.6	69.5	61.5	55.8	65.7	55.3	62.1	64	65.3	62.3	65.5	64.7	65.7	61.7
Women	46.2	50.6	51.7	47.6	49.3	50.7	47.1	50.4	52.8	52.5	53.1	52.9	53.3	53.3
Out of Work/Unable to Work (18–64)														
All								7.5	6.5	6.2	6.3	6	5.8	6.5
Men								6.7	6.4	5.7	6.5	6.3	4.5	6.5
Women								8.3	6.5	6.5	6.1	5.8	7.5	6.6
No Health Insurance (18–64)														
All						8.6	8.3	6.9	10	10	10.8	8.7	7.8	7
Men						8.2	10	7.8	11.5	10.7	12.1	10.4	8.5	8
Women						9	6.8	6	8.6	9.4	9.6	7.1	7.2	6
No Checkup in Last Year														
All		36.3	30.3	31	30	27.9	25.2	24.2	26.9	27.1	27.3	20.9	20.2	20.3
Men		47.7	39.1	41.6	40.7	33.3	29.2	30.8	33.8	36.1	36.8	28.5	26.9	26.9
Women		26.3	22.8	21.5	21.4	23.1	21.9	18.3	21.1	19.3	18.9	14.2	14.3	14.4
Fair/Poor Health														
All							8.3	9.3	10.6	11.7	12.2	11.5	9.7	10.1
Men							6.9	9.1	9.7	11.4	11.4	11.2	8.7	10.5
Women							9.4	9.4	11.3	12	12.9	11.8	10.5	9.8
Poor Mental Health: 14+ Days in Last Month														
All	7.6	9.2	8.1	8.1	7.5	7	6.5							
Men	5.2	8.2	6.5	6	6.7	5.2	6.4							
Women	9.8	10.1	9.6	9.9	8.2	8.6	6.6							
Activities Limited by Poor Physical or Mental Health: 14+ days in last month														
All								4.3	4.8	4.7	3.9	4.9	4.5	4.9
Men								4.2	5.7	3.6	3.7	5.1	3.8	5.5
Women								4.4	4	5.7	4.1	4.7	5.1	4.3
Alcohol Problem (Binge or Chronic Drinker)														
All	21.3	18.2	15.2	19.4	16	17	17.4	17.7		15.6		14.9		14.6
Men	29.9	30.7	24.3	31.7	28.5	26.5	25.7	28.3		26.5		23.1		22.7
Women	13.9	7.2	7.2	8.2	5.9	8.8	10.4	8.1		6.3		7.6		7.4
Age (Mean Age)														
All	45.4	45	44.5	44.7	45.7	45.9	45	44.9	44.8	45.7	45.2	46	46.1	46.5
Men	43.6	42.8	42.6	43.2	44.1	44.4	43.5	43.1	42.8	44.5	44	44.5	44.6	45
Women	46.9	46.9	46.1	46.1	47	47.1	46.3	46.5	46.5	46.8	46.3	47.4	47.6	47.9

Table 9-3
Results of Regression Analyses for Trends Over Time and Differences in Trends in Various Characteristics of Smokers and Nonsmokers

Logistic Regression		Smokers		Nonsmokers		Comparison of Smokers to Nonsmokers	Difference in Trend
Variable	Years	Trend	*p* value (Trend)	Trend	*p* value (Trend)	*p* value (Difference in Trend)	
Less Than High School	1986–99						
All		Decrease	0.0001	Decrease	<.0001	0.0808	
Men		Decrease	0.0020	Decrease	<.0001	0.6103	
Women		Decrease	0.0200	Decrease	<.0001	0.0410	Nonsmokers, > dec
College Graduate	1986–99						
All		Increase	0.7988	Increase	<.0001	0.0314	Nonsmokers, > inc
Men		Decrease	0.3036	Increase	0.0082	0.0368	
Women		Increase	0.1336	Increase	<.0001	0.3978	
Out of Work (age 18–64)	1993–99						
All		Increase	0.0026	Increase	0.0042	0.6533	
Men		Increase	0.0800	Increase	0.0200	0.8976	
Women		Increase	0.0089	Increase	0.0617	0.4316	
Employed for Wages	1986–99						
All		Increase	0.6066	Increase	0.0065	0.3691	
Men		Decrease	0.7856	Increase	0.6352	0.6353	
Women		Increase	0.3197	Increase	0.0009	0.4474	
High Income	1986–99						
All		Increase	<.0001	Increase	<.0001	0.0001	Nonsmokers, > inc
Men		Increase	<.0001	Increase	<.0001	0.0684	Nonsmokers, > inc
Women		Increase	0.0431	Increase	0.0020	0.0003	Nonsmokers, > inc
Low Income	1986–99						
All		Decrease	<.0001	Decrease	<.0001	0.0959	
Men		Decrease	<.0001	Decrease	<.0001	0.2769	
Women		Decrease	<.0001	Decrease	<.0001	0.2259	

continued

Table 9-3 (continued)

Variable	Years	Smokers: Trend	Smokers: *p* value (Trend)	Nonsmokers: Trend	Nonsmokers: *p* value (Trend)	Comparison of Smokers to Nonsmokers: *p* value (Difference in Trend)	Difference in Trend
Logistic Regression							
No Health Insurance (age 18–64)	1991–99						
All		Decrease	0.0056	Decrease	0.0633	0.2706	
Men		Decrease	0.1418	Decrease	0.2689	0.2193	
Women		Decrease	0.0109	Decrease	0.1074	0.0466	Smokers, > dec
Fair/Poor Health	1992–99						
All		Increase	0.0557	Increase	0.5885	0.1603	
Men		Increase	0.1298	Increase	0.3365	0.4114	
Women		Decrease	0.2419	Decrease	0.8557	0.2648	
No Checkup in Past Year	1987–99						
All		Decrease	0.0025	Decrease	<.0001	0.0006	Nonsmokers, > dec
Men		Decrease	0.7203	Decrease	<.0001	0.0001	Nonsmokers, > dec
Women		Decrease	<.0001	Decrease	<.0001	0.3804	
Poor Mental Health	1993–99						
All		Decrease	0.0082	Decrease	0.0044	0.6496	
Men		Decrease	0.1645	Decrease	0.4323	0.5080	
Women		Decrease	0.0175	Decrease	0.0009	0.8389	
Activities Limited	1993–99						
All		Increase	0.5250	Increase	0.6869	0.7590	
Men		Decrease	0.8841	Increase	0.6873	0.7212	
Women		Increase	0.2813	Increase	0.8856	0.3904	
Alcohol Problem							
All		Increase	0.6384	Decrease	0.0001	0.0089	
Men		Decrease	0.3087	Decrease	0.0003	0.2668	
Women		Increase	0.0636	Decrease	0.0596	0.0085	
Linear Regression							
Age							
All		Increase	0.0012	Increase	0.0230	0.1765	
Men		Increase	0.0072	Increase	0.0605	0.2676	
Women		Increase	0.0420	Increase	0.1528	0.3925	

Table 9-4
Results of Linear and Logistic Regressions for Trends Over Time in Various Behaviors of Smokers

		Linear Regression		Logistic Regression	
Variable	**Years**	**Change**	***p* value**	**Change**	***p* value**
Current Smoker	1986–99				
All				Decrease	<.0001
Men				Decrease	<.0001
Women				Decrease	<.0001
Quit Attempt	1991–93, 1995, 1997–99				
All				Increase	0.035
Men				Increase	0.1511
Women				Increase	0.1193
Plan to Quit	1994–99				
All				Increase	<.0001
Men				Increase	0.0003
Women				Increase	<.0001
No Intent to Quit	1994–99				
All				Decrease	0.5017
Men				Decrease	0.3002
Women				Increase	0.8712
<=30 Minutes to First Cigarette	1994–99				
All				Increase	0.1407
Men				Increase	0.464
Women				Increase	0.1369
Number of Cigarettes/Day					
All		Decrease	<.0001		
Men		Decrease	<.0001		
Women		Decrease	<.0001		
>1 Pack/Day					
All				Decrease	<.0001
Men				Decrease	0.0003
Women				Decrease	0.0008

Changes in trends over time were tested for the prevalence of a variety of demographic, health status, and health care characteristics, for current smokers as compared with the rest of the population (not current smokers), overall, and by gender. For smokers, change over time in tobacco use and cessation variables was also tested; i.e., mean number of cigarettes smoked per day, smoking over one pack per day, smoking within 30 minutes of waking, past-year quit attempts, intention to quit in next 30 days, and not thinking about quitting within the next 6 months. Table 9-3 depicts the *p* values associated with the trends over time for smokers and nonsmokers and the difference in trends. Table 9-4 depicts the *p* values associated with the trends in tobacco use and cessation variables.

Change in Tobacco-Use and Cessation Variables

Results indicate no support for a hardening of the target among current smokers, and on several measures there is evidence of less tobacco dependence now than in 1986. As noted in Table 9-4, the percentage of current smokers reporting a past-year quit attempt and intention to quit smoking within the next 30 days has significantly increased over time. Similarly, the reported number of cigarettes smoked per day has decreased as have those reporting smoking greater than a pack (20 cigarettes) per day. Patterns for women and men are similar.

There was no significant change in the percentage reporting that they smoke within the first 30 minutes after awakening. But contrary to prediction, there was a suggestion among women of an increase in this variable ($p = 0.14$). There was virtually no change in those who report no intent to quit within the next 6 months.

In summary, changes for current smokers are either in the hypothesized direction of less hardening or are unchanged. No evidence supports a hardening. Smokers do not appear to be less motivated to quit in terms of past quitting history, less likely to quit in next 30 days, or less likely to be thinking about quitting in the next 6 months.

Change in Demographic and Health-Related Variables

Table 9-3 displays the results of logistic and linear regressions for changes over time in various demographic and health-related characteristics for smokers and nonsmokers, and it presents the *p* value of tests for differences in the trends between smokers and nonsmokers. The proportion of those with less than a high school education has significantly decreased over time for both smokers and nonsmokers. The decrease was significantly greater for nonsmoking women than smoking women. There was an increase in college graduates over time among nonsmokers, but not among smokers, and the significant difference between smokers and nonsmokers was largely attributable to changes among men. The population is aging in Massachusetts and trends were significant for smokers and nonsmokers, but there were no significant differences between smokers and nonsmokers.

Significant decreases were evident over time in the lowest income group, with comparable increases in the highest income group. Compared with smokers, the increase in the percent reporting high income was significantly greater for nonsmokers overall and for nonsmoking women, and was suggestive for nonsmoking men. There were increases in the percentage of smokers and nonsmokers who were out of work/unable to work, but no significant differences between them.

The percentage reporting no health insurance declined among smokers (aged 18 to 64), attributable primarily to declines among women, and this decline was greater for women who smoke as compared with those who do not. Declines in the percentage of nonsmokers who reported no health insurance were also suggestive ($p = 0.063$). The percentage of smokers reporting no checkup in the past year declined, a decrease again driven primarily by women, but nonsmokers compared with smokers had a significantly greater decline overall and for men.

There is a suggestion ($p = 0.06$) that an increased proportion of smokers reported being in fair or poor health, while there was no discernable trend among nonsmokers. The difference between smokers and nonsmokers did not reach significance. Among both smokers and nonsmokers, there were reported declines in poor mental health and these were significant for women. However, there was no difference between smokers and nonsmokers in the trend in this measure. There were no significant trends in the percent reporting limited activities over time.

Nonsmokers reported fewer alcohol problems, while smokers did not, and the difference between the trends for smokers and nonsmokers was significant. Self-reported alcohol problems decreased significantly among nonsmoking men, but not among smoking men. The marginal decreases in self-reported problems with alcohol among nonsmoking women ($p = 0.06$) and the marginal increases among smoking women ($p = 0.06$) resulted in a significant difference in trends among women.

DISCUSSION There is scant evidence that smokers in Massachusetts have become more hardened. The results generally show that the residual population of smokers is declining in tobacco dependence and increasing in access to economic and health resources even with the successful implementation of the MTCP. Decreases in tobacco dependence are substantiated by declines in the mean number of cigarettes smoked per day and the percentage of smokers smoking more than one pack per day. In addition, the percentage of smokers reporting a quit attempt in the past year or who plan to quit in the next 30 days increased. The percentage of smokers reporting that they smoke within the first 30 minutes of waking did not change over time, and there was no significant change in the percentage reporting no intent to quit in the next 6 months. Increases in access to resources are documented by the significant decreases in the percentage of smokers with low education, low income, no health insurance, no past-year checkup, and significant increases in those with high income. Smoking women were less likely over time to have no health insurance, no past-year checkups, and poor mental health, but were marginally more likely to report alcohol problems.

While smokers have made significant gains in education and income over the 13 years covered in this study, they have not done so to the same extent as nonsmokers. This divergence is due in part to significantly steeper trends that favored nonsmokers compared with smokers with respect to increases in the percentage with college degrees, decreases among women with less than a high school education, and increases overall and among both women and men in the percentage reporting high income. Additionally, directional differences in trends over time among men with college degrees (nonsignificant decreases among smokers and significant increases among nonsmokers) resulted in significantly greater increases for nonsmokers.

While the increase over time among smokers who reported being out of work or unable to work is consistent with a harder-to-reach, less advantaged or more-hardened smoking population, a comparable increase was evident

among nonsmokers. And since the difference in trends between the two groups was not significant, it is unlikely that this increase is related solely to smoking. The percentage of women without health insurance decreased significantly for smokers but not for nonsmokers, and the difference was significant. The percentage of the population who did not receive a health care checkup in the last year declined over time for female smokers, female nonsmokers, and male nonsmokers, but did not decrease for male smokers. The difference between smokers and nonsmokers was significant overall and for men, favoring nonsmokers.

Finally, with respect to health-related variables that could influence smoking, there were no significant differences over time between smokers and nonsmokers in the percentage reporting poor mental health or limited activity. However, smokers were marginally more likely to increase reporting fair/poor health ($p = 0.06$) over time. It is likely that age differentially affects the health status of smokers compared with nonsmokers, and this effect could account for the marginal increases in reports of fair and poor health among smokers. There was no significant change in smokers' reports of alcohol problems, but alcohol problems among nonsmokers have significantly declined over time, and the difference between smokers and nonsmokers over time is significant. This is especially true for women.

In summary, these trends do not suggest that the population of smokers who remains is more addicted, more resistant to cessation messages, less likely to attempt cessation, or increasingly composed of those with limited activities or poor mental health. However, there is concern that, if program resources are reduced or an economic slowdown diminishes the economic or educational opportunities presently available, smokers may benefit less from the tobacco control initiatives because they are not as economically advantaged as nonsmokers. Should this occur, the target may harden.

LIMITATIONS These findings should be interpreted in light of some important limitations. First, households without telephones have no opportunity to participate in the survey. Second, BRFSS data are based on self-report and subject to resultant biases. Respondents may overreport socially acceptable behaviors and underreport behaviors deemed unacceptable. The response rate to the BRFSS during the years 1986 to 1999 ranged from 54% to 83%. If smoking status was different for people who did not respond to the survey, there could be a bias in the analysis. In addition, many of these observations were made over a relatively short interval of time when there was a relatively small change in smoking prevalence. This may limit the ability to detect trends in mental health and substance abuse behaviors that result from the difficulty in achieving long-term abstinence by smokers with these problems.

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