Changes in Cross-Sectional Measures of Cessation, Numbers of Cigarettes Smoked per Day, and Time to First Cigarette—California and National Data

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INTRODUCTION Per capita consumption of cigarettes and smoking prevalence have been declining since the 1960s (U.S. DHHS 2000), but trends in these measures ceased to decline and became flat during the mid-1990s. These observations suggest that smoking cessation rates may also have fallen because those who could easily quit may have done so and left behind a more-addicted and hardened target population of smokers.

This chapter presents the decline in national cessation rates observed between the 1992/93 and 1995/96 Current Population Surveys (CPS) and explores whether these declines in cessation are accompanied by changes in smoking behavior or in the pattern of cessation activity consistent with hardening of the residual smoking population. Data from the 1990, 1996, and 1999 California Tobacco Surveys (CTS) are also examined. California has experienced a decline in both per capita consumption and prevalence over the last decade well in excess of that seen nationally (Gilpin et al. 2001). If a hardened population of residual smokers is developing because those who could be induced to quit using current tobacco control strategies have already quit, then it might be most evident in California where the largest gains in reducing smoking with current tobacco control approaches have occurred. Changes in cessation, number of cigarettes smoked per day, and time to first cigarette (a measure of addiction) occurring between 1990 and 1999 in California are explored for evidence of hardening.

CHANGES IN NATIONAL CESSATION RATES AND NUMBER OF CIGARETTES SMOKED PER DAY One of the clearest measures of change in smoking behavior is the per capita consumption of cigarettes. Figure 8-1 presents the U.S. per capita consumption from 1950 to 2000. It shows a progressive decline from 1974 through the early 1990s. However, between 1993 and 1996, there was very little change in per capita consumption, and the total consumption of cigarettes was also essentially unchanged. This flattening in the per capita consumption trend is one of the lines of evidence raising concerns that smokers are becoming unresponsive to existing tobacco

control approaches. However, following the Master Settlement Agreement (MSA) of the state attorneys general's litigation against the tobacco companies in 1998, and the subsequent substantial increase in the cost of cigarettes, per capita consumption declined steeply. This suggests that, at least as far as cost as a tobacco control intervention is concerned, the population of smokers in 1997 remained responsive to environmental measures previously shown to alter smoking behavior.

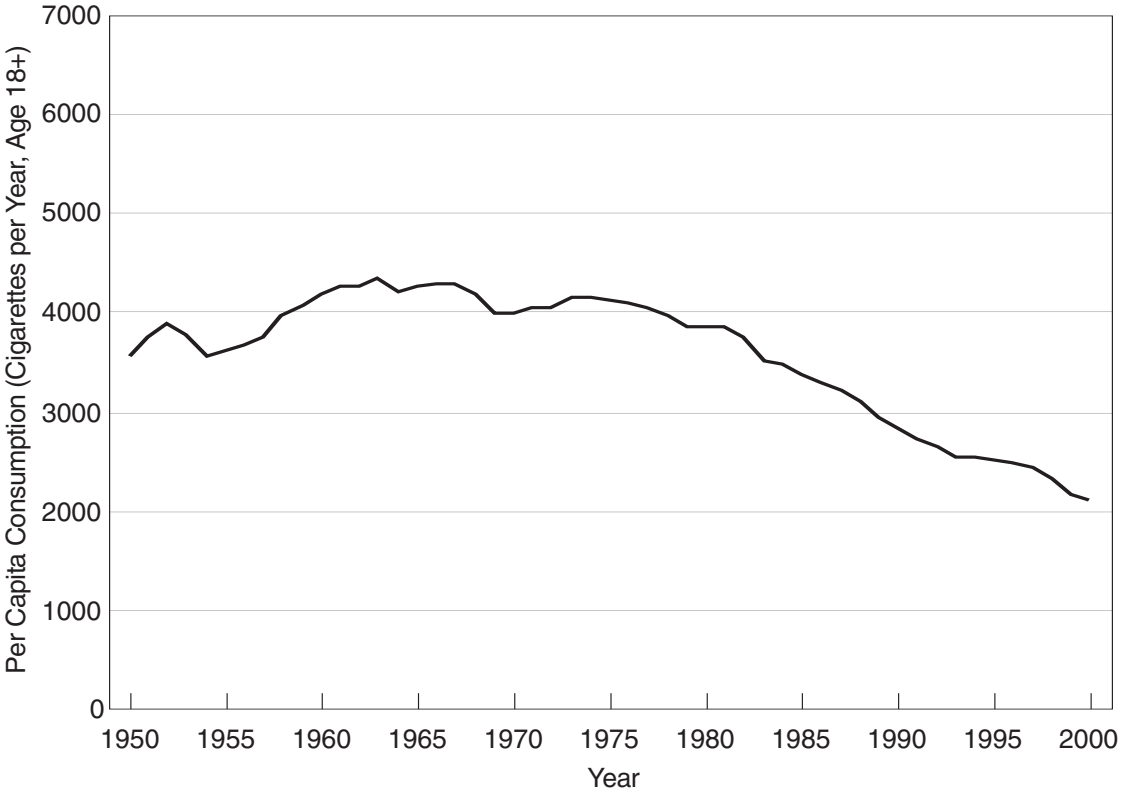
CPS data for the years 1992/93, 1995/96, and 1998/99 are used to examine changes in cessation and number of cigarettes smoked per day in order to determine whether the per capita consumption changes are consistent with a hardening of the residual smoking population as cessation activity fell between the 1992/93 and 1995/96 surveys. The measures of cessation used for the CPS are based on the changes in smoking behavior reported during the 12 months prior to the survey, and they allow changes in the level of cessation activity in the year prior to each survey to be compared.

The cessation measures are calculated using the current smoking status reported by those who were daily smokers one year prior to the survey and who were age 25 or older at the time of the survey. Those smokers could be current daily smokers who had not made a quit attempt, current daily smokers who had made a quit attempt and failed, current occasional smokers, or former smokers. Former smokers were divided into those who had quit for less than 3 months and those who had quit for 3 or more months at the time of the survey. In addition, current daily smokers who had made a quit attempt and occasional smokers were combined into a single measure of those who had made a change in their smoking behavior short of cessation in the prior year. A more detailed description of this measure is presented elsewhere (Burns et al. 2000).

There was a small but statistically significant decline in the prevalence of smoking among self-respondents who were age 25 or older between the 1992/93 and 1995/96 CPS. The percentage declined from 20.06 ± 0.28% daily and 4.26 ± 0.11% occasional smokers in 1992/93 to 19.23 ± 0.23% daily and 3.99 ± 0.11% occasional smokers in 1995/96. However, the percentage of the population reporting that they were former smokers did not increase and actually declined slightly between the two surveys, from 25.99 ± 0.23% to 24.95 ± 0.23%. This suggests that the fall in prevalence between the two surveys may not be the result of increased cessation.

The measures of cessation for the surveys are presented in Table 8-1. The percentage of those who were daily smokers one year prior to the survey who had not made a quit attempt during that year rose between the 1992/93 CPS and the 1995/96 CPS. The percentage who had quit at the time of the survey or who had quit for 3 or more months at the time of the survey fell. Each of these changes was statistically significant, and a multiple logistic regression analysis demonstrated that the differences across surveys persisted when gender, age, education, income, and number of cigarettes smoked per day were entered into the regression (Burns et al. 2000).

Figure 8-1
Per Capita Consumption of Cigarettes in the U.S.A., 1950–2000



These data from the CPS are consistent with changes in per capita consumption over the same period. They suggest that cessation activity and success fell during the mid-1990s and contributed to the absence of a decline in consumption during those years.

Cessation rates vary over time (Burns et al. 1997), both increasing and decreasing, and it is possible that the decline observed in the 1995/95 CPS was one of these variations. Data from the 1998/99 CPS show that the fraction of daily smokers one year prior to the survey who had not made any change in their cessation behavior fell to 63.17%, a level similar to that reported in the 1992/93 survey. In addition, the fraction of smokers who were successfully abstinent at the time of the survey or who had been abstinent for 3 or more months increased significantly between the 1995/96 and 1998/99 surveys. A rapid increase in cigarette cost occurred due to the Master Settlement Agreement in November of 1998, and this increase almost certainly contributed to the increase in cessation activity recorded in the 1998/99 CPS. However, the 1998/99 data were collected in September 1998, January 1999, and May 1999; and the September 1998 survey was conducted prior to the settlement and subsequent price increase. Therefore, cessation behavior reported in the September 1998 survey would represent

Table 8-1

Current Smoking Status Among Those Who Were Daily Smokers 1 Year Prior to the Survey and Who Were Age 25 or Older; Self-Respondents Only

	Daily Smokers						Former Smokers					
	No Quit Attempts		Quit Attempts		Occasional		Quit <3 Months		Quit 3+ Months		Sample
Survey Years	%	±95% CI	%	±95% CI	%	±95% CI	%	±95% CI	%	±95% CI	Size
1992/93											
Total	63.59	(0.60)	25.90	(0.63)	3.05	(0,.22)	2.41	(0.19)	5.06	(0.28)	38,283
Male	64.54	(0.84)	25.25	(0.82)	2.67	(0.30)	2.56	(0.30)	4.98	(0.44)	18,247
Female	62.51	(0.73)	26.63	(0.77)	3.48	(0.30)	2.23	(0.22)	5.14	(0.33)	20,036
1995/96											
Total	67.89	(0.63)	23.51	(0.62)	2.93	(0.19)	1.97	(0.18)	3.69	(0.25)	30,606
Male	68.37	(0.86)	23.02	(0.83)	2.72	(0.25)	2.11	(0.25)	3.79	(0.33)	14,322
Female	67.36	(0.74)	24.05	(0.74)	3.18	(0.29)	1.83	(0.24)	3.58	(0.30)	16,284
1998/99											
Total	63.20	(0.60)	25.60	(0.60)	3.40	(0.20)	2.80	(0.20)	5.00	(0.30)	26,989
Male	63.40	(0.90)	25.40	(0.80)	3.30	(0.30)	2.90	(0.30)	5.00	(0.40)	12,890
Female	62.90	(1.00)	25.80	(0.90)	3.60	(0.40)	2.70	(0.30)	4.90	(0.40)	14,099
Total											
September 1998	63.70	(1.10)	26.70	(1.00)	2.90	(0.40)	1.80	(0.30)	4.90	(0.50)	9,614
January 1999	62.80	(1.10)	24.10	(1.00)	4.20	(0.40)	4.40	(0.50)	4.50	(0.50)	8,984
May 1999	63.20	(1.10)	26.00	(1.00)	3.20	(0.40)	2.10	(0.30)	5.50	(0.50)	8,391

Source: CPS 1992/93, 1995/96, 1998/99.

behavior not influenced by the cost increase, and the cessation measures for the September 1998 survey show an increase in cessation compared with the 1995/96 CPS. This suggests that the increased cessation activity observed between the 1995/96 and 1998/99 CPS occurred prior to, and was the result of factors other than, the increase in cost following the MSA.

It is possible that the increase in cessation observed by the 1998/99 CPS was transient and that cessation rates will fall again in the future. However, per capita consumption fell substantially during the two years following the MSA, suggesting that the effects on smoking behavior continued and that, at least in regard to cost as an intervention, the residual population of smokers did respond to the temporal changes.

In order to examine whether the decline in cessation rates observed between the 1992/93 and 1995/96 CPS is consistent with hardening, Table 8-2 presents the shift between the two surveys in self-reported number of cigarettes smoked per day. In contrast to what might have been expected if the decline in cessation was the result of hardening of the residual population of smokers, the fraction of smokers who smoked 25 or more cigarettes per day did not increase. It declined nonsignificantly from 20.80% to 20.25%. The percentage of smokers smoking 15 to 24 cigarettes per day also remained constant.

Multiple logistic regression analyses were performed independently for each of the measures of cessation described above in the 1992/93 and 1995/96 CPS with gender, age, race/ethnicity, education, income, and cigarettes smoked per day (CPD) included in the regression (Tables 8-1 and 8-2) (Burns et al. 2000). The odds ratios for making a cessation attempt declined with increasing amount smoked in both surveys. The odds ratio for having successfully quit at the time of the survey also was lower for those who had smoked 5-plus CPD compared with those who had smoked 1 to 4 CPD, but there was no clear decline in cessation success with increasing number of cigarettes smoked per day for amounts above 5 CPD. However, the likelihood of making a cessation attempt and the difficulty in achieving cessation did not change between the two surveys for those smokers who smoked 25-plus CPD, at least as measured by the magnitude of the odds ratios. There was no significant difference between the two surveys in the odds ratio for making a cessation attempt or for achieving successful cessation of any duration among those who smoked 25-plus CPD compared with those who smoked 1 to 4 CPD, suggesting that the decrease in quitting seen between the 1992/93 and 1995/96 CPS was not greater for heavy smokers. Thus the proportion of heavy smokers in the population did not increase as cessation fell, and those smokers who were left behind as heavy smokers when their peers quit did not appear to have a greater fall between the two surveys in cessation activity or success than lighter smokers.

An alternate mode of hardening over this period is also examined in the same multiple logistic regressions (Tables 8-1 and 8-2). If those who successfully quit leave behind a more resistant population of smokers, then the fall in cessation rates should be greatest among those demographic groups in which the most cessation has occurred. In multivariate logistic

Table 8-2
Number of Cigarettes Smoked per Day Among Current Smokers 25 Years and Older; Self-Respondents Only, National Data

	Occasional Smokers		Cigarettes per Day								
			1–4		5–14		15–24		25+		Sample
Survey Years	%	±95% CI	%	±95% CI	%	±95% CI	%	±95% CI	%	±95% CI	Size
1992/93											
Total	17.65	(0.45)	2.39	(0.17)	19.19	(0.46)	39.96	(0.58)	20.80	(0.38)	48,915
Male	17.41	(0.65)	2.25	(0.27)	15.41	(0.55)	39.06	(0.77)	25.87	(0.58)	22,914
Female	17.92	(0.52)	2.55	(0.23)	23.34	(0.64)	40.95	(0.76)	15.24	(0.41)	26,001
1995/96											
Total	17.31	(0.42)	2.59	(0.17)	19.77	(0.53)	40.08	(0.64)	20.25	(0.50)	38,817
Male	17.30	(0.62)	2.36	(0.24)	15.47	(0.67)	39.89	(0.93)	24.98	(0.74)	17,943
Female	17.33	(0.55)	2.85	(0.25)	24.50	(0.71)	40.28	(0.71)	15.04	(0.51)	20,874

Source: CPS 1992/93 and 1995/96.

regression analyses controlled for age, gender, race/ethnicity, education, income, and number of cigarettes smoked per day, the magnitude of odds ratios for cessation activity and for abstinence or abstinence for 3-plus months at the time of the survey were unchanged between the two survey periods for those with 16-plus years of education compared with those with less than 12 years of education. The magnitude of the odds ratio is a measure of the relative difference in cessation activity or success across the different educational groups. If successful cessation among higher educational groups left behind a group of smokers who were more resistant to cessation, the odds ratios for the highest educational level compared with the lowest should decline between the two surveys, and it does not.

In contrast, there was a substantial decline between the two surveys in the odds ratio for the highest income group compared with the lowest for the measure of cessation activity. There was a substantial, but not statistically significant, decline in the odds ratio for abstinence of 3 or more months. These analyses suggest that a disproportionate fall between the two surveys in cessation activity and successful abstinence did not occur among the most highly educated smokers, but may have occurred among smokers in the highest income group.

The relationship between smoking prevalence and cessation activity was also examined across the 50 states. State-specific data from the 1995/96 CPS on the percentage of those who were daily smokers one year prior to the survey who had not had any cessation activity (no cessation attempt and not becoming an occasional smoker) or who had successfully quit for 3 or more months at the time of the survey were examined in relation to the state-specific prevalence of smoking (age 18-plus and age 25-plus). These cessation measures were also examined in relation to the quit ratio (fraction of ever-smokers age 18-plus in the state who had quit at the time of the survey). If the population of residual smokers is hardening, one might expect to see less cessation activity (higher percentages not making a cessation attempt) and fewer smokers with 3-plus month successful abstinence in those states where smoking prevalence is lower or where the quit ratio is higher. Presumably, the smoking population in these states might be the most hardened.

When plotted against either the prevalence of smoking or the quit ratio, trends across states in the absence of cessation activity and 3-plus month successful abstinence show linear slopes in the opposite direction from that expected if the population were hardening. Absence of cessation activity in the past year decreases (i.e., cessation activity increases) on a state-specific basis when plotted against decreasing state-specific prevalence of smoking (age 25-plus, $p = <.0001$) and increasing quit ratio ($p = 0.000024$). The percentage of those who were daily smokers one year prior to the survey who had quit for 3 or more months increases nonsignificantly as smoking prevalence declines ($p = 0.17$) and increases significantly as the quit ratio increases ($p = 0.011$).

Since the cost of cigarettes may influence both prevalence and cessation, Figure 8-2 presents data for the 1995/96 CPS for all of the states in the form

of a weighted regression that includes both state-specific prevalence (age 25-plus) and total cost of cigarettes (Tobacco Institute 1998) as terms in the regression. The state-specific prevalence was weighted by size of the sample for the state. The dependent variable in the analysis is the percentage of those smokers age 25 and older who were daily smokers one year prior to the survey and who did not attempt to quit or become an occasional smoker in the year prior to the survey; that is, smokers who made no attempt to change their smoking behavior in the year prior to the survey. This variable is adjusted in the figure for the effect of the state-specific price of cigarettes. Cessation activity is higher rather than lower in those states where smoking prevalence rates are the lowest. Similar results are seen for both the 1992/93 and 1995/96 surveys.

Table 8-3 presents the various measures of cessation calculated for the 10 states with the highest smoking prevalence compared with the 10 states with the lowest smoking prevalence. In this analysis as well, cessation activity and success are lower in states with higher smoking prevalence compared with states with lower smoking prevalence.

Figure 8-2
State-Specific Percentage of Daily Smokers One Year Prior to the Survey Who Had No Cessation Activity in the Last Year Compared to State-Specific Smoking Prevalence, Controlling for Price of Cigarettes—1995/96 CPS (Age 25 and Older)

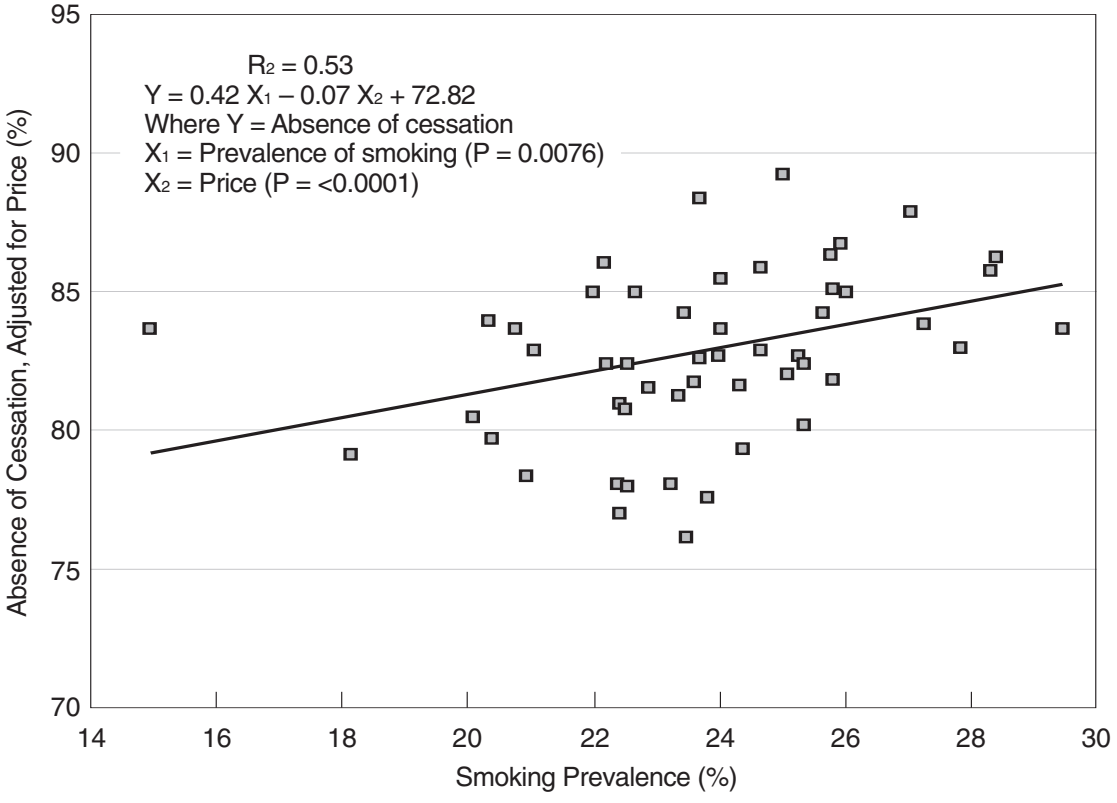


Table 8-3

Current Smoking Status Among Smokers Who Were Daily Smokers 1 Year Prior to the Survey (Age 25+) for States With Lowest and Highest Smoking Prevalence; Self-Respondents Only

	Daily Smokers						Former Smokers					
	No Quit Attempts		Quit Attempts		Occasional		Quit <3 Months		Quit 3+ Months		Sample
Survey Years	%	±95% CI	%	±95% CI	%	±95% CI	%	±95% CI	%	±95% CI	Size
1992/93											
10 states with the lowest smoking prevalence	61.22	(1.03)	26.92	(1.12)	3.45	(0.42)	2.59	(0.35)	5.81	(0.55)	9,110
Other states	63.66	(0.79)	25.87	(0.88)	3.15	(0.27)	2.37	(0.24)	4.95	(0.39)	22,025
10 states with the highest smoking prevalence	66.76	(1.42)	24.53	(1.10)	2.10	(0.38)	2.28	(0.44)	4.34	(0.46)	7,148
1995/96											
10 states with the lowest smoking prevalence	65.25	(1.21)	24.61	(1.18)	3.52	(0.46)	2.26	(0.44)	4.36	(0.48)	6,575
Other states	67.71	(0.89)	23.95	(0.81)	2.85	(0.28)	1.99	(0.23)	3.50	(0.33)	18,562
10 states with the highest smoking prevalence	71.99	(1.49)	20.70	(1.53)	2.39	(0.50)	1.54	(0.32)	3.37	(0.57)	5,469

Source: CPS 1992/93.

These analyses suggest that cessation behavior, as distinct from personal difficulty in achieving cessation, may be enhanced as smoking prevalence falls or in environments where there are fewer smokers. This interpretation provides some support for the hypothesis that the effect of environmental forces is magnified as the fraction of smokers in the population falls, counterbalancing the increased personal difficulty in quitting experienced by the residual smokers.

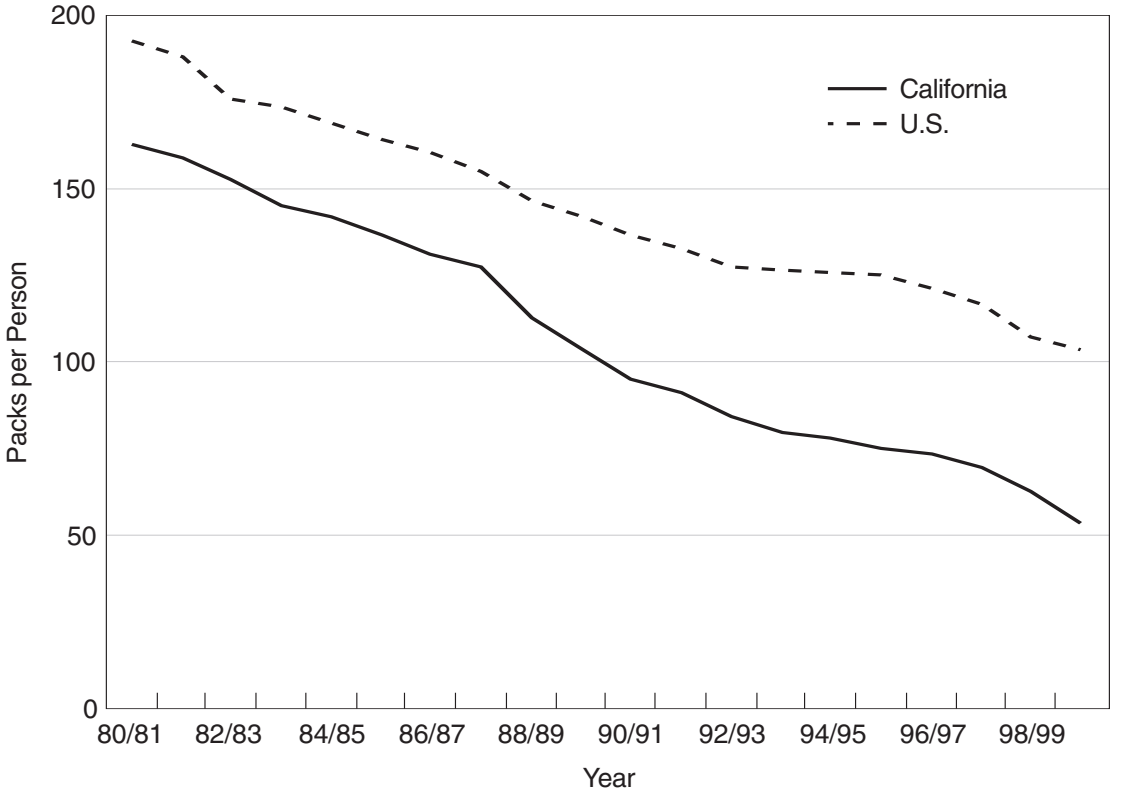
In summary, data from the national CPS demonstrate a fall in cessation activity and success between the 1992/93 and 1995/96 surveys, but cessation activity increased again in the 1998/99 survey concurrent with an increase in the cost of cigarettes. There has been little or no shift in the distribution of number of cigarettes smoked in the population of smokers between the 1992/93 and 1995/96 surveys, and what shift there has been may be a trend toward fewer heavy smokers. Neither heavy smokers nor highly educated smokers show increased difficulty in quitting between the two surveys, but upper income smokers have less cessation activity and may have less abstinence in the 1995/96 survey compared with the 1992/93 survey. Comparisons across states show that cessation activity and success are higher rather than lower in states with lower smoking prevalences, states that might be expected to have the most-hardened smoking populations.

In considering all of this information, it is difficult to see any clear demonstration that the national population has hardened between 1992/93 and 1995/96 as an explanation for the fall in rates of cessation over that interval. However, the time period examined in these national studies is short, and this brief interval may limit the power of these analyses to identify trends consistent with hardening in the population. Alternatively, hardening may have occurred prior to the 1992/93 CPS and would have been missed in the 1992/93 versus 1995/96 comparison. However, the decline in cessation activity and successful abstinence observed between these two surveys are not accompanied by any clear shift in the characteristics of the residual smoking population that would suggest hardening. In order to examine trends over a slightly longer interval during which a larger change in smoking behavior had occurred, data from California are examined.

CHANGES IN CESSATION RATES, NUMBER OF CIGARETTES SMOKED PER DAY, AND TIME TO FIRST CIGARETTE IN CALIFORNIA, 1990 TO 1999

In 1988, California passed an increase in the tax on cigarettes and devoted a portion of that tax to funding a comprehensive tobacco control campaign. That campaign has been successful in reducing per capita consumption of cigarettes and smoking prevalence more rapidly in California than in the rest of the nation (Gilpin et al. 2001). Per capita consumption fell by more than 50% (Figure 8-3) in California, and the prevalence of smoking fell from 22.8% in 1988 to 17.1% in 2000 (California Tobacco Control Section Evaluation Web site 2001).

Figure 8-3
Adult Per Capita Cigarette Consumption in California and U.S., Packs per Fiscal Year, 1980/1981–1999/2000



Data from the CTS are available for the years 1990 through 1999, and they are presented to examine the question whether the substantial decline in smoking behavior observed over this interval resulted in a hardening of the population of residual smokers in California. The CTS uses a modified Waksberg random-digit–dialed telephone methodology to obtain random samples of the California population. Each cross-sectional survey began with a brief screener interview from which an adult provided smoking status and demographic information for each member of the household. Based on the information obtained from the screener interview, adults were randomly selected to answer an extended interview. The data gathered from the extended interviews provide information on smoking prevalence, cessation activity, and number of cigarettes smoked per day for adults (≥25 years of age) in the calendar years 1990, 1996, and 1999. Base weights for those interviewed were computed to take into account the design effect on the probability of selection. Poststratified weights were then used to adjust the samples to the California population provided by the Census in the years 1990, 1994, and 1999, respectively.

Table 8-4 presents the cigarette smoking status of those self-respondents aged 25 and older for the 1990, 1996, and 1999 surveys. The definition of current smoker changed between the 1990 and 1996 surveys. Ever-smokers are defined as those who had smoked 100 or more cigarettes in their lifetime for both surveys. The 1990 survey defined current smokers by asking whether ever-smokers smoked now, and the 1996 and 1999 surveys asked whether they currently smoke every day, some days, or not at all. In these analyses, only the ever-smokers' responses to the current smoking question were tabulated. The difference in definition of current smoker produces a slight increase in the prevalence of current smoking, particularly for occasional smokers (Gilpin et al. 2001). However, over the interval from 1990 through 1999, the prevalence of daily smoking among Californians aged 25 and older fell from 17.8% to 13.0%. This decline is large enough to be beyond that which could be attributed to a change in the definition, and it is also large enough to expect that some evidence of hardening might be evident if it was occurring. It should be noted that the decline in prevalence was accompanied by a rise in never-smoking prevalence and a fall in the prevalence of former smokers between the 1990 and 1996 surveys. It is not clear whether these differences are due to the change in definition, other changes in the survey, or shifts in the population.

Table 8-5 presents the current cessation status for those who were daily smokers one year prior to the survey. In contrast to the fall in cessation attempts and activity seen for the nation, cessation attempts and success held constant between 1990 and 1996 in California. Between 1996 and 1999, cessation attempts and the fraction who had quit for 3 or more months increased. These cessation measures are presented by demographic characteristics in Tables 8-3 to 8-5. The surveys for the 1999 CTS were conducted between August and December of 1999. In November of 1998, there was a price increase following the Master Settlement Agreement, and

Table 8-4
California Cigarette Smoking Prevalence, Ages 25 and Older—1990, 1996, 1999

	Current Smoker				Former Smoker		Never Smoker		Population Size	Sample Size
	Daily		Occasional							
Year	%	CI	%	CI	%	CI	%	CI	(N)	(n)
1990										
Total	17.8	0.57	3.3	0.34	30.1	0.96	48.7	1.08	18,248,686	20,718
Male	19.9	1.05	4.0	0.53	35.8	1.49	40.3	1.62	8,887,409	9,680
Female	15.8	0.67	2.7	0.25	24.6	1.21	56.8	1.32	9,361,269	11,038
1996										
Total	14.2	0.27	4.1	0.29	27.4	0.62	54.2	0.61	19,829,250	16,117
Male	16.1	0.41	5.0	0.51	32.8	1.00	46.1	1.00	9,633,769	7,769
Female	12.5	0.35	3.3	0.32	22.3	0.73	61.9	0.71	10,195,419	8,348
1999										
Total	13.0	0.28	4.7	0.39	27.7	0.56	54.6	0.58	20,538,778	12,518
Male	14.9	0.52	5.9	0.59	32.5	0.85	46.7	1.04	9,926,575	6,104
Female	11.2	0.50	3.7	0.45	23.2	0.69	62.0	0.83	10,612,211	6,414

Table 8-5

Current Smoking Status of Californians Age 25 and Older Who Were Daily Smokers 12 Months Prior to the Survey, 1990, 1996, and 1999 CTS

	Daily Smoker				Occasional Smoker				Former Smoker				Unknown Attempts or Duration		Population Size	Sample Size
	Quit Attempts		Without Quit Attempts		Quit Attempts		Without Quit Attempts		Former <3 mos		Former >=3 mos					
Year	%	CI	%	CI	%	CI	%	CI	%	CI	%	CI	%	CI	(N)	(n)
1990	32.7	1.72	53.2	1.72	2.6	0.51	0.8	0.32	4.2	0.68	5.6	0.73	0.9	0.50	3,419,535	7,260
1996	31.4	1.28	53.6	1.40	3.3	0.53	1.3	0.45	4.8	0.66	5.0	0.79	0.6	0.22	2,894,421	6,211
1999	35.8	2.09	46.9	2.09	4.5	0.92	1.3	0.67	4.2	0.82	7.1	1.06	0.2	0.15	2,790,004	3,798

Table 8-6
1990 California Tobacco Survey: Multiple Logistic Regression Model of Cessation Measures

	Cessation Activity[1]		Cessation Attempt*[2]		Occasional[3]		Former (Any Length)		Former (3–12 Months)	
Variable	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Gender										
Male	1.00									
Female	1.00	(0.90, 1.11)	1.00	(0.90, 1.11)	0.86	(0.64, 1.15)	1.23	(1.04, 1.45)	1.41	(1.13, 1.76)
Age (Years)										
25–44	1.00									
45–64	0.75	(0.67, 0.85)	0.75	(0.67, 0.84)	0.95	(0.69, 1.31)	1.21	(1.01, 1.45)	1.47	(1.16, 1.86)
65+	0.74	(0.62, 0.90)	0.74	(0.62, 0.89)	0.73	(0.40, 1.31)	1.40	(1.04, 1.88)	1.70	(1.18, 2.45)
Race/Ethnicity										
Non-Hispanic White	1.00									
Hispanic	1.60	(1.35, 1.90)	1.49	(1.25, 1.76)	2.02	(1.35, 3.01)	1.69	(1.31, 2.20)	1.54	(1.09, 2.17)
African-American	2.05	(1.66, 2.54)	2.02	(1.64, 2.50)	2.99	(2.00, 4.46)	1.19	(0.86, 1.65)	1.33	(0.89, 2.00)
Other	1.07	(0.87, 1.32)	1.09	(0.88, 1.34)	0.78	(0.40, 1.55)	0.72	(0.49, 1.07)	0.77	(0.47, 1.29)
Education (Years)										
<12	1.00									
12	1.10	(0.95, 1.27)	1.09	(0.94, 1.26)	1.08	(0.72, 1.63)	1.28	(0.99, 1.66)	1.44	(1.03, 2.01)
13–15	1.34	(1.14, 1.57)	1.31	(1.11, 1.53)	1.50	(0.97, 2.34)	1.64	(1.24, 2.15)	1.68	(1.17, 2.40)
16+	1.26	(1.04, 1.51)	1.25	(1.03, 1.50)	1.06	(0.61, 1.85)	1.91	(1.41, 2.59)	1.66	(1.11, 2.49)
Household Income										
<=$10,000	1.00									
$10,001–20,000	1.32	(1.09, 1.60)	1.24	(1.02, 1.50)	1.20	(0.74, 1.96)	1.48	(1.03, 2.13)	1.03	(0.67, 1.59)
$20,001–30,000	1.22	(1.01, 1.48)	1.20	(0.99, 1.45)	0.75	(0.44, 1.27)	1.69	(1.19, 2.42)	1.27	(0.83, 1.92)
$30,001–50,000	1.30	(1.08, 1.57)	1.28	(1.07, 1.55)	1.08	(0.67, 1.76)	1.76	(1.24, 2.48)	1.11	(0.74, 1.68)
$50,001–75,000	1.38	(1.12, 1.70)	1.36	(1.10, 1.67)	1.02	(0.57, 1.80)	2.12	(1.46, 3.06)	1.29	(0.83, 2.02)
$75,001+	1.16	(0.92, 1.46)	1.13	(0.89, 1.42)	1.44	(0.78, 2.66)	2.35	(1.58, 3.49)	1.85	(1.16, 2.95)

continued

Table 8-6 (continued)

Variable	Cessation Activity[1] OR	Cessation Activity[1] 95% CI	Cessation Attempt*[2] OR	Cessation Attempt*[2] 95% CI	Occasional[3] OR	Occasional[3] 95% CI	Former (Any Length) OR	Former (Any Length) 95% CI	Former (3–12 Months) OR	Former (3–12 Months) 95% CI
Cigarettes per Day										
1 to 4	1.00									
5 to 14	0.75	(0.55, 1.02)	0.73	(0.54, 0.99)	0.63	(0.39, 1.01)	0.52	(0.36, 0.75)	0.49	(0.31, 0.77)
15 to 24	0.41	(0.30, 0.55)	0.43	(0.32, 0.57)	0.22	(0.13, 0.37)	0.38	(0.26, 0.55)	0.34	(0.22, 0.54)
25+	0.39	(0.28, 0.53)	0.40	(0.29, 0.54)	0.13	(0.07, 0.25)	0.46	(0.31, 0.67)	0.52	(0.32, 0.83)

*Cessation Attempts include attempts made by occasional smokers.

NOTE: Model adjusted for gender, age, race/ethnicity, education, household income, and number of cigarettes smoked per day. Population includes respondents who reported smoking daily 12 months ago, ages 25 and older.

[1]Cessation Activity: Includes those who have made a quit attempt, have become occasional smokers, or have become former smokers.

[2]Cessation Attempt: Includes those who have made a quit attempt or have become former smokers.

[3]Occasional: Includes those who reduced from smoking every day to smoking some days.

in January of 1999, the tax on cigarettes increased in California by $0.50. Both of these price increases occurred during the one-year period prior to the survey and may have contributed to the increase in cessation attempts and 3-plus month cessation success in 1999 compared with prior surveys. However, it is clear that the measures of cessation increased in California as the prevalence fell, suggesting that the residual population was not hardening, at least not to cost as a tobacco control intervention.

Multiple logistic regression analyses were performed for each survey with age, race/ethnicity, education, income, and number of cigarettes smoked per day entered into the analyses. The odds ratios from these analyses are presented in Tables 8-6 through 8-8. As was true for the analyses of the CPS data, there is no clear trend toward lower cessation activity or successful abstinence by level of education across the three California surveys as measured by the odds ratio for the highest education group compared with the lowest. This suggests that the increased cessation activity and abstinence experienced by those with higher levels of education are not diminishing compared with those with less education. This effect is present even though the higher educational groups have lower smoking prevalence and higher cumulative cessation, factors that might be expected to make them the most-hardened population of smokers.

In contrast, the effect of income on cessation success has diminished over time, and the absence of an effect of income on cessation was also observed in the national CPS analyses. Income is no longer a statistically significant predictor of being a former smoker or having successfully quit for 3 or more months in the 1999 California Tobacco Survey. This trend may have been influenced by the increase in the cost of cigarettes in the year prior to the 1999 survey, but it appears that the trend may have been present in the 1996 survey as well, although the differences between 1990 and 1996 were not statistically significant.

Table 8-9 examines the prevalence of smoking different numbers of cigarettes for the three California tobacco surveys. The data are presented as percentages of the population rather than as percentages of smokers in order to avoid the effect of the change in definition of smoking on overall smoking prevalence. The change in definition would not be expected to have a substantive impact on the fraction of the population reporting that they smoked 25 or more cigarettes, but it does have an effect on the fraction reporting occasional smoking and hence on the total smoking prevalence. The percentage of the population who smokes 25 or more cigarettes per day in California fell by more than 50% between 1990 and 1999, a much greater proportional reduction than had occurred with either total smoking prevalence or prevalence of daily smoking. This decline in prevalence of heavy smoking in California was confirmed using the California-specific data from the CPS between 1992/93 and 1995/96, during which period there was no change in the definition used to define current smokers (data not shown). Clearly, the fall in smoking prevalence in California was not accompanied by a higher fraction of smokers who were in the heavy-smoking categories.

Whether the heavy smokers who remain in the California population have more difficulty quitting than the larger group of heavy smokers in the prior surveys can be examined using the odds ratios for cessation activity and abstinence by number of cigarettes smoked per day in the multiple logistic regression analyses presented in Tables 8-6 through 8-8. There is an effect of number of cigarettes smoked per day on the likelihood of making a cessation attempt and on the likelihood of having quit at the time of the survey. In the 1990 and 1996 surveys, heavy smokers were less likely to make a cessation attempt than were lighter smokers. In all three surveys, lower odds ratios with increasing amount smoked were evident for any smoking success and for 3-plus months of abstinence, but only for the comparison with those who smoked 1 to 4 CPD one year prior to the survey. There was no gradient of reduced success with increasing amount smoked above 5 CPD.

If the population of heavy smokers has become hardened, the likelihood of making a cessation attempt or of having successfully quit among those who smoke 25-plus CPD should fall. This would be manifest as a lower odds ratio for the 25-plus CPD smokers as the prevalence of heavy smoking falls in sequential surveys. When the odds ratios for heavy smokers in the three surveys are compared (Table 8-10), the impact of smoking 25-plus CPD on the likelihood of cessation attempts has not changed over the nine-year interval. There are also no changes in the odds ratios for cessation success or for 3-plus–month abstinence between the 1990 and 1999 surveys. The odds ratios for the 1996 survey were higher and, statistically, were not significantly different from the comparison group (1 to 4 CPD). These data suggest that, even in the face of a more than 50% decline in the fraction of the population that report smoking 25-plus CPD, those who remain heavy smokers are not less likely to make a cessation attempt or less likely to be successful in that attempt. Even in this population of heavy smokers, who persist in being heavy smokers in spite of the powerful trends toward lower number of cigarettes smoked per day in California, there is no evidence that they have fewer quit attempts or less cessation success.

Smoking the first cigarette of the day within 30 minutes of waking is a measure commonly used in scales of addiction (Fagerström and Schneider 1989), and it is one of the most powerful individual measures used to predict addiction in these scales (Kozlowski et al. 1994). If addicted smokers are less likely to try to quit or to remain abstinent, then the fraction of addicted smokers in the population should increase over time. Among Californians who were daily cigarette smokers at the time of the survey, the proportion reporting that they smoked their first cigarette within 30 minutes of waking decreased from 62.5 ± 1.6% in 1990 to 58.6 ± 2.0% in 1999. In order to control for the shift toward reporting fewer cigarettes smoked per day over this interval, the percentages of smokers reporting smoking a cigarette within 30 minutes of waking are presented by number of cigarettes smoked per day for each of the three surveys in Figure 8-4. Over the nine years covered by the California surveys, and after a 27% fall in the prevalence of daily smoking and a more than 50% fall in the prevalence of heavy smoking, there is no change in the percentage of

Table 8-7
1996 California Tobacco Survey: Multiple Logistic Regression Model of Cessation Measures

	Cessation Activity[1]		Cessation Attempt*[2]		Occasional[3]		Former (Any Length)		Former (3–12 Months)	
Variable	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Gender										
Male	1.00									
Female	0.96	(0.86, 1.07)	0.93	(0.83, 1.04)	1.26	(0.97, 1.65)	1.23	(1.03, 1.48)	1.17	(0.91, 1.49)
Age (Years)										
25–44	1.00									
45–64	0.65	(0.58, 0.73)	0.67	(0.59, 0.76)	0.83	(0.61, 1.11)	0.78	(0.64, 0.95)	0.97	(0.75, 1.27)
65+	0.63	(0.51, 0.77)	0.64	(0.52, 0.79)	0.88	(0.52, 1.51)	1.25	(0.92, 1.70)	1.43	(0.96, 2.15)
Race/Ethnicity										
Non-Hispanic White	1.00									
Hispanic	1.22	(1.04, 1.46)	1.21	(1.02, 1.44)	1.68	(1.16, 2.43)	1.12	(0.86, 1.48)	1.15	(0.79, 1.66)
African-American	1.29	(1.04, 1.60)	1.20	(0.97, 1.49)	1.54	(1.00, 2.35)	0.47	(0.30, 0.75)	0.66	(0.38, 1.15)
Other	0.93	(0.77, 1.12)	0.94	(0.78, 1.13)	0.69	(0.41, 1.17)	0.72	(0.52, 1.00)	0.73	(0.47, 1.15)
Education (Years)										
<12	1.00									
12	0.73	(0.62, 0.85)	0.73	(0.63, 0.86)	1.08	(0.71, 1.65)	0.76	(0.58, 1.00)	0.80	(0.55, 1.15)
13–15	0.95	(0.80, 1.11)	0.92	(0.78, 1.08)	1.96	(1.31, 2.95)	1.04	(0.79, 1.36)	1.04	(0.72, 1.50)
16+	1.16	(0.95, 1.40)	1.17	(0.97, 1.42)	1.65	(1.02, 2.67)	1.40	(1.03, 1.88)	1.39	(0.93, 2.08)
Household Income										
<=$10,000	1.00									
$10,001–20,000	1.18	(0.96, 1.44)	1.25	(1.02, 1.53)	0.87	(0.54, 1.39)	1.23	(0.86, 1.77)	0.98	(0.60, 1.61)
$20,001–30,000	0.96	(0.79, 1.17)	1.04	(0.85, 1.27)	0.67	(0.41, 1.09)	1.22	(0.85, 1.74)	1.21	(0.76, 1.93)
$30,001–50,000	1.05	(0.87, 1.27)	1.09	(0.90, 1.32)	0.89	(0.57, 1.38)	1.44	(1.03, 2.01)	1.24	(0.79, 1.93)
$50,001–75,000	1.10	(0.89, 1.35)	1.12	(0.91, 1.38)	0.94	(0.59, 1.51)	1.26	(0.87, 1.82)	1.45	(0.90, 2.32)
$75,001+	1.08	(0.86, 1.35)	1.13	(0.91, 1.42)	0.72	(0.41, 1.26)	1.87	(1.29, 2.71)	1.60	(0.98, 2.62)

continued

Table 8-7 (continued)

Variable	Cessation Activity[1] OR	Cessation Activity[1] 95% CI	Cessation Attempt*[2] OR	Cessation Attempt*[2] 95% CI	Occasional[3] OR	Occasional[3] 95% CI	Former (Any Length) OR	Former (Any Length) 95% CI	Former (3–12 Months) OR	Former (3–12 Months) 95% CI
Cigarettes per Day										
1 to 4	1.00									
5 to 14	0.77	(0.56, 1.06)	1.05	(0.77, 1.42)	0.34	(0.22, 0.51)	0.64	(0.42, 0.98)	0.88	(0.49, 1.60)
15 to 24	0.48	(0.35, 0.66)	0.68	(0.51, 0.92)	0.17	(0.11, 0.26)	0.50	(0.33, 0.77)	0.62	(0.34, 1.13)
25+	0.40	(0.29, 0.55)	0.57	(0.41, 0.78)	0.11	(0.06, 0.20)	0.67	(0.43, 1.04)	0.83	(0.45, 1.54)

*Cessation Attempts include attempts made by occasional smokers.

NOTE: Model adjusted for gender, age, race/ethnicity, education, household income, and number of cigarettes smoked per day. Population includes respondents who reported smoking daily 12 months ago, ages 25 and older.

[1]Cessation Activity: Includes those who have made a quit attempt, have become occasional smokers, or have become former smokers.

[2]Cessation Attempt: Includes those who have made a quit attempt or have become former smokers.

[3]Occasional: Includes those who reduced from smoking every day to smoking some days.

Table 8-8
1999 California Tobacco Survey: Multiple Logistic Regression Model of Cessation Measures

	Cessation Activity[1]		Cessation Attempt[2]		Occasional[3]		Former (Any Length)		Former (3–12 Months)	
Variable	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Gender										
Male	1.00									
Female	0.86	(0.74, 0.99)	0.87	(0.75, 1.00)	1.09	(0.79, 1.49)	0.86	(0.69, 1.08)	0.75	(0.57, 1.00)
Age (Years)										
25–44										
45–64	0.63	(0.54, 0.73)	0.62	(0.53, 0.72)	1.10	(0.79, 1.54)	0.81	(0.64, 1.03)	1.04	(0.78, 1.39)
65+	0.63	(0.49, 0.80)	0.60	(0.47, 0.77)	0.95	(0.40, 1.31)	1.27	(0.87, 1.84)	1.47	(0.94, 2.30)
Race/Ethnicity										
Non-Hispanic White										
Hispanic	1.11	(0.90, 1.37)	1.08	(0.87, 1.33)	1.15	(0.74, 1.80)	1.41	(1.03, 1.93)	1.25	(0.85, 1.85)
African-American	1.68	(1.25, 2.26)	1.68	(1.26, 2.25)	1.49	(0.89, 2.49)	1.29	(0.85, 1.96)	0.86	(0.48, 1.54)
Other	0.97	(0.77, 1.23)	1.01	(0.80, 1.28)	1.01	(0.61, 1.68)	0.89	(0.61, 1.31)	0.89	(0.56, 1.41)
Education (Years)										
<12										
12	1.31	(1.07, 1.61)	1.27	(1.04, 1.56)	1.09	(0.69, 1.72)	1.35	(0.96, 1.91)	1.30	(0.86, 1.98)
13–15	1.18	(0.95, 1.46)	1.17	(0.95, 1.45)	1.27	(0.78, 2.05)	1.37	(0.96, 1.97)	1.38	(0.89, 2.15)
16+	1.45	(1.13, 1.87)	1.46	(1.13, 1.88)	1.25	(0.71, 2.20)	2.00	(1.35, 2.97)	1.74	(1.07, 2.82)
Household Income										
<=$10,000										
$10,001–20,000	1.24	(0.95, 1.62)	1.19	(0.91, 1.55)	0.73	(0.42, 1.26)	0.90	(0.57, 1.42)	0.80	(0.47, 1.38)
$20,001–30,000	1.19	(0.91, 1.56)	1.20	(0.92, 1.56)	0.92	(0.54, 1.56)	1.09	(0.70, 1.69)	1.07	(0.64, 1.79)
$30,001–50,000	1.03	(0.80, 1.33)	1.03	(0.80, 1.32)	0.61	(0.35, 1.06)	1.10	(0.72, 1.67)	0.79	(0.47, 1.32)
$50,001–75,000	1.12	(0.86, 1.47)	1.15	(0.88, 1.50)	0.49	(0.27, 0.91)	1.22	(0.79, 1.88)	0.94	(0.56, 1.59)
$75,001+	1.14	(0.86, 1.50)	1.16	(0.87, 1.53)	0.54	(0.29, 1.00)	1.42	(0.91, 2.22)	1.22	(0.72, 2.06)

continued

Table 8-8 continued

Variable	Cessation Activity[1] OR	Cessation Activity[1] 95% CI	Cessation Attempt[2] OR	Cessation Attempt[2] 95% CI	Occasional[3] OR	Occasional[3] 95% CI	Former (Any Length) OR	Former (Any Length) 95% CI	Former (3–12 Months) OR	Former (3–12 Months) 95% CI
Cigarettes per Day										
1 to 4										
5 to 14	0.54	(0.35, 0.82)	0.76	(0.51, 1.12)	0.40	(0.24, 0.66)	0.53	(0.33, 0.84)	0.46	(0.27, 0.80)
15 to 24	0.38	(0.25, 0.58)	0.55	(0.37, 0.81)	0.15	(0.09, 0.26)	0.40	(0.25, 0.64)	0.38	(0.22, 0.66)
25+	0.35	(0.23, 0.54)	0.51	(0.34, 0.76)	0.11	(0.06, 0.22)	0.58	(0.36, 0.95)	0.51	(0.29, 0.90)

*Cessation Attempts include attempts made by occasional smokers.

NOTE: Model adjusted for gender, age, race/ethnicity, education, household income and number of cigarettes smoked per day. Population includes respondents who reported smoking daily 12 months ago, ages 25 and older.

[1]Cessation Activity: Includes those who have made a quit attempt, have become occasional smokers, or have become former smokers.

[2]Cessation Attempt: Includes those who have made a quit attempt or have become former smokers.

[3]Occasional: Includes those who reduced from smoking everyday, to smoking some days.

Table 8-9
Percentage of the California Population Age 25 and Older Who Smoke Different Numbers of Cigarettes per Day

	Occasional*		1–4		5–14		15–24		25+		Daily, Unknown Amount	
Year	%	CI	%	CI	%	CI	%	CI	%	CI	%	CI
1990	3.3	0.34	0.6	0.14	4.7	0.29	7.9	0.33	4.4	0.33	0.2	0.07
1996	4.1	0.29	0.7	0.09	4.7	0.26	6.0	0.22	2.8	0.19	0.1	0.04
1999	4.7	0.39	0.7	0.14	4.5	0.29	5.6	0.34	2.1	0.16	0.1	0.03

*Change in definition of current smoker 1990–96.

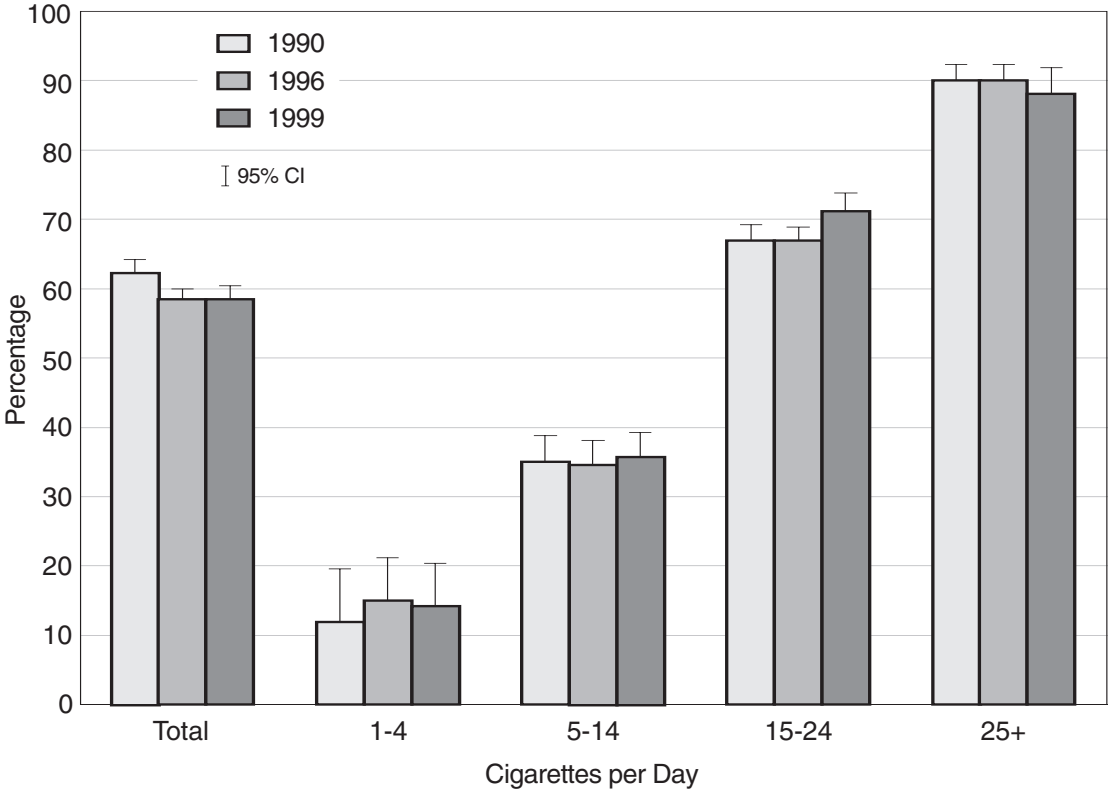
Table 8-10
Multivariate Logistic Regression Models of Cessation Activity and Current Cessation Status for Adult Smokers Who Were Current Daily Smokers One Year Prior to the Survey and Who Were Age 25 or Older at the Time of the Survey, 1990,1996, and 1999 California Tobacco Surveys

	Cessation Activity[1]*		Former*		Former 3+*	
Cigarettes/Day	OR	95% CI	OR	95% CI	OR	95% CI
1990						
1–4	1.00					
5–14	0.75	(0.55, 1.02)	0.52	(0.36, 0.75)	0.49	(0.31, 0.77)
15–24	0.41	(0.30, 0.55)	0.38	(0.26, 0.55)	0.34	(0.22, 0.54)
25+	0.39	(0.28, 0.53)	0.46	(0.31, 0.67)	0.52	(0.32, 0.83)
1996						
1–4	1.00					
5–14	0.77	(0.56, 1.06)	0.64	(0.42, 0.98)	0.88	(0.49, 1.60)
15–24	0.48	(0.35, 0.66)	0.50	(0.33, 0.77)	0.62	(0.34, 1.13)
25+	0.40	(0.29, 0.55)	0.67	(0.43, 1.04)	0.83	(0.45, 1.54)
1999						
1–4	1.00					
5–14	0.54	(0.35-0.82)	0.53	(0.33-0.84)	0.46	(0.27-0.80)
15–24	0.38	(0.25-0.58)	0.40	(0.25-0.64)	0.38	(0.22-0.66)
25+	0.35	(0.23-0.54)	0.58	(0.36-0.95)	0.51	(0.29-0.90)

[1]Cessation activity: Includes those who have made a quit attempt, have become occasional smokers, or have become former smokers.

*Also adjusted for gender, age, race/ethnicity, education, and household income.

Figure 8-4
Percentage of Adult Daily Smokers Age 25 and Older Smoking Their First Cigarette Within 30 Minutes of Waking by Number of Cigarettes Smoked per Day, 1990, 1996, and 1999, California Tobacco Surveys



smokers, stratified by amount smoked, who reports smoking the first cigarette within 30 minutes of waking.

SUMMARY Data from the national CPS conducted in 1992/93, 1995/96, and 1998/99, and from three California surveys conducted in 1990, 1996, and 1999, are examined for evidence that the residual population of smokers represents a hardened group, more addicted and less likely to be successful in cessation. National rates of cessation attempts declined between 1992/93 and 1995/96, but appear to have increased again in 1998/99. The fall in rates between 1992/93 and 1995/96 was not accompanied by an increased fraction of the population reporting that they smoked more than 25 cigarettes per day, and there was no decline in the odds ratios for cessation attempts and success among those with higher educational attainment between the two surveys. There was a decline in the odds ratios for those with higher income levels.

In California, where cessation rates did not decline between 1990 and 1996 and where there has been a large fall in the prevalence of smoking, particularly heavy smoking, there has been no increase in the fraction of smokers who report smoking more than 25 cigarettes per day or in the percentage of smokers who smoke the first cigarette within 30 minutes of waking. The odds ratios for cessation activity and success for higher levels of education have not declined between 1990 and 1999, which suggests that the group with the highest level of cessation success is continuing to enjoy undiminished higher levels of cessation success. This effect was not seen for those with higher levels of income.

These data do not provide compelling evidence that the residual population of smokers either nationally or in California is becoming hardened or is less likely to successfully quit smoking. It is possible to argue that the absence of evidence for hardening is due to the lack of a measure that adequately quantifies the difficulty an individual smoker has in achieving cessation. However, the measures used do gauge self-reported cessation behavior and success, and an increasing difficulty in quitting on a personal level may be less important for purposes of tobacco control if it is not accompanied by a diminished likelihood of cessation activity or cessation success.

The evidence presented also suggests that the residual population of smokers in California is not composed of a larger fraction of heavily addicted smokers, at least for number of cigarettes smoked per day and time to first cigarette as measures of addiction. One reasonable interpretation of these observations is that comprehensive tobacco control campaigns, such as that conducted in California, produce environmental changes that affect heavy smokers and addicted smokers more powerfully than less dependent smokers. This differential impact may counterbalance the greater personal difficulty in achieving cessation experienced by those who have thus far been unable to quit. It is also possible that those environmental changes that lead to reductions in number of cigarettes smoked per day may also reduce the strength of the addiction among those smokers who manage to reduce the number of cigarettes that they smoke. In this way, the changing environment could make it personally easier for the smoker to quit instead of the residual population of smokers having more difficulty quitting.

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