

Pattern of Adolescent Initiation Rates over Time: National and California Data

Christy M. Anderson, David M. Burns

INTRODUCTION This chapter presents data on trends in adolescent smoking initiation nationally and in California. Historical trends in adolescent initiation are presented for the nation and contrasted with those occurring in California. In 1988, Californian voters passed Proposition 99, which raised the tax on a pack of cigarettes by 25 cents and allotted 20 percent of the revenues to anti-tobacco education and prevention programs. Shortly after Proposition 99 was implemented, cigarette consumption and smoking prevalence in California declined (Bal *et al.*, 1990; Breslow and Johnson, 1993; Burns *et al.*, 1992; Burns, 1994; Elder *et al.*, 1996; Hu *et al.*, 1994; Pierce *et al.*, 1991). In this chapter, the impact of this proposition, and of the programs funded by it, on the initiation of cigarette smoking by Californian adolescents is examined.

Definitions used to define adolescent and adult smokers differ. Adolescent-based surveys define smokers as respondents who have smoked at least one cigarette in the last 30 days; the definitions are intended to be sensitive enough to capture respondents who are experimenting with cigarettes and are in the early stages of beginning smoking. Adult-based surveys define smokers as respondents who have smoked at least 100 cigarettes and currently smoke every day or some days. Adult-based surveys are intended to identify those respondents who are regular cigarette smokers—either occasionally or daily—and exclude those who are experimenting or in early initiation. Since not all those who first use cigarettes as adolescents become adult cigarette smokers, adolescent-based surveys may include as smokers those individuals who will be defined as never-smokers in adult surveys. To define initiation rates during adolescence among those who become adult smokers, cross-sectional surveys of adults are used to reconstruct past rates of initiation (Burns *et al.*, 1995; Cummings and Shah, 1995; Gilpin and Pierce, 1997; Pierce *et al.*, 1994). These cross-sectional surveys use the adult definition of ever-smoking and reconstruct adolescent initiation rates using questions that ask for the age at which respondents started smoking regularly, the current age of the respondent, and the survey year.

For this chapter, adolescent initiation rates for each calendar year were reconstructed retrospectively from subjects' responses on the Current Population Survey (CPS) of adults. All ever-smokers were asked the age at which they remembered beginning to smoke regularly. From their current age and the year of the survey, the year at which they initiated could be cal-

culated. Prevalence rates also could be reconstructed using the age at which respondents recalled beginning to smoke and the time they reported quitting. The pattern of U.S. initiation rates from 1940 to 1992 were examined and compared for males and females and for older and younger adolescents. The initiation rates of male and female adolescents in California were also compared with those of the rest of the nation. The rates were computed for males and females by three age groups: 12- to 17-year-olds, 12- to 14-year-olds, and 15- to 17-year-olds.

METHODS To generate retrospective initiation and prevalence rates, two sets of cross-sectional surveys were used from the Tobacco Use Surveys that periodically supplement the Census Bureau's Current Population Surveys (CPS). One set was administered in September, 1992; January, 1993; and May, 1993. The other was administered in September, 1995; January, 1996; and May, 1996. For the CPS, the Census Bureau collects labor force and demographic information monthly from about 50,000 households from the civilian, non-institutional population, surveying household members who are 15 years of age or older; the details of the survey methodology are described elsewhere (Bureau of the Census, 1978). All respondents are weighted to reflect the actual civilian, non-institutional population of the United States and of each individual state.

Data

The 1992/1993 and 1995/1996 surveys interviewed a combined total of 623,613 people who were 15 to 84 years old at the time of the survey. Of these respondents, 68.5 percent were self-respondents, and only the answers from these respondents were used for this analysis. Another 1.5 percent were eliminated from the analysis due to unanswered questions, leaving 417,550 respondents available for analysis.

Cigarette sales and advertising data were used to make comparisons with initiation rates over time. Cigarette sales data were drawn from the Maxwell consumer report, which reports annual cigarette sales for each major cigarette brand since 1925 (Maxwell, Jr., 1994). Additionally, quantitative estimates were collected of the number of cigarette advertisements appearing in 11 popular magazines available from the beginning of the century to 1996. For each advertisement, the cigarette brand name, the title of the magazine, and the date of the magazine issue were compiled, among other facts. These data were summarized to present the average number of advertisements per magazine issue for each calendar year for the Virginia Slims brand of cigarettes.

Calculation of Initiation and Prevalence Rates

Each person's smoking status for each calendar year prior to the date of the survey was reconstructed based upon the respondent's recollection of starting and stopping smoking. All respondents were asked, "Has [respondent] smoked at least 100 cigarettes in his/her entire life?" Those respondents who answered "no" were considered never-smokers. Those respondents who answered "yes" were asked, "How old was [respondent] when he/she started smoking cigarettes fairly regularly?" This question was used to determine the age at initiation of smoking. Respondents who had smoked at least 100 cigarettes were also asked, "Does [respondent] now smoke cigarettes every

day, some days, or not at all?" Those respondents who answered "every day" or "some days" were considered current smokers; those who responded "not at all" were former smokers.

All calculations to determine the year in which respondents were smoking were based upon responses given in the survey regarding the survey administration date, the initiation age, and the age. The survey administration date was represented as a partial year, using both the year and month of the survey in this calculation (*e.g.*, September 1992 became 1992.75). Additionally, 6 months were added to all age responses to account for the distribution of birthdays occurring over the entire calendar year. These age and calendar-year calculations were then used, together with the questions on age of initiation, to reconstruct, for each calendar year, which adolescents were not smoking and which ones had begun smoking during that same year. For each calendar year, the number of adolescents who began that year as non-smokers represented the denominator of the initiation rate. The numerator of the rate was the number of adolescents who initiated during that calendar year.

The survey subjects were 15 to 84 years old at the time of the survey, the last of which was administered in 1996. Since the rates for each calendar year measured smoking initiation and prevalence of 12- to 17-year-olds, the last year all ages were present was 1993. The only survey available for the 1993 analysis was the May 1996 survey, providing a sample size of only about 200 for each gender (compared to 500 in 1992, and 950 in 1990). The small sample size for 1993 offered unstable estimates of the initiation and prevalence rates, so the last year from which the analysis was performed was 1992.

While calculating the initiation rates for each calendar year, the distribution of ages reflected in the original sample was preserved. Since the distribution of 12- to 17-year-olds varied between calendar years, each initiation rate for each calendar year was standardized to the birth-year distribution of all respondents who would have been between the ages of 12 and 17 in that calendar year. Likewise, to make similar comparisons between ethnically diverse samples, the rates for each calendar year were standardized by ethnicity to the ethnic distribution of the United States represented by the 1995/1996 CPS. When comparing the initiation rates across the different ethnic groups, the rates were smoothed using the loess procedure in S-Plus (MathSoft, Inc., 1999; Cleveland, 1979). Twenty percent of the rates were used to quadratically fit each rate, and each rate was weighted to the sample size used to calculate that rate.

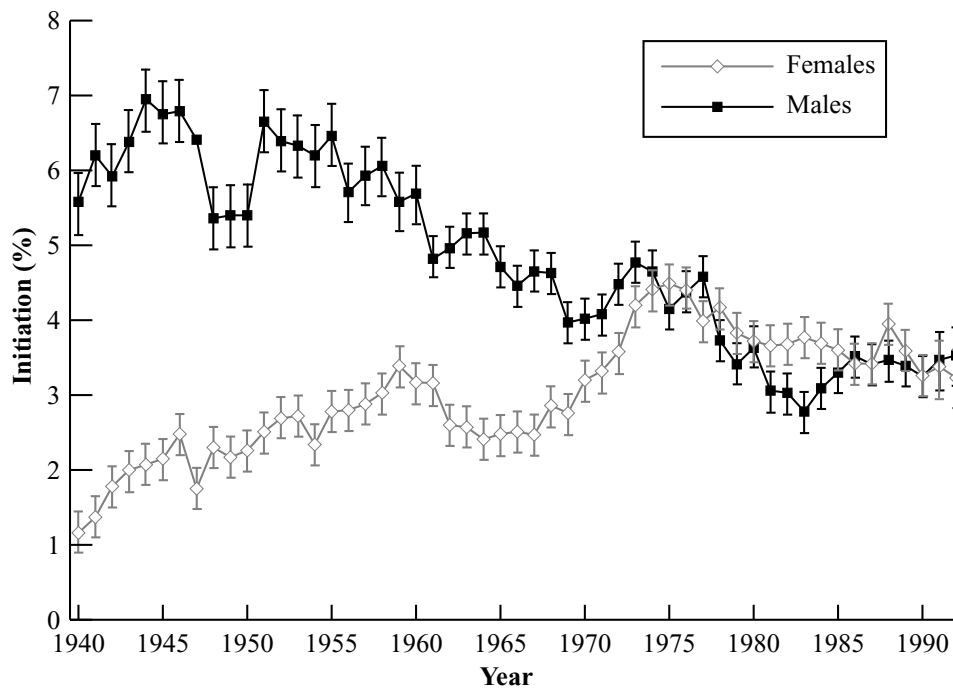
The CPS weights were used to calculate the initiation rates, and those rates and their corresponding sample sizes were used to calculate exact 95-percent binomial confidence intervals (Snedecor and Cochran, 1989).

RESULTS

National Male and Female Initiation Rates

Initiation rates of U.S. adolescents, aged 12 to 17, were compared between males and females. Male adolescents initiated smoking at a higher rate than did female adolescents prior to the mid-1970s (Figure 9-1). Specifically, from 1940 to 1973, boys initiated cigarette smoking at a significantly

Figure 9-1
Incidence of Smoking among 12- to 17-Year-Old Adolescents in the United States, 1940-1993



greater rate than did girls. From 1974 to 1980, boys and girls initiated at rates not significantly different from one another. Between 1981 and 1984, initiation rates for boys were significantly lower than for girls. Initiation rates have been similar for boys and girls since 1985. These observations are consistent with those reported elsewhere in this volume and in previous literature (Fiore *et al.*, 1989; see Chapter 2).

Smoking initiation rates among male adolescents have generally decreased since 1940 (Figure 9-1). This decline in the initiation rate reached its lowest level in 1983. Since that time, initiation rates among adolescent males have increased.

Unlike initiation rates among male adolescents, initiation rates among female adolescents have generally increased since 1940. Female adolescent initiation rates increased from 1940 to 1959, but declined during the early 1960s. Female adolescent initiation rates increased sharply from the late 1960s to the mid 1970s, then declined from the late 1970s to the early 1980s.

As previously reported (Burns, 1994; Pierce *et al.*, 1994; Pierce and Gilpin, 1995), the dramatic increase in girls' initiation rates in the late 1960s coincided with Philip Morris' introduction of Virginia Slims cigarettes (Figure 9-2). Sales of Virginia Slims rose from its inception in 1968 to a peak

in 1981. Contemporaneously, the number of Virginia Slims' cigarette advertisements in popular magazines increased from 1968 to 1987. In fact, the introduction of Virginia Slims was so successful that this brand has commanded up to 3 percent of the market share of cigarette sales (Kluger, 1997).

Initiation rates of 12- to 17-year-old males and females have also been computed for non-Hispanic White, Hispanic, and African American adolescents. Annual initiation rates and the 95-percent confidence intervals appear at the end of the chapter. Figures 9-3 and 9-4 display the loess-smoothing trend lines for male and female adolescents by ethnicity. Since the overall population of the United States is comprised mostly of Whites, initiation rates among White male and female adolescents are similar to initiation rates for males and females overall. In 1940, initiation rates among all three ethnic groups of adolescents were not significantly different for males or females. However, by 1992, White male and female adolescents initiated smoking at a significantly higher rate than the corresponding African American and Hispanic males and females aged 12 to 17 years.

From 1940 to 1992, White male adolescents generally initiated cigarette smoking at higher rates than did Hispanic or African American male adolescents. On the whole, initiation rates among male adolescents of all three ethnicities declined during this period. The overall patterns of initiation among Hispanic and African American male adolescents were similar until recent years. In the early 1980s, initiation rates among African American males declined steeply while White and Hispanic male adolescent initiation rates increased. By the late 1980s, these trends had changed with Hispanic male adolescent initiation rates decreasing and African American and White initiation rates increasing.

Initiation rates among White and Hispanic female adolescents generally increased from 1940 to 1992, although there was less of an increase among Hispanic female adolescents. In contrast, adolescent female initiation rates among African Americans have been decreasing since the mid 1970s and do not show evidence of the recent increase noted among African American male adolescents. The recent increase in African American male initiation rates has returned their rates of initiation to a level similar to those for African American females.

Comparison of Younger and Older Adolescent Initiation Nationally U.S. initiation rates were computed for two separate age groups of adolescents: 12- to 14-year-olds and 15- to 17-year-olds. The initiation rates of both younger and older male adolescents declined from 1940 to 1992, but the decline was much greater among older boys than among younger boys (Figure 9-5). The calendar-year variability of initiation rates among male adolescents is largely explained by calendar-year variability among older boys, suggesting that temporal events have greater influence, both positively and negatively, on older male adolescents than on younger male adolescents.

Female adolescent initiation rates (Figure 9-6) revealed a rise in initiation rates since 1940 for both younger and older adolescents, with a significant increase in initiation among both groups starting around the mid-

Figure 9-2
Incidence of Smoking among 12- to 17-Year-Old Adolescent Females Compared to Virginia Slims' Sales and Advertisement

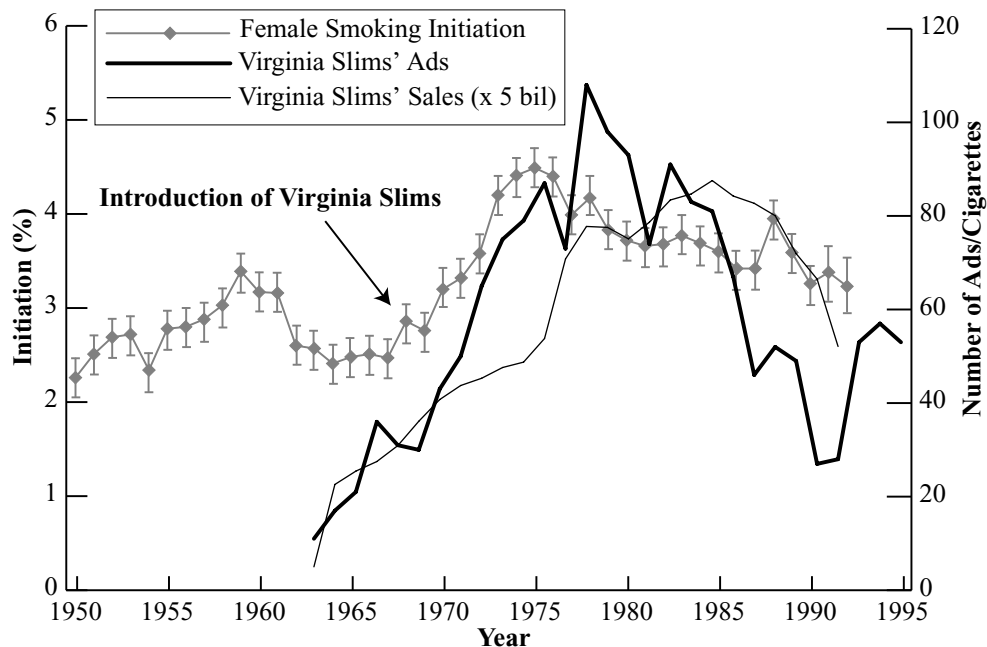


Figure 9-3
Cigarette Smoking Initiation among Adolescent Males 12 to 17 Years Old by Ethnicity [Weighted by Sample Size—Trendlines Fitted with Loess Algorithm (Quadratic)]

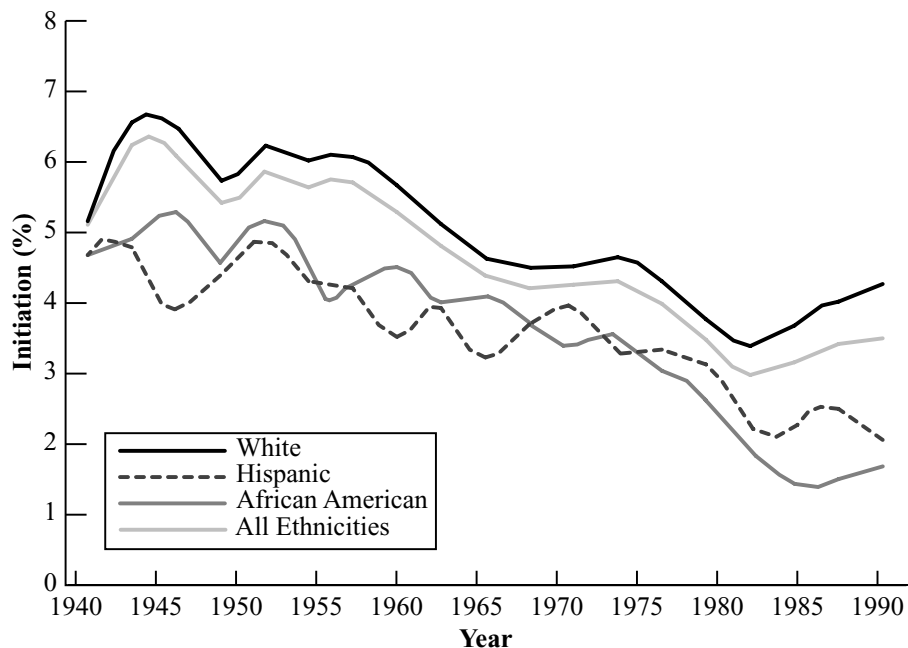


Figure 9-4
Cigarette Smoking Initiation among Adolescent Females 12 to 17 Years Old by Ethnicity [Weighted by Sample Size—Trendlines with Loess Algorithm (Quadratic)]

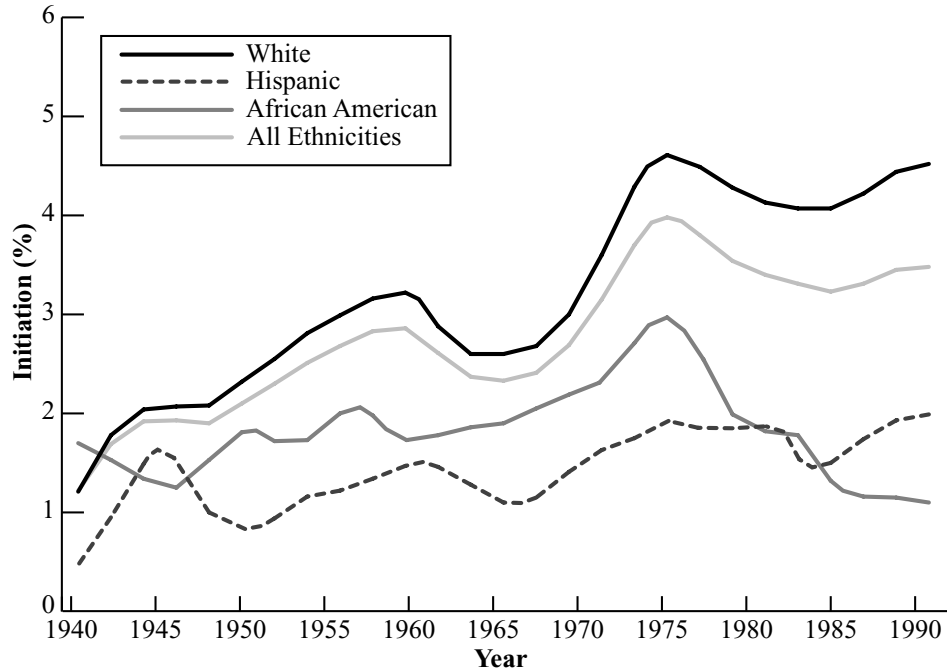
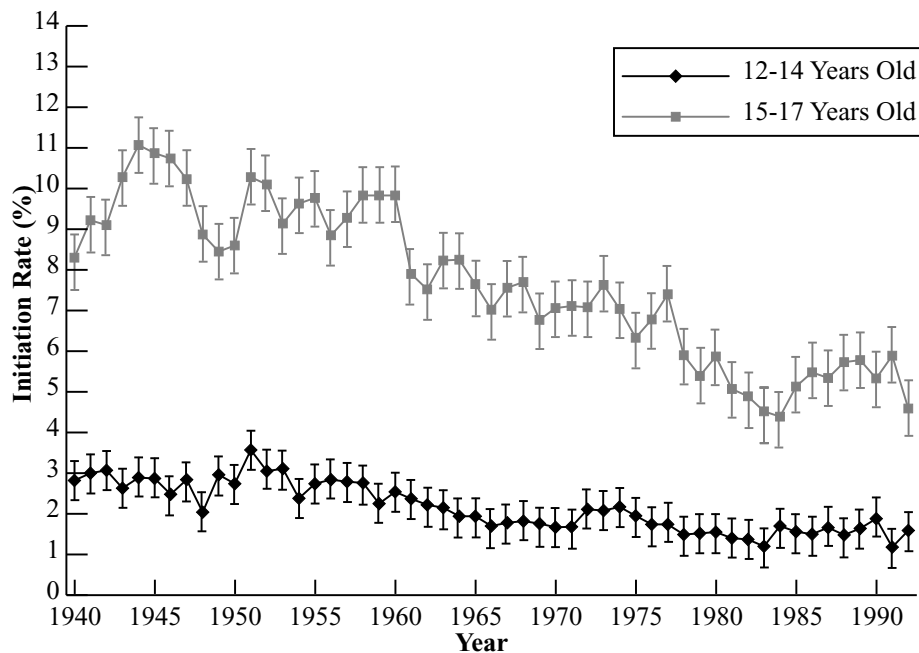


Figure 9-5
Comparison of the Smoking Initiation among Older and Younger Male Adolescents in the United States



1960s. The pattern of increases and decreases in initiation rates by calendar year was similar among older and younger female adolescents, but the fluctuations were more pronounced among the older girls. The pattern of initiation rates over time for female adolescents aged 12 to 17 can be attributed to the increases and decreases in initiation rates among both younger (12 to 14 years of age) and older (15 to 17 years of age) girls. Furthermore, the increase in initiation rates that coincided with the Virginia Slims' advertising campaign was present in both age groups of girls, but not in either age group of boys.

Comparison of California and the Rest of the Nation Initiation rates from 1978 to 1992 were calculated for California and for the rest of the nation. These rates were evaluated for 12- to 14-year-old male and female adolescents and for 15- to 17-year-old male and female adolescents. They were also contrasted before and after 1988, the year in which Proposition 99 was passed.

Among younger male adolescents, there was no significant difference in smoking initiation rates between California and the rest of the nation, either before or after 1988 (Figure 9-7). However, for older male adolescents, some differences were apparent (Figure 9-8). Before 1988, there was no significant difference in initiation rates between male adolescents in California and in the rest of the nation; however, after 1988, the initiation rates of older Californian boys declined significantly and were significantly lower than rates in the rest of the nation in 1991. This difference was no longer statistically significant in 1992. Smoking prevalence rates among this older group of adolescents (not shown) followed a pattern similar to the initiation rates, but differences were not statistically significant.

Initiation rates among younger girls were not significantly different between those in California and the rest of the nation, and there did not appear to be a significant change in the initiation rates in California among younger female adolescents after 1988 (Figure 9-9).

Before standardization by ethnicity, initiation rates among older Californian girls were lower than among girls in the rest of the nation, and most of these rates were significantly different. After standardization for ethnicity, the difference in initiation rates between older girls in California and the rest of the United States disappeared (Figure 9-10). The lower rates in California, before standardization, appeared to be attributable to the lower rates of smoking initiation among the different ethnic groups that comprised California's population in contrast to the rest of the nation. With or without standardization, there did not appear to be a difference between initiation rates among older girls in California following the passage of Proposition 99 in 1988.

SUMMARY The analysis had some limitations because rather than surveying the populations present in each year and calculating corresponding rates, respondents were surveyed in the 1990s and their rates were reconstructed retrospectively for each year from 1940 to 1992. Because the surveys were conducted in the recent past, the survey samples reflected the distribution of ethnic groups present today. Large proportions of the ethnic groups in today's population have immigrated to the United States since 1940, so any

Figure 9-6
Comparison of Smoking Initiation among Older and Younger Female Adolescents in the United States

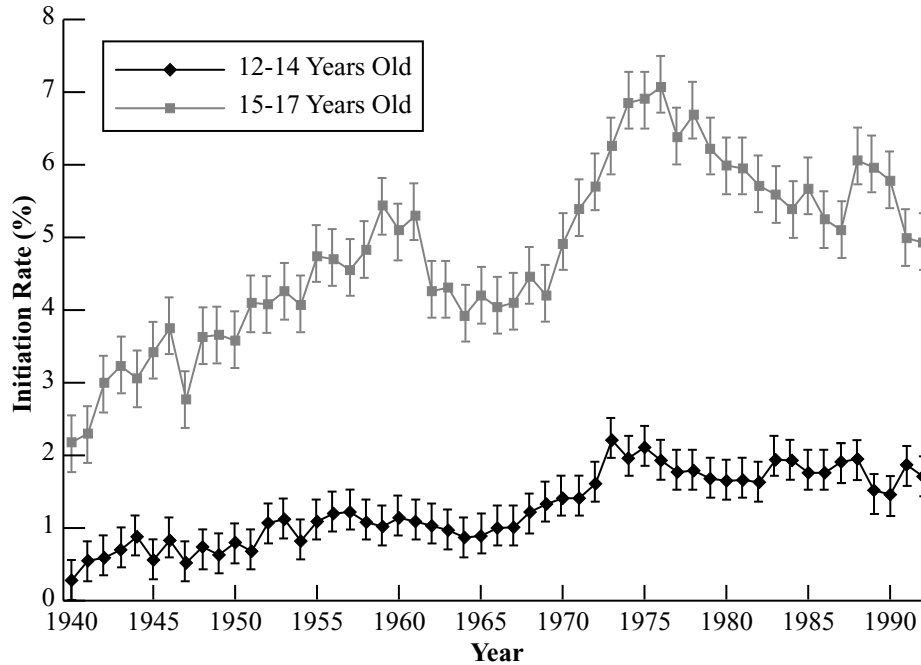


Figure 9-7
Comparison of Smoking Initiation Rates of California to the Rest of the Nation among 12- to 14-Year-Old Male Adolescents

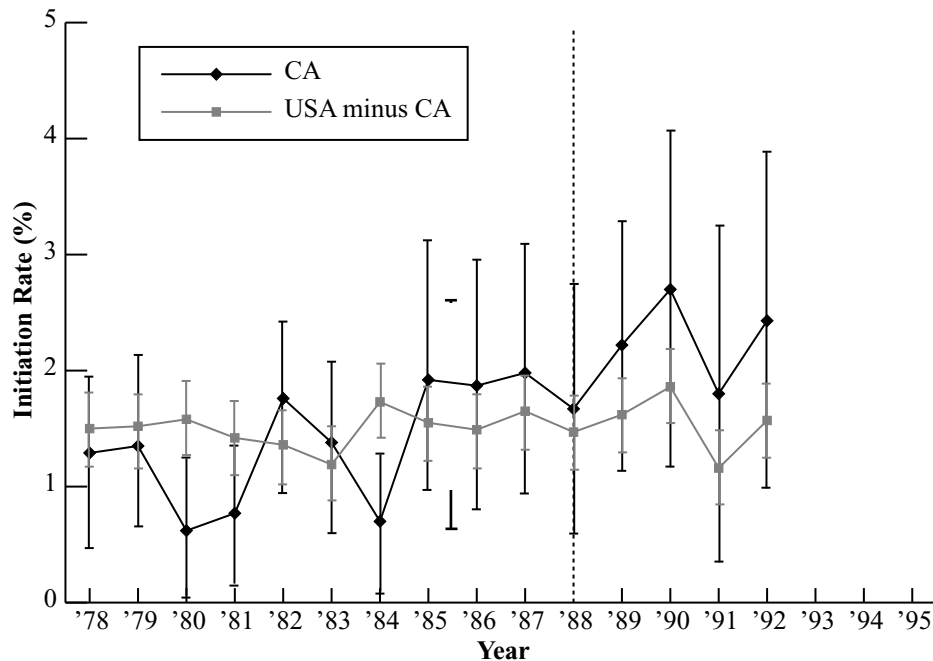


Figure 9-8
Comparison of Smoking Initiation Rates of California to the Rest of the Nation among 15- to 17-Year-Old Male Adolescents

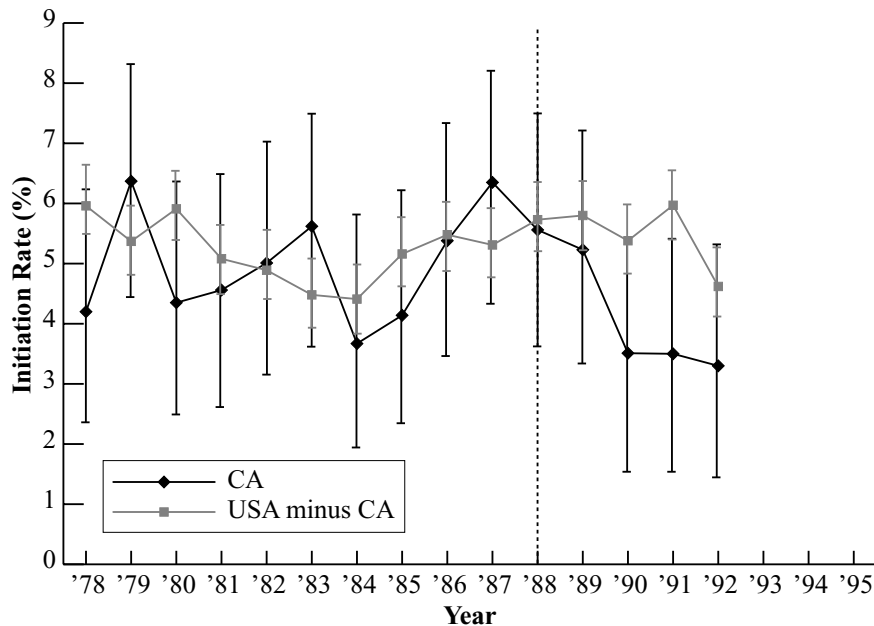


Figure 9-9
Comparison of Smoking Initiation Rates of California to the Rest of the Nation among 12- to 14-Year-Old Female Adolescents

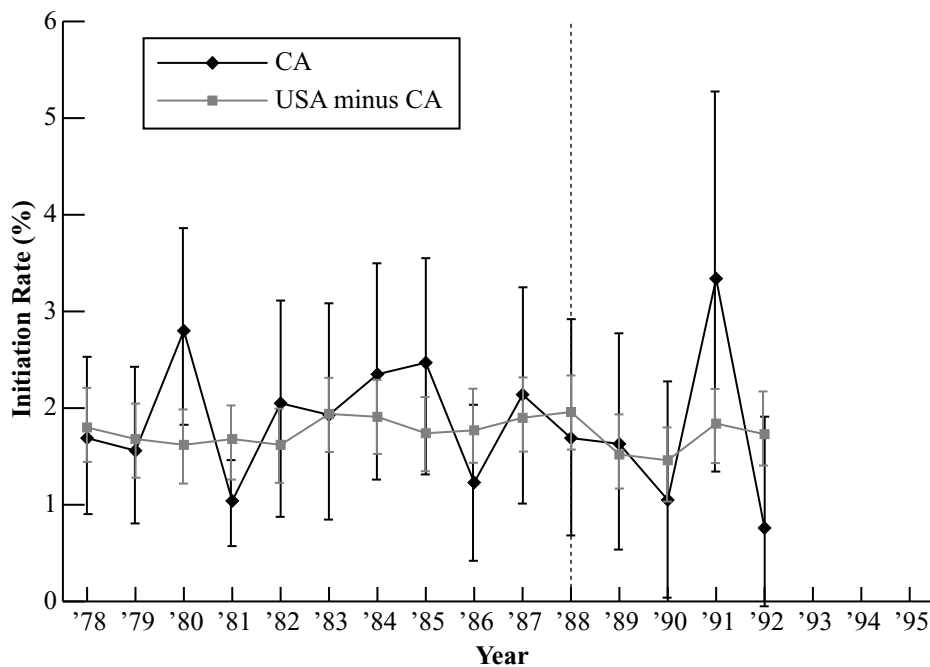
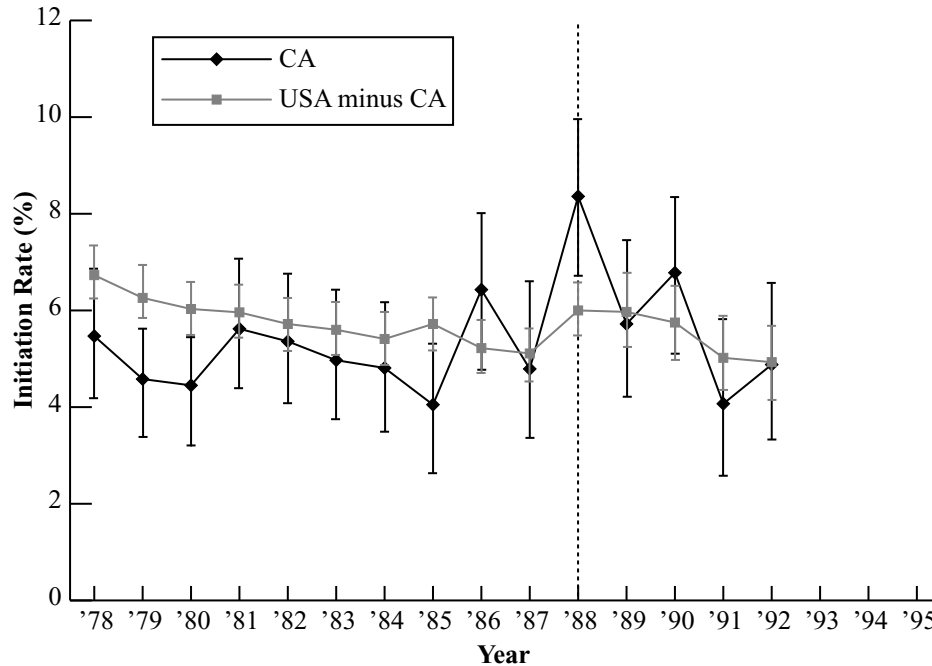


Figure 9-10

Comparison of Smoking Initiation Rates of California to the Rest of the Nation among 15- to 17-Year-Old Female Adolescents



fluctuations in initiation rates do not necessarily reflect events that happened in the United States. These initiation rates also reflected when the current population of the United States and California began smoking, not necessarily when the people present in the United States during each particular year began smoking.

Adolescent males have significantly decreased their smoking initiation since 1940 and most of the decreases and increases in initiation rates can be attributed to the changes among older 15- to 17-year-old adolescents. After the passage of Proposition 99 in California, older Californian boys' initiation rates decreased significantly. In 1991, these rates were significantly lower than the initiation rates among similarly aged boys in the rest of the nation. This suggests that tobacco control efforts in California may have differentially impacted this age group during the early years of the campaign.

Female adolescents increased their smoking initiation rates after 1940; in particular, initiation rates among female adolescents sharply increased at the time that Philip Morris introduced Virginia Slims. Both older and younger female adolescents experienced the increase in smoking initiation rates coincident with the introduction of the Virginia Slims brand. There did not appear to be a significant change in smoking initiation rates among either younger or older Californian girls after the passage of Proposition 99 in 1988.

FOLLOWING ARE FIGURES 9-1a THROUGH 9-1c, WHICH SHOW ANNUAL INITIATION RATES AND 95% CONFIDENCE INTERVALS

Figure 9-1a
Cigarette Smoking Initiation among 12- to 17-Year-Old White Adolescents

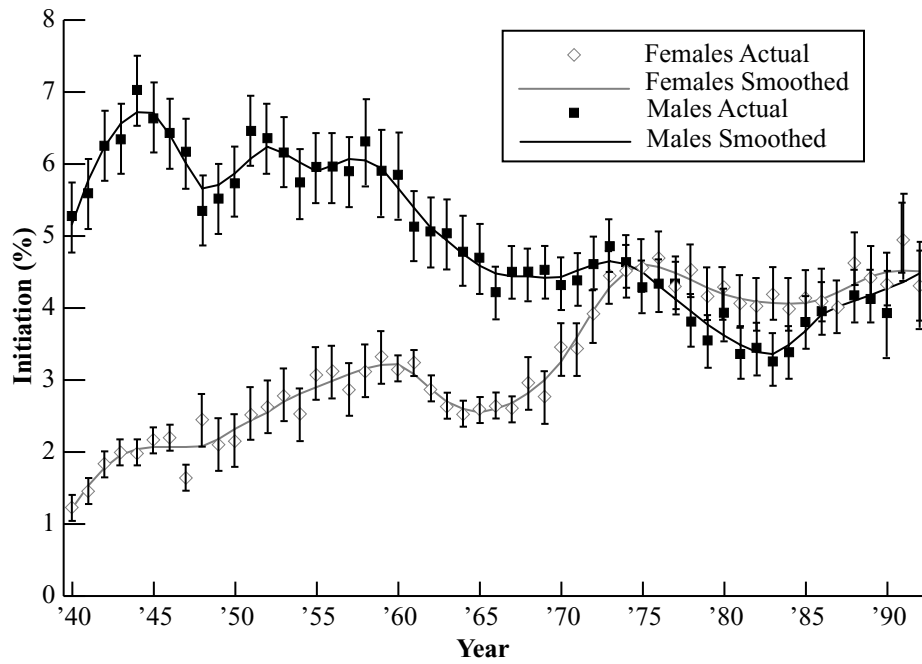


Figure 9-1b
Cigarette Smoking Initiation among 12- to 17-Year-Old Hispanic Adolescents

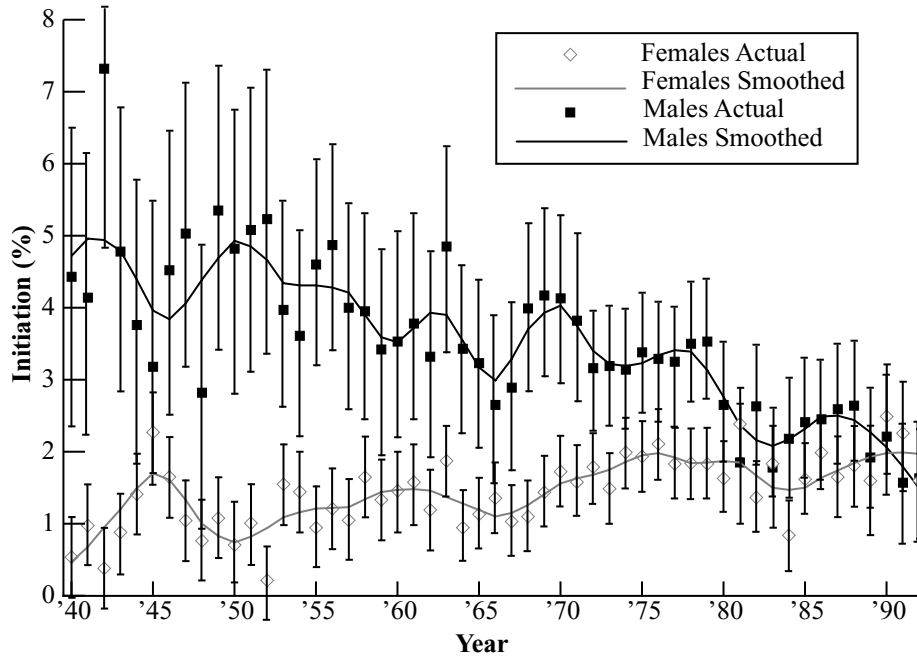
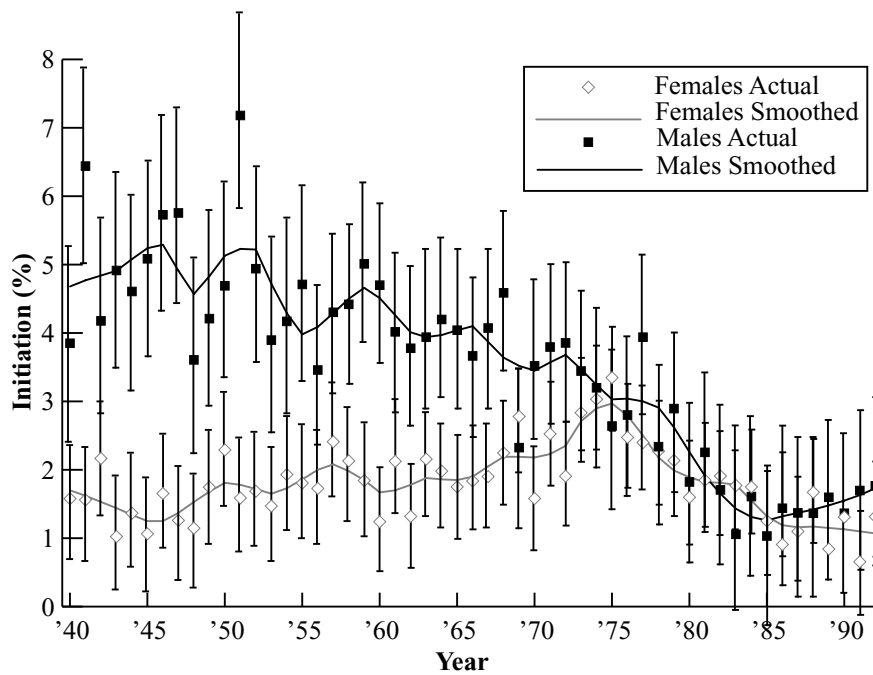


Figure 9-1c
Cigarette Smoking Initiation among 12- to 17-Year-Old African American Adolescents



REFERENCES

- Bal, D.G., Kizer, K.W., Felten, P.G., Mozar, H.N., Niemeyer, D. Reducing tobacco consumption in California. Development of a statewide anti-tobacco use campaign. *Journal of the American Medical Association* 264(12):1570-1574, 1990.
- Breslow, L., Johnson, M. California's Proposition 99 on tobacco, and its impact. *Annual Review of Public Health* 14:585-604, 1993.
- Bureau of the Census. The Current Population Survey: Design and Methodology. *Technical Paper 40*. Washington, D.C.: U.S. Department of Commerce, Bureau of the Census, 1978.
- Burns, D.M. Use of media in tobacco control programs. *American Journal of Preventive Medicine* 10(3 Suppl):3-7, 1994.
- Burns, D.M., Lee, L., Vaughn, J.W., Chiu, Y.K., Shopland, D.R. Rates of smoking initiation among adolescents and young adults, 1907-81. *Tobacco Control* 4(Suppl 1):S4-S8, 1995.
- Burns, D.M., Pierce, J.P., et al. *Tobacco Use in California 1990-1991*. Sacramento, CA: California Department of Health Services, 1992.
- Cleveland, W.S. Robust locally-weighted regression and smoothing scatterplots. *Journal of the American Statistical Association* 74:829-836, 1979.
- Cummings, K.M., Shah, D. Trends in smoking initiation among adolescents and young adults—United States, 1980-1989. *Morbidity and Mortality Weekly Report* 44(28):521-525, 1995.
- Elder, J.P., Edwards, C.C., Conway, T.L., Kenney, E., Johnson, C.A., Bennett, E.D. Independent evaluation of the California Tobacco Education Program. *Public Health Report* 111(4):353-358, 1996.
- Fiore, M.C., Novotny, T.E., Pierce, J.P., Hatziaandreu, E.J., Patel, K.M., Davis, R.M. Trends in cigarette smoking in the United States. The changing influence of gender and race. *Journal of the American Medical Association* 261(1):49-55, 1989.
- Gilpin, E.A., Pierce, J.P. Trends in adolescent smoking initiation in the United States: Is tobacco marketing an influence? *Tobacco Control* 6(2):122-127, 1997.
- Hu, T.W., Bai, J., Keeler, T.E., Barnett, P.G., Sung, H.Y. The impact of California Proposition 99, a major anti-smoking law, on cigarette consumption. *Journal of Public Health Policy* 15(1):26-36, 1994.
- Kluger, R. *Ashes to Ashes: America's Hundred-Year Cigarette War, the Public Health, and the Unabashed Triumph of Philip Morris*. New York: Alfred A. Knopf, 1997.
- MathSoft Inc. *S-Plus 2000, Guide to Statistics*. Seattle, WA: Data Analysis Division, 1999.
- Maxwell, J.C., Jr. *Historical Sales Trends in the Cigarette Industry: A Statistical Summary Covering 69 Years (1925-93)*. Richmond, VA: Wheat, First Securities, Inc., 1994.
- Pierce, J.P., Burns, D.M., Berry, C., Rosbrook, B., Goodman, J., Gilpin, E., Winn, D., Bal, D. Reducing tobacco consumption in California: Proposition 99 seems to work [letter]. *Journal of the American Medical Association* 265(10):1257-1258, 1991.
- Pierce, J.P., Gilpin, E.A. A historical analysis of tobacco marketing and the uptake of smoking by youth in the United States: 1890-1977. *Health Psychology* 14(6):500-508, 1995.
- Pierce, J.P., Lee, L., Gilpin, E.A. Smoking initiation by adolescent girls, 1944 through 1988. An association with targeted advertising [see comments]. *Journal of the American Medical Association* 271(8):608-611, 1994.
- Snedecor, G.W., Cochran, W.G. *Statistical Methods*. (8th ed.). Ames, Iowa: Iowa State University Press, 1989.