Trends in Cigarette Smoking among US Adolescents, 1974 through 1991

ABSTRACT

Objectives. The purpose of this study was to determine national trends in adolescent cigarette smoking prevalence.

Methods. We conducted trend analyses based on 1974 through 1991 current smoking prevalence data among persons aged 12 through 19 years from the National Household Surveys on Drug Abuse, High School Seniors Surveys, and National Health Interview Surveys.

Results. Overall smoking prevalence declined much more rapidly from 1974 through 1980 (1.9 percentage points annually among younger adolescents; the range among surveys of older adolescents was 0.2 to 2.0 percentage points annually) than from 1985 through 1991 (0 to 0.5 percentage points annually among all adolescents). Since 1980, smoking has generally declined at a slightly faster rate among older female adolescents than among male adolescents. Smoking among Black adolescents of all ages declined in nearly every survey population during each study period (range among surveys: 1974–1985 = 1.0 to 2.9 percentage points; 1985–1991 = 0.7 to 1.5 percentage points annually); for White adolescents, only minimal declines in smoking have occurred since 1985.

Conclusions. Since 1974, major changes in adolescent smoking patterns have occurred, especially among Blacks. The overall slowing rate of decline in smoking prevalence since 1985 may indicate success of increased tobacco advertising and promotional activities targeted at adolescents or inadequate antitobacco education efforts. (*Am J Public Health.* 1995;85:34–40)

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Introduction

Over the past three decades, despite increased public knowledge about the adverse health effects of smoking, the majority of adolescents still experiment with cigarettes,[1–3] and 89% of persons aged 30 through 39 years who ever smoked cigarettes on a daily basis reported having smoked their first cigarette by age 18.[4] Because the average age of initiation of smoking has declined across birth cohorts, and because few people begin smoking after age 20,[2,4,5] adolescence is the critical period during which most persons begin smoking. Unfortunately, persons who begin to smoke at younger ages are more likely to experience the adverse health consequences from smoking.[2]

National trends in prevalence of adolescent smoking are important for determining the need for smoking prevention programs, determining the effectiveness of existing prevention efforts, predicting the future burden of tobacco-related disease, and measuring the impact of cigarette manufacturers' marketing efforts directed toward adolescents. To our knowledge, only limited national data on adolescent smoking have been published in scientific journals, and these were based on one ongoing national survey.[6,7] To determine trends in adolescent cigarette smoking, we examined data on current smoking among adolescents aged 12–19 years from three national surveys conducted periodically from 1974 through 1991.

Methods

We analyzed data from the National Household Surveys on Drug Abuse (NHSDA) (this survey, previously conducted by the National Institute on Drug Abuse, is now conducted by the Substance Abuse and Mental Health Services Administration [SAMHSA]), the University of Michigan Institute for Social Research High School Seniors Surveys, and National Health Interview Surveys (NHIS) conducted by the National Center for Health Statistics, Centers for Disease Control and Prevention.

National Household Surveys on Drug Abuse

We analyzed data from the NHSDA conducted in 1974, 1976, 1977, 1979, 1982, 1985, 1988, 1990, and 1991. Details of these surveys are reported elsewhere.[8–15] Respondents were interviewed in person in their homes by trained interviewers, and analyses were restricted to persons aged 12 through 16 years (younger adolescents) and persons aged 17 through 19 years (older adolescents). The response rate averaged 80% (Joseph Gfroerer, SAMHSA, personal communication, August 1992), and data were weighted to provide national estimates.

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For all years except 1979, current smoking was defined as having smoked within the past month. In 1979, only persons who reported having smoked five or more packs of cigarettes in their lifetime were asked whether they smoked cigarettes within the past month; thus, direct comparison of data from this year with data from other years was problematic. By using results from the 1982 survey, we adjusted the 1979 current smoking prevalence estimates so that they were comparable with other years by using the ratio of the 1982 overall prevalence estimate (based on the 1979 definition) to the overall prevalence estimate based on the definition used in other years.[8–15]

For the 1982 and 1985 surveys only, race and ethnicity were combined into one question.[11,12] For these years, we classified all Hispanics as Whites, because analyses of data from other years revealed that nearly all Hispanics were classified as Whites.

High School Seniors Surveys

We analyzed published data on high school seniors from 1976 through 1988 and unpublished data for 1989 through 1991 (University of Michigan, unpublished data, 1990, 1991, 1992).[16–28] Detailed descriptions of the methodology used can be found elsewhere.[6,16–29] Written surveys were administered to students in classrooms by trained personnel using standardized procedures. An average of 130 high schools were selected each year, and about 83% of sampled seniors participated; data were weighted to provide national estimates.[6] Based on 1982 through 1989 survey data, 0.8% of the high school seniors were less than 17 years of age, 51.9% were aged 17 years, 42.8% were aged 18 years, 4.0% were aged 19 years, and 0.5% were more than 19 years of age (Patrick O'Malley, PhD, University of Michigan Institute for Social Research, personal communication, March 1993); therefore, we considered high school seniors to be older adolescents. Because the response rate was much lower and the sample size smaller in 1975 than they were in subsequent years, we excluded 1975 data from our analyses.[30] We defined current smoking as having smoked within the past 30 days.

National Health Interview Surveys

We analyzed NHIS data from 1974, 1976, 1978, 1979, 1980, 1983, 1985, 1987, 1988, 1990, and 1991 for persons aged 18 and 19 years. Detailed descriptions of the methodology of these surveys can be found elsewhere.[31–36] Most interviews were conducted in the home; when respondents could not be interviewed in person, telephone interviews were conducted. The overall response rate for the NHIS was between 85% and 90%.[31–36] Only data collected since 1974 were analyzed because proxy data were used in prior years. Data were weighted to provide national estimates. We defined current smokers as persons who reported having smoked more than 100 cigarettes in their lifetime and who said they were current smokers.

TABLE 1—Predicted Average Annual Change[a] in Smoking Prevalence among Adolescents, by Survey and Time Period, 1974 through 1991

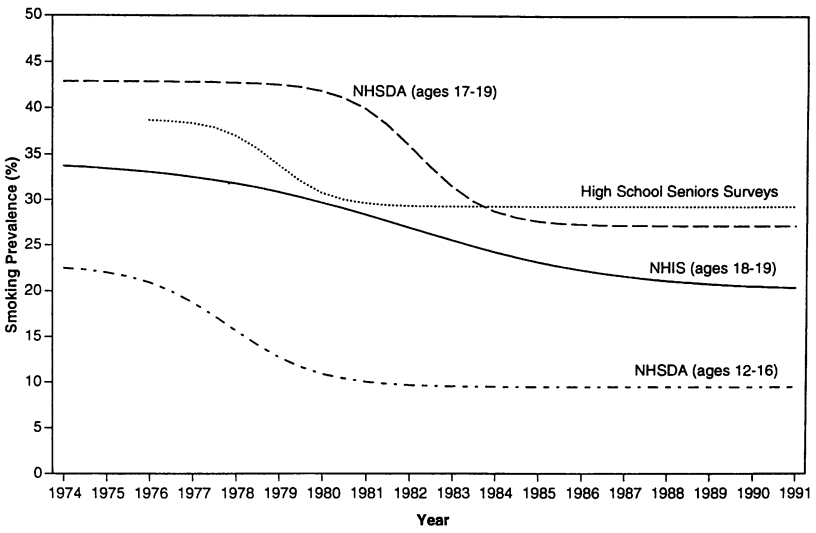
Group (Age)	Average Annual Percentage Point Change						R^2 for Model
	1974–1980[b]	*P*	1980–1985	*P*	1985–1991	*P*	
Overall							
NHSDA (12–16)	−1.9	<.01	−0.3	NS	0	NS	.87
NHSDA (17–19)	−0.2	NS	−2.8	<.01	−0.1	NS	.95
High School Seniors Surveys	−2.0	<.01	−0.3	<.01	0	NS	.97
NHIS (18–19)	−0.7	<.01	−1.3	<.01	−0.5	<.05	.96
Male							
NHSDA (12–16)	−1.9	<.05	−0.6	NS	−0.1	NS	.80
NHSDA (17–19)	−0.1	NS	−2.4	<.01	−0.1	NS	.88
High School Seniors Surveys	−2.3	<.01	−0.1	NS	0	NS	.93
NHIS (18–19)	−1.7	<.01	−1.0	<.01	−0.1	NS	.97
Female							
NHSDA (12–16)	−1.7	<.01	−0.6	<.05	−0.1	NS	.90
NHSDA (17–19)	−0.6	NS	−2.6	<.05	−0.4	NS	.80
High School Seniors Surveys	−1.1	<.01	−0.9	<.01	−0.1	NS	.90
NHIS (18–19)	0	NS	−1.4	<.01	−0.8	<.05	.90
White							
NHSDA (12–16)	−1.8	<.01	0	NS	0	NS	.81
NHSDA (17–19)	−0.1	NS	−2.4	<.01	−0.1	NS	.93
High School Seniors Surveys	−1.6	<.01	−0.1	NS	0	NS	.93
NHIS (18–19)	−0.5	NS	−1.2	<.01	−0.3	NS	.89
Black							
NHSDA (12–16)	−1.5	<.05	−1.4	<.01	−0.7	<.01	.96
NHSDA (17–19)	−2.0	NS	−2.9	<.01	−1.5	<.01	.91
High School Seniors Surveys	−2.0	<.01	−2.2	<.01	−0.8	<.01	.96
NHIS (18–19)	−1.0	<.05	−2.1	<.01	−1.5	<.01	.96

Note. NS = not significant; NHSDA = National Household Surveys on Drug Abuse; NHIS = National Health Interview Surveys.
[a]Based on regression models for each data source.
[b]1976–1980 for High School Seniors Surveys.

Statistical Analyses

Standard errors for NHSDA and High School Seniors Surveys prevalence estimates were computed by multiplying the square root of the design effect by the standard error expected under a binomial sampling scheme.[8–15,29] Separate design effects were used for each population subgroup. Point estimates and standard errors for NHIS data were computed with SUDAAN software.[37,38]

To identify trends in current smoking, we created regression models for each survey from 1974 (1976 for High School Seniors Surveys) through 1991 for all adolescents and separately for males, females, Whites, and Blacks. Based on scatter plots, we hypothesized that the data would best be described with logistic models. Unlike the typical models used in logistic regression analyses, the version of the logistic equation we used was S-shaped but with an upper asymptote on the left and a lower asymptote on the right.[39] Weighted least squares were used to estimate the parameters of the logistic models, with weights computed as the inverse of the estimated variance of prevalence. The goodness of fit for the models was estimated by the R^2 coefficient.[39]



Note. Estimates were predicted from logistic models. NHSDA = National Household Surveys on Drug Abuse; NHIS = National Health Interview Surveys.
Source. Based on data from references 4 and 11–31; the University of Michigan (unpublished data, 1990–1992); and the Centers for Disease Control and Prevention (unpublished data, 1993).

FIGURE 1—Overall weighted estimates of current smoking prevalence among adolescents in the United States, by survey, 1974 through 1991.

To better summarize changes over time, we calculated predicted prevalence values for 1974 (1976 for High School Seniors Surveys), 1980, 1985, and 1991 and estimated the rate of change in prevalence over these time periods by calculating the differences in model-predicted prevalence values at the end points of the time periods and dividing the difference by the number of years in the time periods (equations used for logistic models are available from the authors). The significance of the change was tested by estimating the standard error of the change and comparing this result with the normal (z) distribution.

Results

The range of sample sizes was 775 through 6696 among persons aged 12 through 16 years in the NHSDA, 371 through 3429 for persons aged 17 through 19 years in the NHSDA, 16 056 through 18 448 in the High School Senior Surveys, and 453 through 1385 in the NHIS.

Although smoking declined in all surveys from 1974 through 1991, there was substantial variation by time period and within subgroups.[4] Within each survey, current smoking prevalences among female and male adolescents were essentially equal by 1991.[4] The most striking differences, however, are racial: by 1985, all surveys revealed that Black adolescents were less likely to smoke than White adolescents, and these differences had widened substantially by 1991.[4]

Trend analyses indicated that overall smoking prevalence declined by an average of 1.9 percentage points per year among younger adolescents and 0.2 to 2.0 percentage points per year among older adolescents during 1974 through 1980 and 0.3 percentage points per year among younger adolescents and 0.3 to 2.8 percentage points per year among older adolescents during 1980 through 1985 (Table 1 and Figure 1). Minimal changes, except in the NHIS, occurred during 1985 through 1991.

Declines in smoking prevalence among younger male and younger female adolescents across the study years were similar (Table 1 and Figures 2 and 3). Since 1980, smoking prevalence has generally declined at a slightly faster rate among older female adolescents than it has among older male adolescents. Although there was variation among surveys, statistically significant declines in smoking prevalence among White adolescents occurred in each survey population during 1974 through 1980 and 1980 through 1985; however, no significant declines in White adolescent smoking prevalence occurred in any surveys during 1985 through 1991 (Table 1 and Figure 4). In marked contrast, declines in smoking prevalence among Black adolescents of all ages were observed in nearly every survey population across each study period (Table 1 and Figure 5).

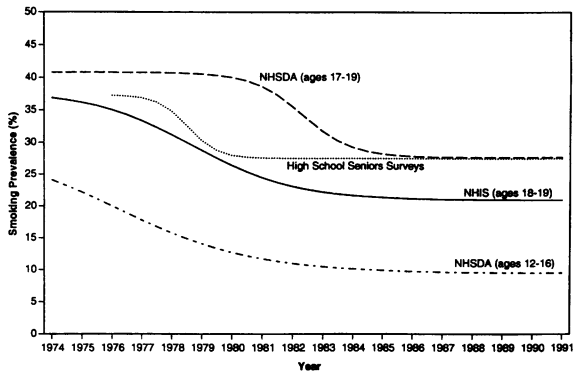
Discussion

The decline in prevalence of smoking among female adolescents since 1980 is encouraging and parallels recent declines in adult female smoking prevalence.[40,41] Reasons for this decline among adolescent females are unclear, although correlates of adolescent smoking do differ somewhat by sex.[42,43] Possible explanations for the decline in female adolescent smoking include increased belief in the perceived harmfulness of cigarettes and more conservative cultural norms.[29]

The large decline in smoking prevalence among Black adolescents has been reported elsewhere,[6,11,29,44] and declines in the use of other drugs have also been reported for Black high school seniors.[6] Because the decline in cigarette smoking was consistent across multiple studies over the study period, it is unlikely to be the result of sample bias or differential school dropout rates,[11] and it may represent a cultural shift.[6] Possible explanations for the decline may include religious beliefs; changing parent, peer, and community norms; higher levels of perceived health risk; increased cost of cigarettes and relative decrease in disposable income; and reduced impact of peer smoking.[6,29,45] Significant declines in smoking prevalence for Hispanics, Native Americans, and Asian Americans from High School Seniors Surveys have also been reported from 1976 through 1989.[6]

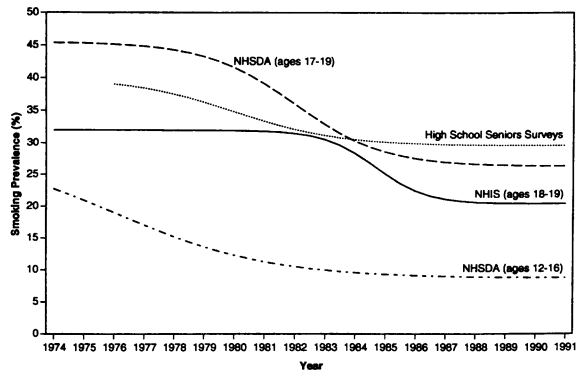
Although the average age of smoking initiation has been higher for Blacks than for Whites for many years, the smoking prevalence among Blacks aged 20 through 24 years has also declined in recent years.[5,41] If these encouraging trends continue through adulthood, the long-standing higher incidence of smoking-related health problems for Blacks compared with Whites may be reversed; however, this reversal would not occur until well into the 21st century.[46,47]

Reasons for the overall decline in prevalence of smoking from 1974 through 1985 are not well understood, nor is there a clear explanation of why the rates of maximum decline in prevalence (inflection points) differed among the surveys of older adolescents. Adolescents in the 1970s and early 1980s were the first cohort



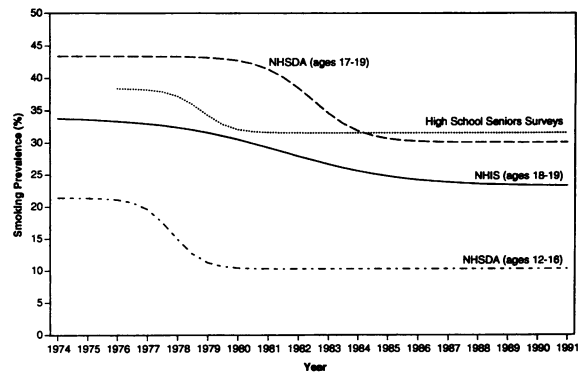
Note. Estimates were predicted from logistic models. NHSDA = National Household Surveys on Drug Abuse; NHIS = National Health Interview Surveys.
Source. Based on data from references 4 and 11–31; the University of Michigan (unpublished data, 1990–1992); and the Centers for Disease Control and Prevention (unpublished data, 1993).

FIGURE 2—Weighted estimates of current smoking prevalence among male adolescents in the United States, by survey, 1974 through 1991.



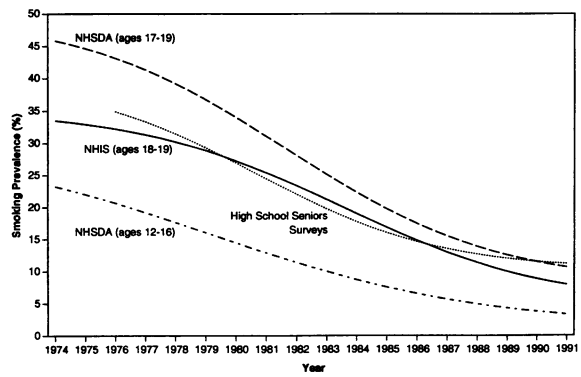
Note. Estimates were predicted from logistic models. NHSDA = National Household Surveys on Drug Abuse; NHIS = National Health Interview Surveys.
Source. Based on data from references 4 and 11–31; the University of Michigan (unpublished data, 1990–1992); and the Centers for Disease Control and Prevention (unpublished data, 1993).

FIGURE 3—Weighted estimates of current smoking prevalence among female adolescents in the United States, by survey, 1974 through 1991.



Note. Estimates were predicted from logistic models. NHSDA = National Household Surveys on Drug Abuse; NHIS = National Health Interview Surveys.
Source. Based on data from references 4 and 11–31; the University of Michigan (unpublished data, 1990–1992); and the Centers for Disease Control and Prevention (unpublished data, 1993).

FIGURE 4—Weighted estimates of current smoking prevalence among White adolescents in the United States, by survey, 1974 through 1991.



Note. Estimates were predicted from logistic models. NHSDA = National Household Surveys on Drug Abuse; NHIS = National Health Interview Surveys.
Source. Based on data from references 4 and 11–31; the University of Michigan (unpublished data, 1990–1992); and the Centers for Disease Control and Prevention (unpublished data, 1993).

FIGURE 5—Weighted estimates of current smoking prevalence among Black adolescents in the United States, by survey, 1974 through 1991.

not exposed to vast amounts of cigarette advertising on radio and television as a result of the advertising ban imposed by Congress in 1971, and this ban may have played some role in slowing initiation of smoking.[2] Other possible reasons for the decrease may include the emphasis on healthier lifestyles and physical fitness and the decreased social acceptability of smoking, both of which first became prominent during this period.

The recent evidence of minimal declines in adolescent smoking since 1985, especially among Whites and males, is disturbing because it may be in part due to increased cigarette advertising and promotion. Tobacco companies targeted much of their advertising and promotional products toward younger audiences in the 1980s.[48–52] Promotional products such as T-shirts, posters, and baseball caps are more likely to appeal to adolescents than to adults,[49–51] and promotional allowances and specialty item distribution expenditures by tobacco companies increased from $503.7 million in 1984 to $1.33 billion in 1990 (264%).[53] The "Old Joe" campaign for Camel cigarettes strongly appeals to adolescents and even young children,[49–51] and the "Marlboro Man" may appeal to adolescents' desire for freedom and independence.[54] In the United States and in other countries,

tobacco companies have also sponsored youth events, such as rock music concerts, and heavily subsidized sporting events (e.g., automobile races) viewed by a substantial number of adolescents.[52,55,56] Recently, the R. J. Reynolds Corporation introduced merchandise catalogues featuring products with the Camel cigarette brand logo,[57] and the Philip Morris Corporation began distributing products with the Marlboro logo as part of the Marlboro Adventure Team advertising campaign and lowered the price of Marlboro cigarettes.[58,59] Because both these cigarette brands are popular among adolescents, these activities may have an impact on the use of tobacco in this population.

Another possible reason for the overall minimal decline in smoking prevalence since 1985 was the emergence of a group of high-risk adolescents who are more likely to experiment with cigarette smoking and who may have resisted school, parental, and media efforts to discourage smoking.[60] This group may help explain why data from the surveys fit the logistic, or S-shaped, regression models so consistently. This type of curve characterizes many changes in populations, including changes in health behavior,[61,62] and implies that the rate of change (i.e., decline in smoking prevalence) would start slowly and then accelerate and approximate a linear trend, followed by a reduced rate of change.[61,62] Finally, during most of the 1980s extensive media and school campaigns (e.g., "just say no to drugs") emphasized prevention of adolescent use of drugs such as marijuana and cocaine rather than cigarettes, and this emphasis may have implied that tobacco use was not as serious a problem as illicit drug use.[63]

There are limitations to our study. Because of different methodologies, comparisons between study populations are not possible. Our results may be more indicative of trends in older adolescents, because only the NHSDA included younger adolescents. Household interview surveys generally provide lower estimates of smoking prevalence than school-based surveys of adolescents of comparable ages, possibly because of concerns about lack of privacy.[64–69] In addition, the definition of current smoking was substantially different for NHIS and may explain why estimates from these surveys were consistently lower than estimates for older adolescents from other surveys. All the surveys, which relied on self-reports of cigarette smoking and lacked biochemical verification, may underestimate prevalence.

Although we defined current smoking as smoking within the past 30 days or within the past month for two of the surveys (and adolescent smoking within the previous month substantially increases the risk of smoking as an adult[70,71]), similar trends were observed among high school seniors for daily smoking over most of the study period.[6] Our results apply to cigarette smoking only and not to total tobacco use; because smokeless tobacco use is more common among male adolescents than female adolescents, male adolescents would be more likely to report any tobacco use in the past month than would female adolescents.[44]

Each study has its own limitations. Both the NHSDA and NHIS excluded persons not living in households, although in the NHIS, dormitories and group homes are considered to be households. The need to adjust NHSDA smoking prevalence estimates for 1979 made comparability with other years uncertain, and the impact this adjustment had on the estimates is unclear. The High School Seniors Surveys excluded absentees and dropouts, and because smoking prevalence is high among dropouts, the estimates should only be reliable for adolescents who remained in school[11,72]; however, because dropout and absentee rates remained stable over most of the study years, this exclusion probably had a minimal impact on trends.[6,73]

Despite evidence of a decline since 1974, adolescent smoking continues to be a major problem in the United States, and far too many adolescents are smoking. Estimates from the 1992 and 1993 High School Senior Surveys[74] (Institute for Social Research, University of Michigan, unpublished data, February 1994) and from the 1992 National Household Survey on Drug Abuse[75] demonstrate little change in adolescent and young-adult smoking prevalence since 1991. If current trends continue, it is unlikely that the year 2000 national health objective to reduce cigarette smoking by children and youth so that no more than 15% become regular smokers by age 20 will be achieved.[76] Because no one approach is guaranteed to reduce adolescent smoking, several approaches—including antitobacco educational activities,[77,78] reduced access to tobacco products,[79,80] environmental approaches,[2,80,81] and increased cigarette excise taxes—are needed.[82,83] □

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