

Patterns of adolescent smoking initiation rates by ethnicity and sex

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Abstract

Objective—To define US national sex specific rates of smoking initiation among Hispanic, non-Hispanic white, and African American adolescents aged 12–17 years for each calendar year from 1940 through 1992.

Methods—Adult survey data from the tobacco use supplement of the Current Population Survey in 1992–93 and 1995–96 were used to reconstruct the age at which individuals began to smoke and the calendar year in which they were that age. From these data, the number of individuals who began a calendar year as never smokers and who were aged 12–17 years during that year could be estimated and formed the denominator of the initiation rate. The number of these individuals who reported taking up smoking during that year formed the numerator of the initiation rate.

Results—Initiation rates among male adolescents in each of the three racial/ethnic groups have declined since 1945. However, since 1983, initiation rates among male adolescents overall have increased. Non-Hispanic white male adolescents generally initiated cigarette smoking at higher rates than Hispanic or African American male adolescents. Initiation rates among Hispanic male adolescents have not been statistically different from initiation rates among African American male adolescents. From 1978 to 1982, initiation rates among Hispanic and African American male adolescents experienced a sharp decline, and the rate of decline was steeper than that experienced by non-Hispanic white male adolescents. Initiation rates among female adolescents have increased since 1940, catching up to male adolescent initiation rates by the mid 1970s. Initiation rates among female adolescents appeared to level off or increased slightly again from the mid 1980s to 1990. Non-Hispanic white female adolescents generally initiate cigarette smoking at higher rates than Hispanic or African American female adolescents. Initiation rates among non-Hispanic white and African American female adolescents equalled the initiation rates of their male counterparts by the mid 1970s, but initiation rates among Hispanic female adolescents did not overlap with initiation rates of Hispanic male adolescents until 1990. From 1975 to 1980, initia-

tion rates among African American female adolescents decreased sharply, but, unlike initiation rates among the two other ethnic groups, rates continued to decline from 1984 to 1990.

Conclusions—Different patterns of increasing and decreasing smoking initiation among sex and ethnic adolescent groups suggest the effect of varying social and cultural influences. These findings support the importance of including ethnic factors in studies of smoking behaviour.

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The initiation of cigarette smoking occurs largely during adolescence, and trends in initiation have varied considerably over the last several decades among males and females and across racial and ethnic groups.^{1–4} Cross sectional data for adolescent smoking prevalence is available for white male and female adolescents as well as for African American and Hispanic adolescents.⁴ Current cross sectional data on adult smoking prevalence and age at which smokers first began to smoke regularly have also been used to reconstruct past rates of adolescent smoking initiation,^{3 5–8} but these estimates have largely been limited to general population estimates. We explored racial and ethnic differences in adolescent smoking initiation from 1940 onward using the 1992–93 and 1995–96 Current Population Surveys to construct retrospectively past rates of smoking initiation. Since most smokers initiate by the age of 18 years, we investigated the initiation rates of 12 to 17 year old adolescents from 1940 to 1992. Initiation rates were calculated for non-Hispanic white, Hispanic, and African American male and female adolescents.

Definitions used to define adolescent and adult smokers in surveys are different. Adolescent surveys most commonly define smokers as respondents who have smoked at least one cigarette in the last 30 days, and this definition is sensitive enough to capture respondents who are experimenting with cigarettes or are in the early stages of beginning smoking. Adult based surveys usually define smokers as respondents who have smoked at least 100 cigarettes and currently smoke every day or some days. Adult surveys are intended to identify those respondents who are regular cigarette smokers—either occasional or daily—and exclude those who are experimenting or in early initiation. Since not

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all those who first use cigarettes as adolescents become adult cigarette smokers, adolescent surveys may include as smokers some individuals who will be defined as never smokers in adult surveys. Cross sectional surveys of adults have been used to reconstruct past rates of initiation³⁻⁹ in order to define initiation rates during adolescence among those who have become adult smokers. These surveys use the adult definition of ever smoking and reconstruct adolescent initiation rates using questions that ask for the age at which respondents start smoking regularly, the current age of the respondent, and the survey year. We used this approach to construct sex specific rates of smoking initiation for non-Hispanic white, Hispanic, and African American adolescents during each calendar year from 1940 to 1992.

Methods

We have reconstructed adolescent initiation rates for each calendar year, retrospectively from subjects' responses on the tobacco use supplement of the Current Population Survey (CPS) of adults. All ever smokers were asked the age at which they remember beginning to smoke regularly, and from their current age and the year of the survey, the year in which they initiated could be calculated. We examined the pattern of US initiation rates from 1940 to 1992, comparing them for males and females and for adolescents of the non-Hispanic white, Hispanic, and African American racial and ethnic groups.

DATA

In order to generate retrospective initiation rates we used two sets of cross sectional surveys. The surveys are the Tobacco Use Surveys that periodically supplement the Census Bureau's 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 labour force and demographic information monthly from about 50 000 households from the civilian, non-institutional population, surveying household members who were 15 years of age or older. The details of the survey methodology are described elsewhere.¹⁰ All respondents were weighted to reflect the actual civilian, non-institutionalised population of the USA and of each individual state.

The 1992-93 and 1995-96 surveys interviewed a combined total of 623 613 people who were 15 to 73 years old at the time of the survey. Of these respondents, 68.5% were self respondents, and only the answers from these respondents were used for this analysis. Another 1.5% were eliminated from the analysis because of unanswered questions, leaving 417 550 respondents available for analysis. The range of sample sizes and confidence intervals for each of the race/ethnicity groupings are presented in table 1.

Table 1 Initiation rates of 12-17 year old adolescents by ethnicity. Minimum and maximum sample sizes of each group and maximum 95% CI

Race/ethnicity	Sex	Range of sample sizes	Maximum 95% CI
Non-Hispanic white	Male	4089-18 949	0.66
	Female	4678-24 475	0.61
Hispanic	Male	367-1921	2.54
	Female	587-2706	1.11
African American	Male	606-1804	1.79
	Female	951-3339	0.77

CALCULATION OF INITIATION AND RATES

We reconstructed each person's smoking status for each calendar year before the date of the survey based upon the respondent's recollection of starting and stopping smoking. All respondents were asked, "Have you smoked at least 100 cigarettes in your entire life?" Those respondents who answered "no" were considered never smokers. Those respondents who answered "yes" were asked, "How old were you when you started smoking cigarettes fairly regularly?" This question was used to determine the age of initiation of smoking.

All calculations to determine the year in which respondents started smoking were based upon the survey administration date, the initiation age, and the age at the time of the survey. Since the surveys were administered in a specific month, all respondents at a given age would be assigned the same birth year as if they had turned that age during that month. In reality, the birth years of the respondents would be spread over two different calendar years, since the distribution of birth months for the respondents would vary from the month of the survey to the month of the survey plus 12 months. This created a slight temporal lag between the age recorded and the actual mean age of the respondents. In order to minimise that temporal difference, 0.5 years was added to all respondents' ages before the estimation of the birth 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 73 years old at the time of the survey, and the last survey was administered in 1996. Since the rates for each calendar year measured initiation 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 sex (compared to 500 in 1992, and 950 in 1990). The small sample size for 1993 offered unstable estimates of the initiation rates, so the last year for which the analysis was performed was 1992.

While calculating the initiation rates for each calendar year, we preserved the distribution of ages reflected in the original sample. Since the

distribution of 12 to 17 year olds varied between calendar years, each initiation rate for each calendar year was standardised to the birth year distribution of all respondents who would have been between the ages of 12 and 17 in that calendar year. To account for the differing variability between years caused by the changing sample sizes among ethnic and sex groups, the rates were smoothed using the loess procedure in S-Plus (MathSoft, Version 2000).¹¹ Twenty per cent of the rates were used to fit each rate quadratically, 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% binomial confidence intervals (CI).¹² The sample sizes for each of the ethnic-sex groups upon which rates were calculated are shown in table 1, along with the range of 95% CI for the groups.

Results

MALES

Initiation rates among male adolescents overall and among male adolescents in each of the three race/ethnic groups have declined since 1945 (fig 1). However, since 1983, initiation

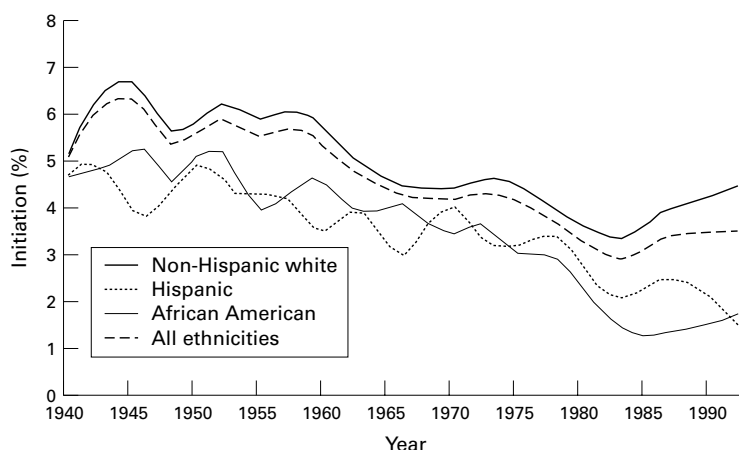


Figure 1 Cigarette smoking initiation among adolescent males 12-17 years old by ethnicity.

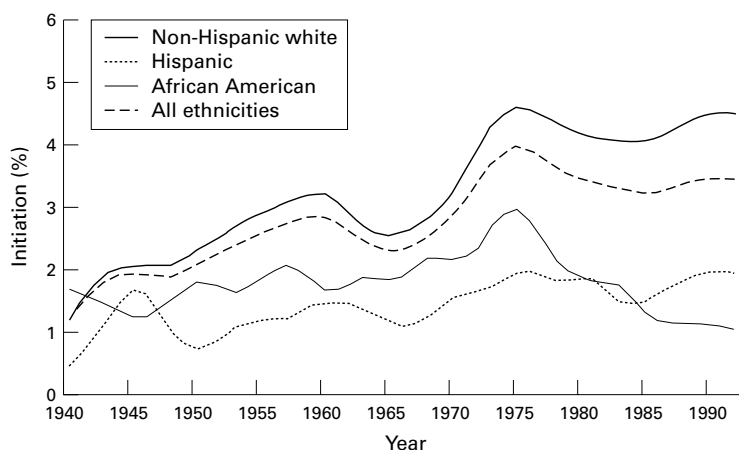


Figure 2 Cigarette smoking initiation among adolescent females 12-17 years old by ethnicity.

rates among male adolescents overall have increased.

As would be expected since they are the largest group, initiation rates among non-Hispanic white male adolescents were similar to initiation rates for all US males, with the exception that the increase in initiation from 1986 to 1992 was somewhat larger. From 1940 to 1992, non-Hispanic white male adolescents generally initiated cigarette smoking at higher rates than Hispanic or African American male adolescents. Since 1983, initiation rates among non-Hispanic white male adolescents have been significantly higher than initiation rates among Hispanic and African American male adolescents and these rates among non-Hispanic white males have been increasing.

Initiation rates among Hispanic male adolescents have not been statistically different from initiation rates among African American male adolescents. From 1978 to 1982, initiation rates among Hispanic and African American male adolescents experienced a sharp decline, and the rate of decline was steeper than that experienced by non-Hispanic white male adolescents. Initiation rates rose from 1983 to 1986 among Hispanic male adolescents, but not among African American male adolescents. Unlike initiation rates among non-Hispanic white and African American male adolescents, initiation rates among Hispanic male adolescents declined from 1987 to 1992, although this difference was not significant.

FEMALES

Initiation rates among female adolescents have increased since 1940 (fig 2). Initiation rates among female adolescents increased sharply from 1967 to the mid 1970s, catching up to male adolescent initiation rates. They declined from the late 1970s to the mid 1980s but not as steeply as among male adolescents, resulting in female adolescent initiation rates being significantly higher than male adolescent initiation rates during the early 1980s. Initiation rates among female adolescents appeared to level off or increase slightly again from the mid 1980s to 1990.

Initiation rates among non-Hispanic white female adolescents were similar to initiation rates for female adolescents overall. From 1940 to 1992, non-Hispanic white female adolescents initiated cigarette smoking at higher rates than Hispanic or African American female adolescents.

Initiation rates among Hispanic female adolescents generally increased during this time, but the rates increased at a slower rate among Hispanic female adolescents than among non-Hispanic white females. Like non-Hispanic white female adolescents, initiation rates among Hispanic female adolescents levelled off or increased slightly from 1984 to 1990. Initiation rates among non-Hispanic white and African American female adolescents coincided with initiation rates of their male counterparts by the mid 1970s (figs 3 and 5), but initiation rates among Hispanic female adolescents did not

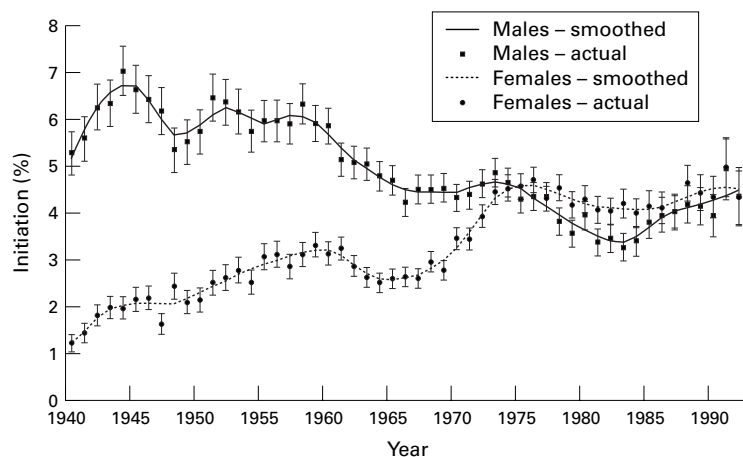


Figure 3 Cigarette smoking initiation among non-Hispanic white adolescents 12–17 years old.

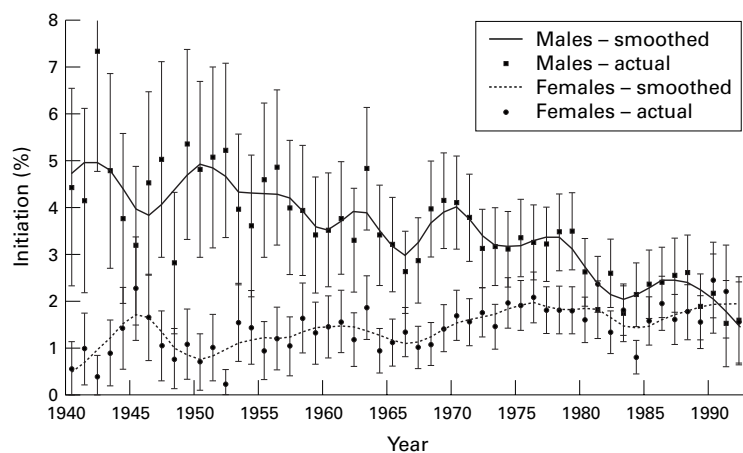


Figure 4 Cigarette smoking initiation among Hispanic adolescents 12–17 years old.

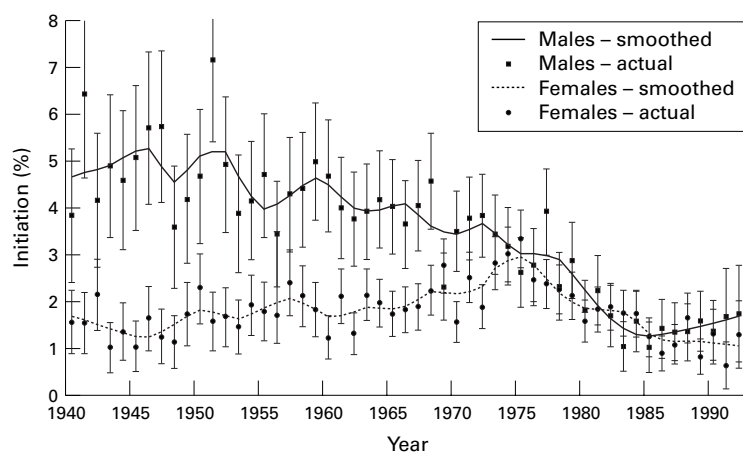


Figure 5 Cigarette smoking initiation among African American adolescents 12–17 years old.

initiation rates among the two other ethnic groups, rates continued to decline from 1984 to 1990. Initiation rates among all three ethnic groups were fairly flat from 1990 to 1992.

Initiation rates among African American female and male adolescents followed a similar pattern from the mid 1970s to the mid 1980s. After 1985, initiation rates among African American female adolescents declined or remained the same, in contrast to increasing initiation rates among African American males. However, these differences did not achieve significance.

Discussion

Dramatic changes in rates of adolescent cigarette smoking initiation have occurred over the last 50 years.^{13 14} Cross sectional data on adolescent smoking prevalence have described the prevalence of cigarette smoking among high school seniors since the mid 1970s.⁴ These data show a similar time trend in sex specific smoking prevalence to that demonstrated in our data for initiation, with male smoking prevalence initially being higher than female prevalence, but falling below that of female high school seniors by the late 1970s before rising again to above that of females. These data also show a dramatic fall in black adolescent smoking prevalence from 1981 to 1992. In general, these prevalence changes are consistent with the initiation rate changes demonstrated in our data.

The differential mortality of ever smokers to never smokers becomes prominent in populations over 50 years of age¹⁵ and can lead to an underestimation of the absolute rates of initiation for populations over the age of 50 years at the time of the survey. Rates presented in this paper for years after 1963 would not be based on individuals older than 50 years at the time of the survey, and therefore one would expect little effect of differential mortality on the rates of initiation. Rates for the years before 1963 would include an increasing effect of differential mortality as one moves back to earlier calendar years, as the rates are based on individuals who are at older ages at the time of the survey. About 9% of the ever smokers born between 1900 and 1914 die before the age of 73, whereas 2% of the ever smokers born between 1935 and 1939 die before the age of 50.¹⁶ These excess death rates would produce only small increases in the rates of initiation presented in this paper for the rates from 1940 to 1963, and therefore we have chosen not to adjust our data for this effect since there is no simple way to evaluate whether the adjustments for differential mortality would be uniform across the different race/ethnic groupings.

The adolescent initiation rates before 1963 may be underestimated because of this differential mortality of ever-smokers, but only the most general trends are observed before the 1960s for the rates of each ethnic group. Instead comparisons are primarily drawn between the rates of differing ethnic groups for comparable years, and specific trends after 1963 are compared. Recall bias between older

overlap with initiation rates of Hispanic male adolescents until 1990 (fig 4).

Initiation rates among African American female adolescents followed a pattern of increasing initiation rates from 1945 to 1975 similar to that among non-Hispanic white female adolescents. From 1975 to 1980, initiation rates among African American female adolescents decreased sharply, but, unlike

and younger respondents is minimised for the same reason.

Our analyses complement and extend similar retrospective reconstructions of smoking initiation derived from the National Health Interview Surveys and the Community Intervention Trial.³⁻⁶⁻⁹ In addition to adding supportive analyses using an independent tobacco survey data set, we also are able to provide race/ethnic and sex specific adolescent initiation rates owing to the large number of respondents in the CPS data set. It is clear that both historical and more recent trends in smoking prevalence vary greatly by sex, although rates of initiation for Hispanic and non-Hispanic whites appear to be similar between sexes for the period after 1985. In contrast there is a suggestion that initiation rates among black females may be continuing to fall while rates among African American males are rising.

These analyses differ from cross sectional measures because respondents were surveyed in the 1990s and their rates reconstructed retrospectively for each year from 1940 to 1992, instead of surveying the populations present in each year and calculating contemporaneous rates. Since the surveys are conducted in the recent past, the survey samples reflect the distribution of ethnic groups present today. Large proportions of some ethnic groups in today's population may have immigrated to the USA since 1940, so fluctuations in initiation rates do not necessarily reflect events that happened in the USA during those years.

These initiation rates reflect the calendar years when the current US adult smoking population began smoking, and therefore are not subject to biases that may be introduced by differences between the adult and adolescent definitions of smoking. It is only those who have become adult smokers that are examined in these analyses, and any overestimation of future adult smoking prevalence based on the more sensitive definition of smoking used in surveys of adolescents is thereby eliminated.

Different patterns of increasing and decreasing smoking initiation among sex and ethnic adolescent groups suggest the effect of varying social and cultural influences. For example, it

appears the white non-Hispanic and Hispanic females had dramatic increases in initiation coincident with the introduction and marketing of Virginia Slims and other female targeted brands in the late 1960s and early 1970s, but these campaigns appear to have had much less of an effect among African American females. These findings support the importance of including ethnic and sex factors in studies of smoking behaviour.

- 1 Centers for Disease Control. Cigarette smoking in the United States, 1986. *MMWR Morbid Mortal Wkly Rep* 1987;36:581-5.
- 2 Fiore MC. Trends in cigarette smoking in the United States. The epidemiology of tobacco use. *Med Clin North Am* 1992;76:289-303.
- 3 Burns DM, Lee L, Vaughn JW, Chiu YK, Shopland DR. Rates of smoking initiation among adolescents and young adults, 1907-81. *Tobacco Control* 1995;4(suppl 1):S2-8.
- 4 Johnston LD. Changing demographic patterns of adolescent smoking over the past 23 years: national trends from the monitoring the future study. *Changing adolescent smoking prevalence*, Smoking and Tobacco Control Monograph, No. 13. In press.
- 5 Pierce JP, Lee L, Gilpin EA. Smoking initiation by adolescent girls, 1944 through 1988. An association with targeted advertising. *JAMA* 1994;271:608-11.
- 6 Gilpin EA, Lee L, Evans N, Pierce JP. Smoking initiation rates in adults and minors: United States, 1944-1988. *Am J Epidemiol* 1994;140:535-43.
- 7 Pierce JP, Gilpin EA. A historical analysis of tobacco marketing and the uptake of smoking by youth in the United States: 1890-1977. *Health Psychol* 1995;14:500-8.
- 8 Gilpin EA, Pierce JP. Trends in adolescent smoking initiation in the United States: is tobacco marketing an influence? *Tobacco Control* 1997;6:122-7.
- 9 Pierce JP, Lee L, Gilpin EA. Smoking initiation by adolescent girls, 1944 through 1988. An association with targeted advertising [see comments]. *JAMA* 1994; 271:608-11.
- 10 Hanson RA. The Current population survey: design and methodology. Technical paper 40. Washington, DC: US Department of Commerce, Bureau of the Census, 1978.
- 11 Cleveland WS. Robust locally-weighted regression and smoothing scatterplots. *J Am Stat Assoc* 1979;74:829.
- 12 Snedecor GW, Cochran WG. *Statistical methods*, 8th ed. Ames, Iowa: Iowa State University Press, 1989.
- 13 US Department of Health and Human Services. *Preventing tobacco use among young people. A report of the Surgeon General, 1994*. Atlanta, Georgia: Public Health Service, Centers for Disease Control and Prevention, Office on Smoking and Health, 1994. (US Government Printing Office Publication No S/N 017-001-00491-0.)
- 14 Institute of Medicine. *Growing up tobacco free: preventing nicotine addiction in children and youths*. Washington DC: National Academy of Sciences, 1994.
- 15 Kahn HA. The Dorn study of smoking and mortality among US veterans: report on eight and one-half years of observation. In: Haenszel W, ed. *Epidemiological approaches to the study of cancer and other chronic diseases*. NCI Monograph No 19. Bethesda, Maryland: US Department of Health, Education, and Welfare, Public Health Service, National Institutes of Health, 1966: 1-125.
- 16 Burns D, Lee L, Shen Z, et al. Cigarette smoking behavior in the United States. *Smoking and tobacco control monograph 8: changes in cigarette-related disease risks and their implication for prevention and control*. Bethesda: National Cancer Institute, 1997:13-112. (NIH Publication No 97-4213.)